China Human Capital Report Series

Human Capital In China

2012

China Center for Human Capital and Labor Market Research

Central University of Finance and Economics

China Human Capital Report Series

Human Capital in China

Principal Investigator
Haizheng Li

China Center for Human Capital and Labor Market Research
Central University of Finance and Economics
Beijing, China

December 2012

This project is funded by

National Natural Science Foundation of China

and

Central University of Finance and Economics

Research Team Members

Principal Investigator

Haizheng Li	Special-term Director and Professor China Center for Human Capital and Labor Market Research (CHLR) Central University of Finance and Economics (CUFE) & Professor, Georgia Institute of Technology

Core Team Members

Åke Blomqvist	Special-term Professor, CHLR
Belton Fleisher	Special-term Professor and Senior Fellow, CHLR Professor of Economics, Ohio State University
Barbara Fraumeni	Special-term Professor and Senior Fellow, CHLR Professor of Public Policy University of Southern Maine
Zhiqiang Liu	Special-term Professor, CHLR Associate Professor of Economics State University of New York at Buffalo
Xiaojun Wang	Special-term Professor, CHLR Associate Professor of Economics University of Hawaii at Manoa
Kang-Hung Chang	Associate Professor, CHLR
Li Yu	Associate Professor, CHLR
Zhiyong Liu	Post-doctoral fellow, CHLR Associate Professor, Hunan University of Commerce

Yunling Liang	Doctoral Student, 2008, CHLR
Na Jia	Doctoral Student, 2009, CHLR
Bo Li	Doctoral Student, 2010, CHLR
Dazhi Guo	Doctoral Student, 2011, CHLR
Tang Tang	Doctoral Student, 2011, CHLR
Xiaobei Zhang	Doctoral Student, 2009, Hunan University
Qinyi Liu	Doctoral Student, 2011, Hunan University

2012 Team

Graduate Students, CHLR

2011 students	Tingting Ding, Junzi He, Junfeng Li, Tianjing Li, ShiruiWang, Wenbo Wu

2011 Team

Graduate Students, CHLR

2010 students	Zhanwang Chang, Xiaotang Chen, Lu Feng, Yang He, Bo Hu, Angran Li, Li Li, Wenwei Li, Yan Li, Yanchao Li, Xiaoyang Liu, Liying Mu, Xianzhou Wu, Le Zhang, Linjun Zhu

Graduate Students, School of Economy and Trade, Hunan University

2010 students	Biao Luo, Lina Zhai, Li Zhang

2010 Team

Graduate Students, CHLR

2009 students	Jing Bai, Jing Fang, Chao Guo, Xin Gao, Xiaoyan Gan, Jun Li, Jin Li, Tianyi Liu, Dandan Wu, Yuanyuan Xin, Pengfei Xing, Yanqiu Yang, Chen Zhang, Linghua Zhang

Graduate Students, School of Economy and Trade, Hunan University

2009 students	Lin Ding, Hongling Wang, Qiujie Wu, Xiaomin Yan

Graduate Students, Georgia Institute of Technology Chongyu Lu

Hao Deng	Former Executive Assistant to Director, CHLR
Jing Xiao	Graduate Coordinator, CHLR
Qinyi Liu	Executive Assistant to Director, International Research Center for Human Resources, Hunan University

2009 Team

Graduate Students, CHLR

2008 students	Huajuan Chen, Yuhua Dong, Mengxin Du, Jinquan Gong, Jingjing Jiang, Rui Jiang, Qian Li, Sen Li, Chen Qiu, Xinping Tian, Mo Yang

Graduate Students, Georgia Institute of Technology Yuxi Xiao

Song Gao	Assistant Professor, China Academy of Public Finance and Public Policy, CUFE
Ruiju Wang	Former Executive Assistant to Director, CHLR
Hao Deng	Former Graduate Coordinator, CHLR

A Brief Introduction to China Center for Human Capital and Labor Market Research

Established in March 2008, China Center for Human Capital and Labor Market Research (CHLR) at the Central University of Finance and Economics (CUFE) is an integral part of the Advantageous Program Platform in Economics and Public Policy at the CUFE. It is an international research center for the study of human resources, labor markets, and their impact on economic development, focusing on China and related economies.

The CHLR has masters, doctoral and post-doctoral programs. Our advisory board includes two Nobel laureates, Kenneth J. Arrow and James Heckman, and the founder of the income-based method for measuring human capital, Dale W. Jorgenson at the Harvard University.

Our major research areas include: human capital and skill measurement, human capital investment, human capital mobility, human capital and innovation, and health and human capital.

Faculty members and research fellows of the CHLR all hold U.S. Ph.D. degrees in economics and some are tenured professors at U.S. universities. The CHLR Special-term Director, Dr. Haizheng Li, is also Professor at the School of Economics, Georgia Institute of Technology. Currently the Center has 5 full-time faculty, 4 special-term faculty, 7 senior research fellows, and 3 research fellows.

The Center has established its graduate programs following international standards. The curriculum and instruction are rigorously designed. All the courses are taught in English. Since 2008, the CHLR has admitted 68 Master's students, 10 doctoral students, and 1 post-doctoral fellow.

The Center is first and foremost an international research institution. We have a team of international scholars and train graduate students to international standards. We also adopt international management practices in the Center's daily operation. Faculty performance is evaluated using standards similar to those commonly adopted by research universities in the United States.

China's Human Capital Project and Its Social Impact

The research project, "China's Human Capital: Measurement and Index Construction," is conducted by the China Center for Human Capital and Labor Research Center (henceforth the Center) and funded by the National Natural Science Foundation of China and the Central University of Finance and Economics. The project aims to establish China's first scientific and systematic human capital index, quantitatively describe China's human capital distribution, trend and dynamics. It constructs important measurements for further evaluating human capital and its contribution to economic development, and provides policy-makers with important data. The measurement has become a part of the international human capital index system, and joined the effort of eventually incorporating human capital into the national income and product accounting.

The project is led by the Director of the Center, Prof. Haizheng Li. The research team includes Prof. Barbara Fraumeni (a pioneer scholar in developing Jorgenson-Fraumeni method of human capital calculation), other full-time and special-term professors, graduate students, and administrative staff at the Center. Since the inaugural issue of China Human Capital Report in 2009, the project has generated great social impact, and drawn attention of academia and government both at home and abroad.

- "Human Capital in China, 1985-2008", accepted by the peer-reviewed journal, "Review of Income and Wealth"(SSCI indexed).
- Part of the project report is a chapter in *The Changing Wealth of Nations* by the World Bank (2010. Washington, DC: World Bank).
- Part of the project report is a National Bureau of Economic Research (NBER) working paper (http://papers.nber.org/papers/w15500).
- Part of the project report is published in a top Chinese economics journal, Economic Research Journal (2010, vol. 8).
- The report on Beijing from the project is included in 2010 Beijing Human Capital Blue Book published by the Beijing Municipal Department of Organization,

Human Capital Research Center.

- In August 2010, Prof. Haizheng Li was invited to speak on China's human capital measurement in the plenary session of the 31st meeting of the International Association for Research in Income and Wealth (http://www.IARIW.org).
- On November 16, 2010, Prof. Haizheng Li was invited by the Lisbon Council to speak in the "High-level Working Group on Skills and Human Capital" in Brussels. The speech is titled "Measuring Human Capital in China."
- The Center is invited to join the European Union "Lifelong Learning, Innovation, Growth and Human Capital Tracks in Europe" research project. The project has nine research teams from different countries/regions.
- OECD Director of Statistics Directorate, Mr. Paul Schreyer, has officially made the recommendation to China National Bureau of Statistics minister Mr. Jiantang Ma that Prof. Haizheng Li and the Center's research team should participate in the OECD human capital consortium as China's officially designated representative.
- State Councilor Yandong Liu praised the Center's achievement when she visited CUFE in Oct. 2009. She concluded "China is in a transition from a country with huge population to a country with strong human capital, therefore it is very important to conduct research in China's human capital."
- China Ministry of Education requested Center's 2009 research report. Meanwhile, part of the human capital report has also been submitted to the Ministry of Organization of the Chinese government for the Second National Meeting on Talents Policy as supplementary materials.
- The Office of Planning of the "Twelfth Five-Year Plan" in the Ministry of Education has invited the Center's research team to conduct a special project on the contribution of education investment on economic growth.
- The Director of the Center, Prof. Haizheng Li, was invited by the Beijing Municipal Government, Department of Organization to preside over the "Beijing High Skill Talent Development Summit – Global City, Global Talent." The Center was also invited to be one of the co-organizers of the summit.
- Prof. Haizheng Li was invited to speak on the "Ford-Class Experts Forum" organized by the Renmin University of China. The title of the speech is "China's human capital investment: current status and its contribution." Later on August 29, 2010, the Jie-Fang Daily newspaper published the speech on a whole page.

Acknowledgement

We thank all the participants in a series of international symposiums on human capital hosted by CHLR since 2009 for their valuable suggestions. We are grateful for the comments and suggestions from scholars at numerous international and domestic conferences, as well as from anonymous referees.

We are especially grateful to Nobel Laureate Prof. Kenneth J. Arrow, and the founder of the income-based method for measuring human capital, Prof. Dale W. Jorgenson at the Harvard University, for their support to this project.

This research project and its related conferences have benefited tremendously from the supports of the administration at the Central University of Finance and Economics (CUFE). President Guangqian Wang and other university leaders provided strong support and encouragement for the project. Vice President Junsheng Li, Assistant to President Lifen Zhao, and Director of Research Office Baowen Sun coordinated with various offices to ensure the success of the project and the conferences.

Many offices in the CUFE, such as the President's Office, Office of Research, Human Resources Office, Finance/Accounting Office, International Cooperation Office and Assets Management Office provided various administrative supports that facilitated this research. Office space, conference facilities, and computer labs were generously provided by the University. We also acknowledge the supports of the Virtual Experiment Lab, the School of International Exchange, the Academy of Public Finance and Policy, and the School of Marxism Studies.

The School of Economics at Georgia Institute of Technology, especially the former Chair, Professor Patrick McCarthy, offered strong support to the project; Prof. Shi Li from Beijing Normal University provided us with the CHIP(2007) data. Last but not least, we greatly appreciate the help for our conferences from two Chinese academic journals – *Economic Research Journal* and *Labor Economics and Labor Relations*.

What's New in the 2012 Report

This report updates the 2011 Report in the following aspects:

- Followed the methodology(in 2011 Report) for estimating provincial level Mincer model parameters by combining survey data and provincial statistical data, but using the updated provincial statistical data in the 2012 Report.
- Calculated human capital for five new provinces: Tianjin, Heilongjiang, Zhejiang, Guangxi and Shaanxi. And added the analysis of relative trends in human capital for those new provinces.
- Updated interprovincial comparison on human capital.

Briefing Notes:

Abbreviations:

- Provinces:

GD=Guangdong	JS=Jiangsu	SD=Shandong
HeN=Henan	HB=Hubei	HuN=Hunan
AH=Anhui	SH=Shanghai	LN=Liaoning
BJ=Beijing	GZ=Guizhou	GS=Gansu
TJ=Tianjin	HLJ=Heilongjiang	ZJ=Zhejiang
GX=Guangxi	SAX=Shaanxi	

- HC: Human capital
- LFHC: Labor force human capital

Definitions and Clarifications:

- Total human capital: 0-55 for female; 0-60 for male
- Labor force human capital:

  Non-retired population aged 16 and over, excluding full-time students
- Growth rates:

  Use real values, calculated by the difference of logarithm
- Average growth rate: take arithmetic average of growth rates for all years included
- Ratio of HC to GDP: use their current values
- Ratio of GDP to LFHC: use their current values

Contents

Executive Summary

Chapter 1 Introduction.....1

Chapter 2 Methodology.....6

2.1 Jorgenson-Fraumeni income-based approach 7

2.2 Cost approach.....8

2.3 Indicator approach.....10

2.4 Attribute-based approach.....11

2.5 Residual approach 13

Chapter 3 J-F Method and its application for China 15

3.1 Estimate lifetime income by backward recursion 15

3.2 Estimate current income using Mincer models 17

3.3 Growth rates of real income and the discount rate.....24

3.4 Additional data imputations and assumptions for the J-F estimates 28

Chapter 4 China population and education dynamics.....31

4.1 Population imputation 31

4.2 Trend of population and education distribution 32

Chapter 5 National human capital.....40

5.1 Human capital, GDP, and physical capital 40

5.2 Trends in human capital 47

5.3 Human capital per capita.....55

5.4 Labor force human capital.....62

5.5 International comparison.....76

Chapter 6 Cross-province comparison 78

6.1 Cross-province human capital comparison 78
6.2 Cross-province labor force human capital comparison.....81
6.3 Relative trend of human capital.....83
Chapter 7 Human capital for Beijing 87
1. Total human capital 87
2. Human capital per capita.....96
3. Labor force human capital.....101
Chapter 8 Human capital for Liaoning.....109
1. Total human capital 109
2. Human capital per capita.....118
3. Labor force human capital.....123
Chapter 9 Human capital for Shanghai 131
1. Total human capital 131
2. Human capital per capita.....137
3. Labor force human capital.....141
Chapter 10 Human capital for Jiangsu 146
1. Total human capital 146
2. Human capital per capita.....154
3. Labor force human capital.....158
Chapter 11 Human capital for Anhui.....166
1. Total human capital 166
2. Human capital per capita.....174
3. Labor force human capital.....179
Chapter 12 Human capital for Shandong 187
1. Total human capital 187

2. Human capital per capita.....195
3. Labor force human capital.....200
Chapter 13 Human capital for Henan.....207
1. Total human capital 207
2. Human capital per capita.....216
3. Labor force human capital.....221
Chapter 14 Human capital for Hubei 229
1. Total human capital 229
2. Human capital per capita.....237
3. Labor force human capital.....242
Chapter 15 Human capital for Hunan.....249
1. Total human capital 249
2. Human capital per capita.....257
3. Labor force human capital.....262
Chapter 16 Human capital for Guangdong.....269
1. Total human capital 269
2. Human capital per capita.....278
3. Labor force human capital.....283
Chapter 17 Human capital for Guizhou 291
1. Total human capital 291
2. Human capital per capita.....300
3. Labor force human capital.....305
Chapter 18 Human capital for Gansu.....313
1. Total human capital 313
2. Human capital per capita.....322
3. Labor force human capital.....327

Chapter 19 Human capital for Tianjin.....335
1. Total human capital.....335
2. Human capital per capita.....342
3. Labor force human capital.....346
4. Relative trend in human capital.....353
5. Conclusion.....355
Chapter 20 Human capital for Heilongjiang.....357
1. Total human capital.....357
2. Human capital per capita.....364
3. Labor force human capital.....368
4. Relative trend in human capital.....375
5. Conclusion.....377
Chapter 21 Human capital for Zhejiang.....379
1. Total human capital.....379
2. Human capital per capita.....386
3. Labor force human capital.....390
4. Relative trend in human capital.....397
5. Conclusion.....400
Chapter 22 Human capital for Guangxi.....401
1. Total human capital.....401
2. Human capital per capita.....408
3. Labor force human capital.....412
4. Relative trend in human capital.....419
5. Conclusion.....421
Chapter 23 Human capital for Shaanxi.....423

1. Total human capital 423
2. Human capital per capita 430
3. Labor force human capital 434
4. Relative trend in human capital 441
5. Conclusion 443
Appendix A Population imputation 445
Appendix B Mincer parameters 468
Appendix C Human capital stock calculation 493
Appendix D Growth rate and discount rate 520
Reference List 532

Executive Summary

Although the importance of human capital in economic growth and innovation is well recognized, constructing an accurate measure of human capital is still a difficult research agenda for three main reasons. First, the characteristics of human capital make it hard to evaluate. Second, required data are hard to obtain. Third, data collection and cleaning are time-consuming and challenging.

Considering the features of Chinese data, we adopt the widely used Jorgenson-Fraumeni lifetime income approach (hereafter referred to as the J-F approach) to calculate the stock of Chinese human capital. According to the human capital theories, we also modified the J-F approach to combine micro data with the macro data. This significantly improves the feasibility and rationality of applying the J-F approach to China. In this way, we construct systematical measurement of Chinese human capital at both national and provincial level, and various human capital indexes.

In this report we calculate the national human capital stocks of China from 1985 to 2009. Total human capital and human capital per capita are calculated for the same period by gender and region(Urban and Rural). In addition, human capital stocks are estimated for 17 provinces: Beijing, Liaoning, Shanghai, Jiangsu, Anhui, Shandong, Henan, Hubei, Hunan, Guangdong, Guizhou, Gansu, Tianjin, Heilongjiang, Zhejiang, Guangxi and Shaanxi. We also construct several provincial human capital indexes and analyze their trends. All the results are collected as the China Human Capital Database. The panel data nature of this database can help future empirical researches on China's Human capital.

The main findings and conclusions are summarized below (real values are calculated using 1985's currency and growth rates are calculated based on real values).

1. China’s human capital reached 598.4 trillion Yuan in 2009. Urban and rural human capital was 428.7 and 169.7 trillion Yuan, respectively, accounting for 72% and 28% of the total human capital.
2. China’s human capital increased at an average annual rate of 7.20% during 1985-2009. This growth accelerated after 1995, with a growth rate of 2.26% for 1985-1994 and 10.16% for 1995-2009.
3. Human capital per capita reached 541.5 thousand Yuan in 2009. Urban and rural human capital per capita was 820.8 and 291.1 thousand Yuan, respectively. Male and female human capital per capita were 658.3 and 410.3 thousand Yuan respectively.
4. Per capital human capital almost increased five-fold during 1985-2009. Total human capital grew at a higher rate than human capital per capita before 1995 (2.26% and 1.10% average annual rate, respectively), but the two grew at closer rates after 1995 (10.16% and 9.91%, respectively). Population grew at an average annual rate of 1.38% before 1995 and 0.72% after 1995. Thus, the result suggests that human capital growth was mainly caused by education improvement and other factors, in addition to population growth after 1995.
5. During 1985-2009, rural human capital grew at an average annual rate of 4.20%, but urban human capital grew at 9.66%. Growth rate in both urban and rural areas accelerated since 1995 (13.19% and 6.01%, respectively for 1995-2009). Urban human capital exceeded rural human capital starting in 1996, and the gap has been increasing ever after.
6. Rural human capital per capita grew at an average annual rate of 5.16% during 1985-2009, while it was 6.18% in urban for the same period. Before 1995, the rural human capital per capita grew slightly faster than the urban area (0.70% and 0.65%, respectively). After that, however, the urban human capital per capita grew much faster than the rural area (9.51% and 7.83%, respectively). Clearly, the region gap in human

capital rises quickly.

7. At the national level, the ratio between human capital and physical capital decreased rapidly before 1995 and then began to climb slowly, indicating a relatively higher growth rate of human capital relative to physical capital in later years.
8. During 1985-2009, the ratio of labor force human capital (LFHC) including students to total human capital increased, indicating aging of population, in part due to the one child policy. However, the ratio of LFHC excluding students to total human capital decreased in the urban area but increased in the rural area. This phenomenon is likely caused by the rapidly growing share of students in the urban population due to expansion of education.
9. At the national level, the ratio of GDP to human capital shows an upward trend, suggesting increased efficiency of human capital.
10. Human capital at the provincial level generally shows a similar trend to national human capital. However, since provinces differ in their population, education structure and the degree of market mechanism, their dynamics in human capital also show some differences.
11. Among the 17 provinces estimated, the top three provinces ranked by human capital stock in 2009 are Guangdong, Jiangsu and Shandong; and by human capita per capital are Shanghai, Zhejiang and Beijing.
12. While China has a large total human capital stock, its human capital per capita is relatively small compared to developed countries.

Chapter 1 Introduction

Since the concept of human capital was introduced to modern economic analysis by Schultz (1961) and Becker (1964), it has been widely used in academic studies and policy analysis. An Organization for Economic Co-operation and Development (OECD) publication defines human capital as "The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being" (OECD, 2001, page 18). Human capital has been called probably "the most important and most original development in the economics of education" in the second part of the 20th century (Coleman, 1990, page 304). In most countries, human capital accounts for more than 60% of the nation's wealth (World Bank, 1997).[1]

It is generally believed that human capital is an essential source of economic growth and innovation, and an important factor for sustainable development and reducing poverty and inequality (see, for example, Stroombergen et al., 2002, and Keeley, 2007). Detailed analyses of human capital accounts for Canada, New Zealand, Norway, Sweden, and the United States unanimously show that human capital is a key source of economic growth.[2] The Stiglitz Commission report noted the importance of human capital as a "beyond Gross Domestic Product" measure of economic and social progress.[3]

---

[1] These World Bank wealth estimates include natural resources, physical capital and intangible capital, which is primarily human capital.

[2] These include Jorgenson-Fraumeni (J-F) accounts for Canada (Gu and Ambrose 2008), New Zealand (Li, Gibson, and Oxley 2005), Norway (Greaker and Liu 2008), Sweden (Alroth 1997), and the United States (Jorgenson and Fraumeni 1989, 1992a, 1992b, and Christian 2009).

[3] See Stiglitzet. al. (2009).

In China, since the start of economic reforms, the economy has grown at a dramatic rate. It is believed that human capital has played a significant role in the Chinese economic miracle (see, for example, Fleisher and Chen, 1997, and Démurger, 2001). Additionally, studies show that human capital also has an important effect on productivity growth and on reducing regional inequality in China (Fleisher, Li and Zhao, 2009).

Despite the important role of human capital in the Chinese economy, however, until now, there has been almost no comprehensive measurement of the total stock of human capital in China. Human capital measures for China are central to any understanding of the global importance of human capital for a number of reasons. First, China is the most populous country in the world. It is important to understand the dynamics of human capital caused by demographic changes (for example, due to the one-child policy, migration, and urbanization) and by the rapid expansion of education during the course of economic development. Second, such measures would allow for better assessment of the contribution of human capital to growth, development, and social well-being in empirical and theoretical research. Construction of comprehensive human capital measures is an important step in assessing the contribution of human capital to economic growth. Currently, only partial measurement of human capital, such as education characteristics, has been used in such studies.

Additional benefits from human capital measures include the provision of useful information for policy makers for the purpose of assessing how education policies of central and local governments affect the accumulation of human capital. This is especially important, given the long-term nature of human capital investment. For example, since the early 1980s, there has been a remarkable increase in the educational attainment of the Chinese population. In 1985 the largest population masses were concentrated in the “no schooling” and “primary school” categories (Figure 4.2.5). By 2009 the largest

population mass was concentrated in the "junior middle" school category (Figure 4.2.7). Developing comprehensive measures of human capital in China provides the necessary early work for constructing China's human capital account and so that China can join the international OECD initiative in this area. This initiative will facilitate international comparison of human capital accumulation and growth across nations.

There is an ongoing international effort in developed countries to measure a nation's total human capital stock and to develop Jorgenson-Fraumeni (J-F) national human capital accounts. The U.S. Bureau of Economic Analysis has recently supported research on human capital (Abraham 2010 and Christian 2010). Statistics Canada (Gu and Wong 2008), the Australian Bureau of Statistics (Wei 2008), and Statistics Norway (Greaker and Liu 2008) have established similar research programs on the measurement of human capital using agency researchers. In addition, seventeen countries (Australia, Canada, Denmark, France, Italy, Japan, Korea, Mexico, Netherlands, Norway, New Zealand, Poland, Spain, the United Kingdom, the United States, Romania, and Russia), and two international organizations, Eurostat and the International Labour Organization, have joined an OECD consortium to develop human capital accounts. A researcher from Statistics Norway, Gang Liu, has been at the OECD since October 2009 to coordinate this effort.[4] The work of this consortium will facilitate cross-country comparisons.

Another approach to estimating the impact of human capital has been undertaken by the Lisbon Council which is located in Brussels. The Lisbon Council European Human Capital Index has been constructed for the 13

[4] J-F human capital accounts have been constructed for several other countries independent of the consortium efforts. These countries include Argentina (Coremberg, 2010), New Zealand (Le, Gibson, and Oxley, 2005), and Sweden (Ahlroth and Bjorkland, 1997). O'Mahony and Stevens (2004) applied J-F methodology to evaluate government provided education in the United Kingdom.

European Union (EU) states and 12 Central and Eastern European states (see Ederer 2006 and Ederer*et al.* 2007). Developed countries have obviously realized the importance of monitoring human capital accumulation, while most developing and emerging countries, including China, have yet to start such projects.

Until now, there has been no systematic effort to construct comprehensive measures of the total human capital stock in China, but there are a few studies on human capital measurement published in Chinese journals. For example, Zhang (2000) and Qian and Liu (2004) calculated China's human capital stock based on total investment (cost-side); others, such as Zhu and Xu (2007), Wang and Xiang (2006), estimated human capital from the income side. Zhou (2005) and Yue (2008) used some weighted averages of human capital attributes to construct a measurement. In most cases, these studies partially measure human capital based on some education characteristics such as average years of education, for example, Cai (1999), Hu (2002), Zhou (2004), Hou (2000), Hu (2005), etc.

While the above studies have contributed to the understanding of human capital in China, there are major limitations. First, there has been no comprehensive and systematic measurement of the total human capital stock in China from the 1980s up to date, especially on the changes of human capital in rural and urban areas and for males and females respectively. Second, the methodology used has been limited by data availability, feasibility of parameter estimation, and some technical treatment difficulties. Limitations of this kind have made it difficult to implement internationally recognized methods for human capital estimation based on China's data.

We attempt to construct a comprehensive measurement of human capital in China by applying the methods used in other countries after modifying them to fit China's special cases. We estimate total human capital at the national level and provincial level, for males and females, for urban and rural

areas from 1985 to 2009. Our estimates include nominal values, real values, indexes, and quantity measures. We mostly adopted the Jorgensen-Fraumeni (J-F) lifetime income based approach, which has been widely used in other countries.

In addition to a full-implementation of the J-F approach to China's data to estimate the human capital series, another contribution of this study is that we combine micro-level survey data in human capital estimation to mitigate the lack of earnings data in China. In particular, we apply the Mincer equation to estimate earnings by using various available household survey data. Thus, it is possible to integrate the changes of returns to education and experience (on-the-job-training) into our estimates during the course of economic transition.

Moreover, by separating the calculation of human capital for urban and rural areas, we are able to capture the changes caused by rapid urbanization as well as by the large scale rural-urban migration since the start of economic reform in China. This framework is not only important for any transitional economy because of its changing economic structure and migration, it can also at least partially measure the effect of another type of human capital investment–migration, which helps realize a higher value of one's human capital.

The rest of this report is arranged as follows. Chapter 2 discusses methodology for human capital measurement. Chapter 3 describes J-F method and its application and modifications for China. Chapter 4 states China's population and education dynamics. The estimated national results of human capital are reported in Chapter 5, Chapter 6 shows the cross-province comparison results, followed by the disaggregated human capital results for Beijing, Liaoning, Shanghai, Jiangsu, Anhui, Shandong, Henan, Hubei, Hunan, Guangdong, Guizhou, Gansu, Tianjin, Heilongjiang, Zhejiang, Guangxi and Shaanxi.

Chapter 2 Methodology

In general, human capital can be produced by education and training (child bearing and rearing are investments that increase future human capital), as well as by job turnover and migration that help to realize the full potential value of human capital. Like physical capital, the human capital stock can be valued using two methods: i) it can be valued as the sum of investment, minus depreciation, added over time to the initial stock; ii) it can be valued as the net present value of the income flow it will be able to produce over an assumed lifetime. The first method-the perpetual inventory method--is used in the cost approach; while the second method is the income-based approach (this method is also often used to estimate the value of most natural resources). When human capital is measured using the perpetual inventory approach, only costs or expenditures are included in investment. When physical capital is measured in this way, investments are valued at their purchase price which is not generally available for human capital.

These and other measures of human capital have been used by researchers in many studies:

(1) The lifetime income approach of Jorgenson and Fraumeni (1989, 1992a, 1992b);

(2) The cost approach of Kendrick (1976);

(3) The indicator method in The Lisbon Council's approach (2006);

(4) Laroche and Merette (2000) construct indexes with either relative wage weights or relative lifetime income weights;

(5) The World Bank residual approach (2006).

The approach of Jorgenson-Fraumeni is discussed further in the next section.

2.1 Jorgenson-Fraumeni income-based approach

The J-F method estimates human capital stock as the expected future lifetime income of all individuals. If human capital could be traded in the market like physical capital, the asset price would be the net present value of the individuals' lifetime labor income.[5] The lifetime income approach can reflect the importance of long-term investments, such as education and health, in human capital accumulation.

The Jorgenson and Fraumeni (J-F) income-based approach is the most widely used method in estimating human capital stock, and has been adopted by a number of countries in constructing human capital accounts (see the previous section for examples). The advantages of this approach are that it has a sound theoretical foundation and that the data and parameters are relatively easier to obtain than they are for other approaches.

When estimating lifetime income to calculate human capital, an important issue is that income (or implicit income) can be generated from both market and nonmarket activities. Market activities of individuals produce goods and services, foster innovation and growth through managerial

[5] In China, the labor market may still be at a stage where wage income does not fully reflect the marginal productivity of labor. Therefore, in the studies involving wages, there may be a certain degree of distortion. When estimating human capital using the wages income, one must recognize that this problem may exist. Therefore, our study is clearly limited by the current development level of the labor market mechanism in China. But the income approach is the most commonly used method for measuring human capital. Even in the United States and other developed countries, wages do not fully reflect the marginal productivity, because its labor market is not perfectly competitive. Even so, wages are still representative of the human capital gains from an individual perspective, and still a measure of human capital in that sense. With the improvement of market mechanism in China, this limitation will gradually decrease. According to estimates of the current literature, wages are generally lower than the marginal productivity (see Fleisher, Li and Zhao, 2010). Therefore, from this perspective, our calculation can be interpreted as a conservative estimate of human capital.

and creative activities, and generate income that allows for the acquisition of market goods and services. Nonmarket activities of individuals include household production, e.g., cooking, cleaning, and care-giving. Investment is generated from both market and nonmarket activities. Because household production activities are difficult to quantify and value and require time-use estimates, we have opted to exclude them in this first approximation to estimating China's human capital.[6]

2.2 Cost approach

Kendrick is an early pioneer in the construction of human capital accounts. Kendrick (1976) estimates both tangible and intangible human capital. Tangible human capital includes child rearing costs. Intangible human capital includes education, training, medical, health and safety expenditures, and mobility costs. Human capital stocks are created using a perpetual inventory method where investment expenditures are cumulated and existing stocks are depreciated. Implementation of a Kendrick approach for China is difficult as Kendrick's human capital investment is the sum of a long list of human capital related costs, and reliable data on such information is only available for the most recent decades.

Tangible human capital investment is average lifetime rearing costs including expenditures on food, shelter, health, schooling, and so on. The cost of parental time is not included in this measure. Intangible human capital investment in formal and informal education includes both private and government costs. Private formal education costs include net rental for private education sector's plant and equipment and students' expenditures on supplies.

[6] Among the most recent human capital estimates, i.e., Mira and Liu (2010), Gu and Ambrose (2008), Greaker and Liu (2008) and Christian (2010), only Christian, for the United States, includes a full set of nonmarket activities and estimates human capital for those too young to go to school or to perform market work.

Estimate for the total cost of rentals of books and equipment and opportunity cost depends on a student's imputed potential compensation. Government formal education costs include all types of expenditure, including those for construction. Personal informal education expenditures include a portion of those for radio, TV, records, books, periodicals, libraries, museums, and so forth. Business and institutional expenditures include a portion of those for media expenditures. Religious education expenditures are imputed from figures on religious class attendance and imputed interest on plant and equipment of religious organizations. Government expenditures include those for library, recreation costs and military education expenditures.

Intangible human capital investment in training values initial nonproductive time and nonwage costs and includes explicit training expenditures. Both specific and general training is captured, as well as military training. A substantial fraction of medical, health and safety expenditures, which are split between investment and preventive expenditures, are by governments. Annual rental costs for plant and equipment are imputed when not available.

Kendrick considers his human capital mobility investment estimates to be tentative. These include unemployment, job-search, hiring, and moving costs, for both residents and immigrants. Depreciation is estimated using the depreciation methodology most widely used at the time of his research: A double declining balance formula with a switch to a straight-line method. Lifetimes in these formulas are assumed to be the reciprocal of the percentage of persons in the group.

Kendrick estimate of nominal human capital is about five times Gross Domestic Product. However, the J-F human capital estimate is substantially larger than Kendrick's.[7] The Kendrick approach covers detailed aspects of human capital formation from the cost side and provides a very complete

[7] See table 37 of Jorgenson-Fraumeni (1989).

menu for summing up all related costs to estimate the value of human capital. Yet, the data requirements are enormous, for example, we may need to get government statistics ninety years back to do the calculation. This is impossible, given the People's Republic of China is only 61 years old in 2010. Additionally, the Kendrick approach gives no clear rationale for some important assumptions, such as for the split of health expenses between investment and preventative costs. For all these reasons, we do not adopt this approach for our calculation.

2.3 Indicator approach

An example of an indicator approach is the Human Capital Index of the Lisbon Council. It is a human capital input cost, or cost of creation approach. This index has been constructed for the 13 European Union (EU) states and 12 Central and Eastern European states as previously noted.[8] The Human Capital Endowment measure is an input to two of the other three components of the overall European Human Capital Index. The Human Capital Endowment measure sums up expenditures on formal education and the opportunity cost of parental education, adult education, and learning on the job. Parental education includes teaching their children to speak, be trustful, have empathy, take responsibility, etc. The Human Capital Utilization Index is the endowment measure divided by total population and the Human Capital Productivity Measure is Gross Domestic Product (GDP) divided by the endowment employed in the country.

Finally the Demography and Employment measure estimates the number of people who will be employed in the year 2030 in each country by looking

[8] See Ederer (2006) and Ederer*et. al.*(2007). The 2006 paper states that the index was developed by the German think tank Deutschland Denken. In addition the paper states that it is part of a research project undertaken by several individuals in the think tank and with the institutional support of Zeppelin University.

at economic, demographic, and migratory trends.[9]As it has cost components and index components, it is best viewed as a blend of a cost approach and an indicator approach. Since the technical details for this approach have not been released, we do not apply it here in our calculation.[10]

2.4 Attribute-based approach

The attribute-based approach is usually considered to be a variant of the income-based approach (Le, Gibson and Oxley 2003, 2005). However, it constructs an index value of human capital instead of a monetary value as in other income-based methods. The primary advantage of an index value is that it nets out the effect of aggregate physical capital on labor income, therefore this measure captures the variation in quality and relevance of formal education across time and country.

Based on the pioneer work of Mulligan and Sala-i-Martin (1997), Koman and Marin (1997) applied the attribute-based method to Austria and Germany. However, our method is akin to Laroche and Merette (2000) in that we also incorporate work experience into the model along with formal education. That is, we also emphasize informal channels, such as work experience, in the accumulation of human capital.

Specifically in this method, the logarithm of human capital per capita in a country at any time is computed using the following formula：

$$\ln\left(\frac{H}{L}\right)=\sum_{e}\sum_{a}\omega_{e,a}\ln\left(\rho_{e,a}\right) \qquad (1)$$

$$\omega_{e,a}=\frac{e^{\sum_{s}\left(\beta_s e+\gamma_s Exp+\delta_s Exp^2\right)\varphi_{s,a}}L_{e,a}}{\sum_{e}\sum_{a}e^{\sum_{s}\left(\beta_s e+\gamma_s Exp+\delta_s Exp^2\right)\varphi_{s,a}}L_{e,a}} \qquad (2)$$

[9] Ederer (2006), p. 4 and p. 20.

[10] We have discussed with Dr. Ederer on possible collaboration of applying the China data to their method in the future.

where *e* and *a* denote years of formal schooling and age, respectively. $\rho_{e,a} = L_{e,a} / L$ is the proportion of working age individuals of age *a* with *e* years of schooling. $\omega_{e,a}$ is the efficiency parameter defined as proportion of wage income of workers of age *a* with *e* years of schooling in the total wage bill of the economy. *Exp* represents work experience, which is defined as $a-e-6$. *s* is a gender index and $\varphi_{e,a}$ is the share of men and women of age *a* in the population. Parameters β, γ and δ are estimates from a standard Mincer equation. The parameter β is often considered to be the rate of return to one more year of formal education.

In order to implement this method, we need to construct a population data set by age, gender and educational attainment for each year we study. Secondly, we need two sets of estimates from Mincer equations for each year, one for each gender. It is feasible to calculate a human capital measure based on this approach. The major issue is that in this setup, the measurement is actually a Cobb-Douglas formula. In other words, the proportions of different education groups by construction are not "perfect substitutes." When the share of one education group increases, it could cause the total measurement to decline. For example, if we increase the proportion of population with higher education, the measurement should increase as the overall education get higher, but it could decline due to the Cobb-Douglas formulation. This happened in our calculation. Since we believe that an education-based human capital measurement should be a monotonically increasing function of the overall education, we do not report the results of the attribute-based approach. In our future work we plan to modify the structure, using, for example, average years of schooling.[11]

[11] This point was confirmed by email communication with Dr. Reinhard Koman.

2.5 Residual approach

The World Bank (2006) uses a residual approach to estimate human capital for 120 countries. Due to data and methodological limitations, total wealth in the year 2000 is measured as the net present value of an assumed future consumption stream. The value of produced capital stocks is estimated with the perpetual inventory method. Produced capital includes both structures and equipment. Natural capital is valued by taking the present value of resource rents. Natural capital includes nonrenewable resources, cropland, pastureland, forested areas, and protected areas. Intangible capital is equal to total wealth minus produced and natural capital. Intangible capital is an aggregate which includes human capital, the infrastructure of the country, social capital, and the returns from net foreign financial assets. Net foreign financial assets are included because debt interest obligations will affect the level of consumption. Intangible capital represents more than 50% of wealth for almost 85% of the countries studied.

Using a net present value approach to estimate total wealth requires assumptions about the time horizon and the discount rate. The World Bank chooses 25 years as the time horizon as it roughly corresponds to one generation. It chooses a social discount rate rather than a private rate as governments would use a social discount rate to allocate resources across generations. The social discount rate is set at 4%, which is at the upper range of estimates it reviewed for industrialized countries. The same rate is used for all countries to facilitate comparisons across countries.

A Cobb-Douglas specification is employed to estimate the marginal returns and contribution of three types of intangible capital in the model. The model's independent variables include years of schooling per capita of the working population, human capital abroad, and governance/social capital. Human capital abroad is measured by remittances by workers outside the

country. Governance/social capital is measured with a rule of law index. Although the marginal return to human capital in the aggregate is the highest of the three included intangible capital components, the contribution decomposition demonstrates that the relative contributions can differ significantly across countries (World Bank, 2006, chapter 7).

To sum up, taking into account the data availability in China, we believe that the J-F income approach is most suitable for measuring China's human capital. Moreover, this method is widely used internationally, so using it facilitates comparisons of China's human capital level with other countries'. At the same time, it is easier to calculate and implement scientifically and accurately in China. For all these reasons we will use the method of J-F to measure human capital in China.

Chapter 3 J-F Method and its application for China

The J-F approach imputes expected future lifetime incomes based on survival, educational enrollment, and employment probabilities. Expected future wages and incomes are estimated from the currently observed wages and incomes of the cross section of individuals who are older than a given cohort at the time of observation. Future incomes are augmented with a projected labor income growth rate and discounted to the present with a constant interest rate. Estimation is conducted in a backward recursive fashion, from those aged 75, 74, 73, and so forth to those aged 0.[12] When it's applied to China, we made some modifications and assumptions about the method and parameters used accordingly.

3.1 Estimate lifetime income by backward recursion

With the J-F income-based approach and data or estimates of individual's annual market labor income per capita, lifetime incomes are calculated by a backward recursion, starting from the oldest cohorts in the population. The life cycle is divided into five stages, and the equations used for calculating the lifetime expected incomes are as follows.

The fifth and final stage is retirement or no school or work (males older than 60 years old, females older than 55 years old):

$$mi_{y,s,a,e} = 0 \qquad (3)$$

[12] The J-F inclusion of nonmarket lifetime income and expected lifetime income for youngsters produces human capital estimates that are notably higher than those in the studies mentioned above who have adopted the J-F methodology.

where the subscripts *y*, *s*, *a*, and *e* denote respectively year, sex, age and educational attainment, and *mi* stands for lifetime market labor income per capita.

The fourth stage is work but no school (male 25-59 or female 25-54 years old):

$$mi_{y,s,a,e} = ymi_{y,s,a,e} + sr_{y+1,s,a+1} \times mi_{y,s,a+1,e} \times \frac{1+G}{1+R} \quad (4)$$

Where *sr* is the survival rate, defined as the probability of becoming one year older, *ymi* denotes annual market income per capita, *G* is the real income growth rate, and *R* is the discount rate.

The third stage is school and work (16-24 years old):

$$mi_{y,s,a,e} = ymi_{y,s,a,e} + \left[senr_{y+1,s,a+1,e+1} \times mi_{y,s,a+1,e+1} + (1 - senr_{y+1,s,a+1,e+1}) \times mi_{y,s,a+1,e} \right] \times \frac{1+G}{1+R} \quad (5)$$

Where *senr* is school enrollment rate--the probability of an individual with educational attainment *e* to enroll in education level *e+1*.

The second stage is school but no work (6-15 years old):

$$mi_{y,s,a,e} = \left[senr_{y+1,s,a+1,e+1} \times mi_{y,s,a+1,e+1} + (1 - senr_{y+1,s,a+1,e+1}) \times mi_{y,s,a+1,e} \right] \times \frac{1+G}{1+R} \quad (6)$$

The first stage is no school and no work (0-5 years old):

$$mi_{y,s,a,e} = sr_{y+1,s,a+1} \times mi_{y,s,a+1,e} \times \frac{1+G}{1+R} \quad (7)$$

If we let $L_{y,s,a,e}$ stand for the population in the respective categories, the expected lifetime income in a country, i.e., the total human capital stock, can be written as:

$$MI(y) = \sum_{s} \sum_{a} \sum_{e} mi_{y,s,a,e} L_{y,s,a,e} \quad (8)$$

Similar equations can be applied to estimate lifetime nonmarket labor income[13], which can be added to lifetime market labor income to obtain total lifetime labor income:

$$LIFE(y) = \sum_{s}\sum_{a}\sum_{e}(mi_{y,s,a,e} + nmi_{y,s,a,e}) \cdot L_{y,s,a,e} \qquad (9)$$

3.2 Estimate current income using Mincer models

One important component of the income approach is the estimation of future potential earnings for all individuals in the population. With the J-F income-based approach, we first need data or estimates of individual's annual market labor income per capita. We conduct estimation and make projection based on the basic Mincer (1974) equation. It has been shown that there are significant differences in the structure of the earnings equation across gender and between the rural and urban population. To ensure our income estimates to be as accurate as possible, we estimate the parameters for the rural and urban population by gender and year using survey data in selected years and derive their imputed values for missing years over the period of 1985 to 2009.

The data used for estimating the parameters of the earnings equation come from three well-known household surveys in China. The first is the annual Urban Household Survey (UHS) conducted by the National Statistical Bureau of China over the period of 1986-1997. The second data set we use is the China Health and Nutrition Survey (CHNS) for the years of 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009. The third data set we use is the Chinese Household Income Project (CHIP) for the years of 1988, 1995, 2002, 2007. The CHIP and CHNS cover both urban and rural population, while UHS only covers urban population.

[13] Nonmarket activities include household production, e.g., cooking, cleaning, and childrearing and other nonmarket activities such as education and health-related activities. In our calculation we exclude the nonmarket lifetime income because it is difficult to quantify.

The UHS is a representative sample of the urban population. The sample size varies from year to year, ranging from a low of 4,934 respondents in 1986 to a high of 31,266 respondents in 1992. Individual earnings are annual wage incomes, which include basic wages, bonuses, subsidies and other work-related incomes. Years of schooling are calculated using the information on the level of schooling completed: primary school equals 6 years of schooling, junior middle school 9 years, senior middle school 12 years, professional school 11 years, community college 15 years, and college and above 16 years. Assuming schooling begins at age 6, we approximate work experience by age minus years of schooling minus 6. As the minimum legal working age is 16 and the retirement ages are 60 and 55 for males and females respectively, we restrict our sample to include individuals who are currently employed and are between 16 and 60 years old for male workers and between 16 and 55 for female workers. Self-employed and temporary job holders are excluded, so are those who failed to report wage income or educational attainment. Chinese Appendix B.3.1 provides a complete description of the income and education definition and sampling standards. Chinese Appendix Table B.1.1 lists the entire statistic descriptions.

CHIP is Chinese Household Income Project survey, which reports income, consumption, job, production and other related information of urban and rural population. Chinese Appendix B.3.2 provides a complete description of the income and education definition and sampling standards. Chinese Appendix Table B.1.2 includes the entire statistic descriptions.

CHNS is an international project that aims to learn more about China transitional economy and society's impact on social economy, population and health behaviors in urban and rural areas. Chinese Appendix B.3.3 provides a complete description of the income and education definition and sampling standards. Chinese Appendix Table B.1.3 lists the entire statistic descriptions.

With these three data sets, we estimate the parameters of the Mincer equation for each gender of the urban and rural population by year. If we have more than one data set for any year, we weighted the estimates by sampling size to get the parameter estimates for that year. Finally, we extract fitted estimates by applying linear or exponential time trends. We use the fitted time trends to generate the imputed parameters of the earnings equation for the urban and rural population for the period 1985 through 2009.

3.2.1Estimate current income using Mincer models at the national level

We first estimate the basic Mincer equation:

$$\ln(inc) = \alpha + \beta \cdot e + \gamma \cdot Exp + \delta \cdot Exp^2 + u \qquad (10)$$

Where ln(inc) is the logarithm of earnings, e is years of schooling, Exp and Exp^2 are, respectively, years of work experience and experience squared, and u is a random error. The coefficient α is an estimate of the average log earnings of individuals with zero years of schooling and work experience, β is an estimate of the return to an extra year of schooling, and γ and δ measure the return to investment in on-the-job training.

Equation (10) has been widely adopted in empirical research on earnings determination. It has been estimated on a large number of data sets for numerous countries and time periods. Many studies have applied the model to Chinese data and found evidence consistent with the human capital theory. Notable studies include Liu (1998), Maurer-Fazio (1999), Li (2003), Fleisher and Wang (2004), Yang (2005), and Zhang *et al.* (2005). Following the convention of a large body of empirical literature, we estimate equation (10) by ordinary least squares.[14]

[14] Griliches (1977) finds that accounting for the endogeneity of schooling and ability bias does not alter the estimates of earnings equation. Ashenfelter and Krueger (1994) also conclude that omitted ability variables do not cause an upward bias in the estimated parameters of equation (1).

We use UHS, CHIP and CHNS to estimate parameters of the basic Mincer equation, and get the fitted values for the intercept, return to education, and experience related terms. More details about this parameter estimation are in the Chinese Appendix B Table B.1.4 and Table B.1.5. The constant term, which measures the base wage for the no-school, no-experience population, clearly reveals a male advantage. Chinese Appendix B Figure B.1.1 shows an evident gap between urban and rural population during 1985-2009, intercepts for urban are higher than rural ones, urban male has higher intercept than female, while the opposite is true for rural population. Returns to schooling are positive and in general increasing over the sample years. When the Soviet-type wage grid was replaced by market wages (Fleisher, Sabirianova, Wang 2005), Wang, Fleisher, Li, and Li (2009) also reports that female rates of return dominate male returns, and they offered an explanation. Rising returns to education have been a ubiquitous phenomenon in transitional economies. Figure 3.2.1-Figure 3.2.4 shows the measurement method and trend of the return to education for male and female in rural and urban areas. Earnings also increase with work experience but at a decreasing rate—a pattern found in most studies. Over time the earnings-experience profile shifts up for male but fluctuates for females. For most recent years the male profile doesn't curve downward as much as that of female, and the male profile is much higher than the female profile, indicating uniformly higher return to experience for male than for female, *ceteris paribus*.

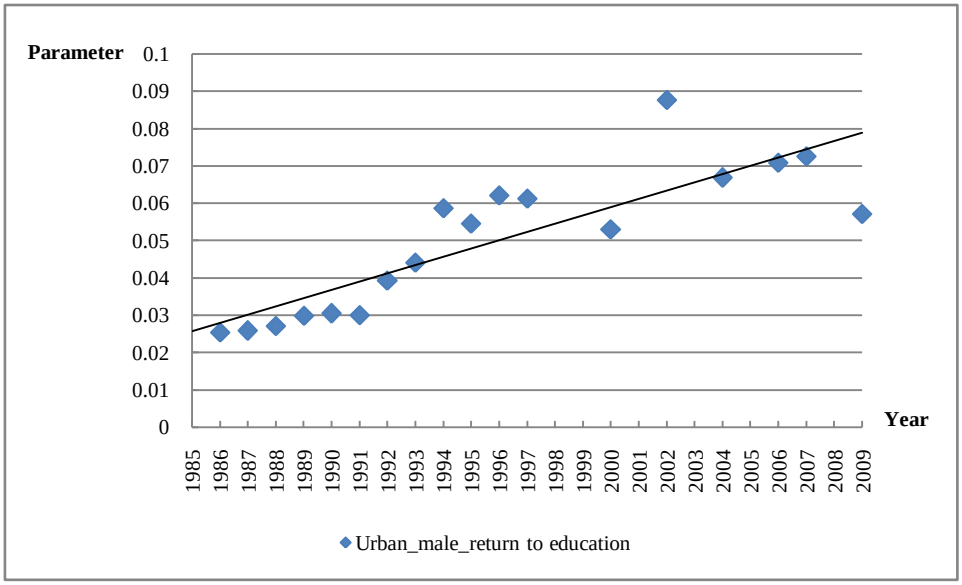


Figure 3.2.1 Return to Education for Urban Male

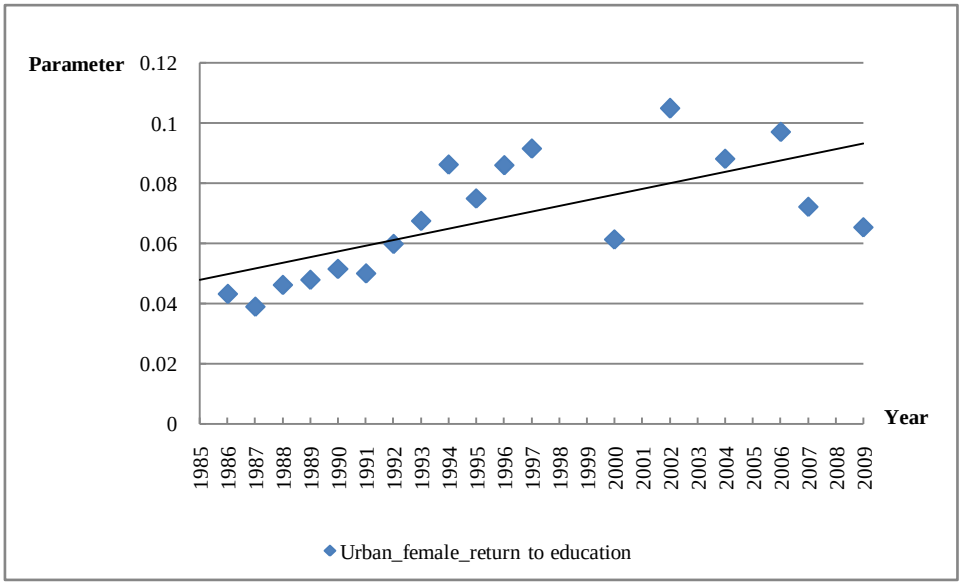


Figure 3.2.2 Return to Education for Urban Female

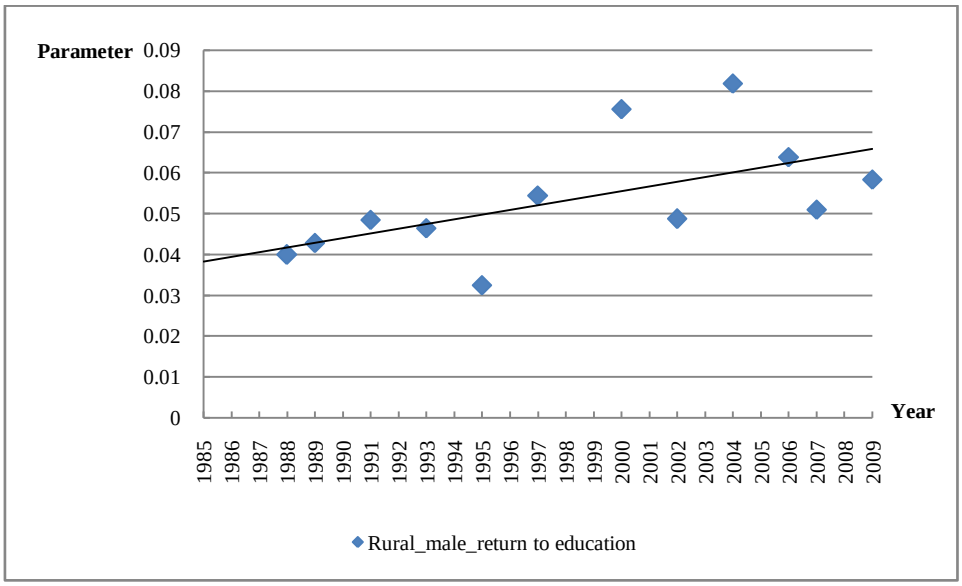


Figure 3.2.3 Return to Education for Rural Male

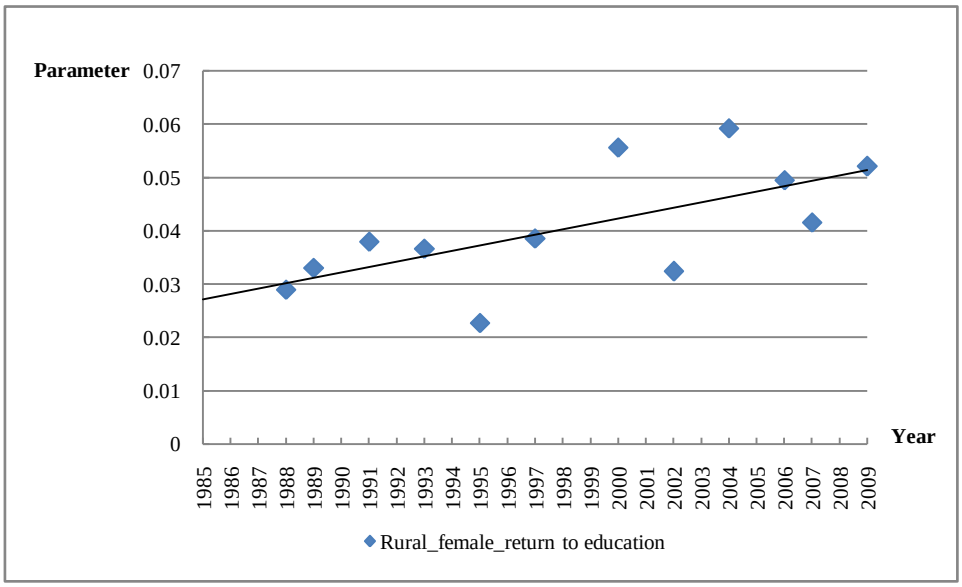


Figure 3.2.4 Return to Education for Rural Female

3.2.2 Estimate current income using Mincer models at the provincial level

As for the provincial level parameter estimation, on the base of Mincer equation, we implement macro data for adjustment. We estimate the following Mincer equation:

$$\ln(inc) = \beta_0 + \beta_1 \cdot \ln(Avwage) + \beta_2 \cdot Sch + \beta_3 \cdot Sch \cdot \mathrm{A}vgdp + \beta_4 \cdot Sch \cdot Ratio + \beta_5 \cdot Exp + \beta_6 \cdot Exp^2 + \mu \quad (11)$$

Where ln*inc* is the logarithm of earnings, *Sch* is years of schooling, *Exp* and Exp^2 are, respectively, years of work experience and experience squared, and *u* is a random error. *Avwage* represents the average employee nominal salary for the rural and urban population accordingly. It could reflect income gap between different provinces to some extent. *Avgdp* stands for nominal GDP per capita. *Ratio* means the primary industry employment ratio of the total working population. The parameters of *Sch Avgdp* and *Sch Ratio* could reflect the job market situation of the educated population. We add *Avwage* into the intercept term, add *Avgdp* and *Sch* as an interaction term, add the first industry employment ratio of the total working population and *Sch* as an interaction term into the equation. Adding these additional variables into the conventional Mincer equation not only makes full use of the existing data and helps solve the missing data problem in parameter estimations, it also makes the estimation results more realistic.

In the model, $\beta_0 + \beta_1 \cdot \ln(Avwage)$ is the logarithm of the base wage for the non-school, non-experience population. $\beta_2 + \beta_3 \cdot Avgdp + \beta_4 \cdot Ratio$ represents the return to education, β_5 and β_6 measure the return to experience. For Shanghai, it only has urban parameter estimates. Moreover, we assume male has different return to experience for urban and rural areas, but shares the same parameter for *Exp* and Exp^2 across all provinces; this is the same case for female.

Like national Mincer parameter estimation, provincial data used for estimation also comes from UHS, CHIP and CHNS. We use ordinary least squares to estimate equation (11). When all three data sets are available for a sample year, we drop CHNS and use UHS and CHIP estimates because of the relatively low quality of CHNS income measures, then they are weighted by respective sample size for larger sample size will make estimates closer to the real value. We adopt the same sampling standards as in the national estimation. We use the fitted trend lines to generate imputed values of the parameters for each gender by year over the period 1985 to 2009. Graphs show that when we plot each of the parameter estimates against time, they are generally trended. We adopt the linear trend model to get the fitted values for parameter, that is $Y = \alpha_0 + \alpha_1 \times time + \mu$. Under the assumption that the effect of *Avwage*, *Sch*, *Exp*, Exp^2 on income growth grows at a fixed rate, we use the linear trend fitting method for all the parameters.

3.3 Growth rates of real income and the discount rate

To measure lifetime earnings for all individuals in the population, we need to project incomes for future years, discount these incomes back to the present, and weight income for each individual by the age-and gender-specific probability of survival. We use the imputed earnings equation parameters to estimate earnings for all individuals in a given year, and then derive earnings for future years until retirement assuming real earnings grow at a constant rate.[15] The main task of this section is to estimate the expected growth rate of real income and select an appropriate discount rate. Since the real income grew at fairly different rates in the past for the urban and rural population, we estimate them separately.

[15] Mincer equation parameter estimates are used to calculate the cohort-wise labor income for a given year, it is not used to project future income.

3.3.1 Growth rates of real income

To measure lifetime earnings for all individuals in the population, we need to project incomes for future years and discount these incomes back to the present. We use the following method to estimate the real income growth rates for urban and rural areas respectively.[16]

Assuming that the technology is labor-augmenting, we specify the aggregate production function as:

$$Y = (AL)^a K^b \qquad (12)$$

Where Y is output, A denotes a technology factor, L denotes labor input, and K physical capital input. The average product of labor or labor productivity is proportional to the marginal product of labor.[17] Because the marginal product of labor equals the real wage when the labor market is in equilibrium, labor productivity and the real wage are expected to grow at the same rate. This suggests that the growth rate of real output per employed worker can serve as a reasonable estimate for the growth rate of real wage.

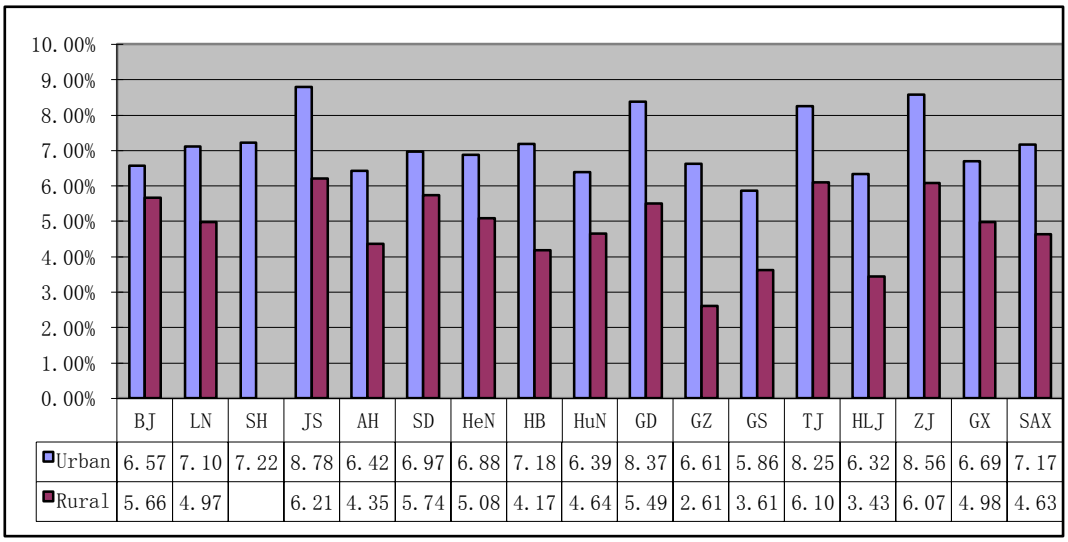
The labor productivity for the rural sector is calculated using real GDP of the primary industry divided by the number of workers in that industry; and for the urban sector we use real GDP of the secondary and tertiary industries divided by the number of workers in these industries. The result shows that, for the 30-year period 1978-2009, labor productivity grew on average 4.33%

[16] In China, there are also growth rates of real annual income in urban areas reported in the series of the *China Statistical Yearbook*, but this income only includes labor wage for those who work in or get paid from the state-owned, urban collective, joint venture, joint-stock, foreign and Hong Kong, Macao and Taiwan invested companies and their subsidiaries. This cannot reflect the overall income level in China, because Chinese enterprises have other ownership forms.

[17] The marginal product of labor is given by $\beta Q/L$, where Q/L is the average product of labor.

and 6.14% per annum in the rural and urban sectors, respectively. Those growth rates will be used in the J-F calculation.[18]

We use the same method to calculate the provincial income growth rates for Beijing, Liaoning, Shanghai, Jiangsu, Anhui, Shandong, Henan, Hubei, Hunan, Guangdong, Guizhou, Gansu, Tianjin, Heilongjiang, Zhejiang, Guangxi and Shaanxi, their growth rates for urban and rural areas are shown in Figure 3.3.1. We assume that provincial labor productivity (real income) grows at a fixed annual rate.



	BJ	LN	SH	JS	AH	SD	HeN	HB	HuN	GD	GZ	GS	TJ	HLJ	ZJ	GX	SAX
Urban	6.57	7.10	7.22	8.78	6.42	6.97	6.88	7.18	6.39	8.37	6.61	5.86	8.25	6.32	8.56	6.69	7.17
Rural	5.66	4.97		6.21	4.35	5.74	5.08	4.17	4.64	5.49	2.61	3.61	6.10	3.43	6.07	4.98	4.63

Figure 3.3.1 Provincial Income Growth Rate

3.3.2 The discount rate

The discount rate that is used to value future incomes into present terms should reflect the rate of return one expects from investments over a long time horizon. We adopt the discount rate of 4.58% which is also used by Jorgenson and Fraumeni (1992a). This discount rate was derived by Jorgenson and Yun

[18] Those rates are considerably higher than the growth rate of 1.32% (Jorgenson and Yun, 1990) used in OECD human capital calculation because the Chinese economy has grown much faster. Although the rate is based on 30-year moving average, it is still unclear whether it can represent long-run growth rate in China.

(1990) based on the long-run rate of return for the private sector of the U.S. economy. As is the case for other calculations using discount rate, the result will be sensitive to the choice of discount rate. We also use alternative discount rates for the purpose of comparison, including the average interest rate on the 10-year government bonds issued to individual investors in China over the period 1996 to 2007, net of the average rate of inflation over the same period, 3.14%[19]; the average benchmark lending rate over 5 years in China from 1996 to 2009, 5.51%;[20] and the social discount rate based on the method from the World Bank, 8.14%.[21]

3.3.3 The deflators

In order to convert nominal human capital into real human capital, we use price deflators. For national human capital, we use the CPI for urban and rural, deflator for fixed capital formation in Zhang, Wu and Zhang (2004) and deflators of fixed assets in Holz (2006), But for provincial estimates, we use two kinds of deflators to get the real human capital, they are: CPI for urban and rural; living cost index based on 1985 Beijing living cost.

---

[19] The details could be found in the *China Human Capital Index Analysis Report* 2009 Version. However, although the ideal discount rate should include market risk, someone may question that coupon rate doesn't reflect it. We used the yield to maturity of the 10-year book-entry bonds issued to individual investors that are circulated in the stock exchange market and commercial banks as a comparison and found that the difference of the results are minor.

[20] The People's Bank of China set and adjusts the benchmark lending rate, which plays a key role in the money market. We excluded the serious inflation period of 1993-1995, starting from 1996 to avoid negative discount rates.

[21] We calculated the average growth rate of individual consumption over the period 1985 to 2008 based on World Bank's method. More details are available in *Where is the wealth of nations?* Human capital and economic growth in China, both from the World Bank, "A Social Discount Rate for the United Kingdom" in *Environmental Economics: Essays in Ecological Economics and Sustainable Development*, ed. D. W. Pearce, 268–285. Cheltenham: Edward Elgar Publishing.

3.4 Additional data imputations and assumptions for the J-F estimates

Besides annual population data by age, sex, and educational attainment, the J-Fmethod requires additional information on the lifetime income, enrollment rate, growth rate of real wage, and discount rate. We briefly discuss how we construct these supplemental data sets in this section. Some parameters have to be set at values appropriate for China. Detailed information can be found in the appendixes.

Following J-F as previously described, an individual may assume one of the following six statuses at any time: no school or work (age 0-5), school only (age 6-15), work and school (age 16-24), work only (25 to retirement), and retirement (age 60+ for male and 55+ for female). Each status implies a different pattern of age-income profile, therefore the method of computing lifetime income shall be different.

We first estimate a standard Mincer equation (i.e. with a regression of annual income on schooling years, work experience, and work experience squared) with microeconomic data sets (China Household Income Project, China Health and Nutrition Survey, and Urban Household Survey). We use annual employment rates by age, sex, and educational attainment (from China Population Statistical Yearbook and China Population Census) to convert annual income into annual market income. Then the lifetime income for each age/sex/education category can be calculated using the methodology described in the previous section.

For the in-school population, we carefully derive the number of people in each education level with data on new enrollment, mortality rate, and attrition rate. We consider the following five categories of schooling: no schooling, primary school, junior middle school, senior middle school, and college and above or for six categories of schooling where we break down

college and above into college (less than 4 years) and university (at least 4 years) and above. We compute lifetime income for every grade at each education level, taking into account how likely the individual will continue into the next grade and the next education level. For the five categories of schooling estimation, college and above is the highest education level. For the six categories of schooling estimation, college or university and above are the highest education levels. We do not allow for the possibility that one can go to college and then to university.

Because data is not available for some age groups and some education levels, additional imputations and assumptions are needed. Imputations of data sets for certain age groups and initial age of enrollment are described in Appendix A. Enrollment and grade advancement imputations and assumptions are described in this section.

The imputation of two components of the J-F human capital estimates is described in this section: 1) Number of years until an education category is completed, and 2) The probability of advancing to the next higher education category. We assume that all students complete a grade level (if they continue) in the same number of years: 6 for primary, 3 for junior middle, and 3 for senior middle school. It is also assumed that no drop-outs return to school, no grades are skipped, and that education continues without a break. These assumptions are also made by J-F. The probability of advancing to the next higher education level is estimated as the average ratio of the sum of all students of any age in a year who are initially enrolled to the sum of all students of any age initially enrolled in the next higher education level 'X' years later. "X" depends on the number of years it takes to complete an education level. The imputations and assumptions allow for the appropriate discounting of a future higher income level.

In each case, continuing students are tracked from their age of initial enrollment, through individual grade levels, until they advance to the next

higher level. The number of years discounted until they realize higher level of lifetime income depends on the number of years it takes to advance given the current grade of enrollment.

Then, we treat the terminal education level as a probabilistic event, and therefore lifetime income is a forecast based on the contemporary information set, except that the probability of advancing depends on initial enrollments at a higher education level in subsequent years. For instance, the lifetime income of a student who is in the first year of junior middle school, assuming the student will live to finish junior middle school and goes onto senior middle school, depends upon an adjusted lifetime income of someone who is currently three years older and whose educational attainment is senior middle school. The adjustments include those for three years of labor income (wage) growth and three years of discounting.

Chapter 4 China population and education dynamics

4.1 Population imputation

In order to implement the various methods used in estimating human capital, we first and foremost need annual population data by age, sex, and educational attainment. We construct such data sets according to the following procedure.

First, data sets are available for the years 1987, 1995, and 2005 from the 1% Population Sampling Survey and for the years 1982, 1990, 2000 from the Population Census. The data sets also contain disaggregated numbers for urban and rural populations categorized by age and gender.

For all other years, based on the existing years' population data, we combine birth rate, mortality rate by age and sex, and enrollment at different levels of education to impute yearly population by age, sex and educational attainment for urban and rural areas. We define the following levels of educational attainment: illiterate (no schooling), primary school (Grade 1-6), junior middle school (Grade 7-9), senior middle school (Grade 10-12), and college and above. From 2000 on, additional statistical information makes it possible to separate the population at the level of college and above into two: one is college, and the other is university and above.

Specifically, we use the following perpetual inventory formula to deduce population by age, sex and educational attainment in missing years:

$$L(y,e,a,s) = L(y-1,e,a,s)\cdot\left(1-\delta(y,a,s)\right) + IF(y,e,a,s) - OF(y,e,a,s) + EX(e,a,s) \quad (13)$$

$L(y,e,a,s)$ is the population in year y at education level e, with age a

and sex *s*. $\delta(y,a,s)$ is the mortality rate in year *y*, with age *a* and sex *s*. $IF(y,e,a,s)$ and $OF(y,e,a,s)$ are inflow and outflow of this particular group. For example, inflow would include individuals who just achieved this level of education, while outflow would include those who just achieved the next level of education. $EX(e,a,s)$ is a discrepancy term.[22] Moreover,

$$IF(y,e,a,s) = \lambda(y,e,a,s) \cdot ERS(y,e,s) \tag{14}$$

$$OF(y,e,a,s) = \lambda(y,e+1,a,s) \cdot ERS(y,e+1,s) \tag{15}$$

$$\sum_a \lambda(y,e,a,s) = 1 \tag{16}$$

ERS is the matriculation at education level *e*, λ is the age distribution at education level *e*. In order to obtain accurate estimate for λ, we use both microeconomic data sets CHNS (China Health and Nutrition Survey, 1989, 1991, 1993, 1997, 2000) and CHIP (Chinese Household Income Project, 1995), macroeconomic data sets (China Education Statistical Yearbook, 2003-2007). Details can be found in Appendix A.

4.2 Trend of population and education distribution

Here we present several features of China's population growth, based on the population by educational attainment, age, sex, and location (i.e. urban and rural). First of all, during our sample period, China's total population increased from 1.02 billion in 1982 to 1.33 billion in 2009. The urban population increased by 412 million, while the rural population decreased by 92.8 million (Figure 4.2.1).

[22] For example, the discrepancy can be caused by migration, but we do not have the data.

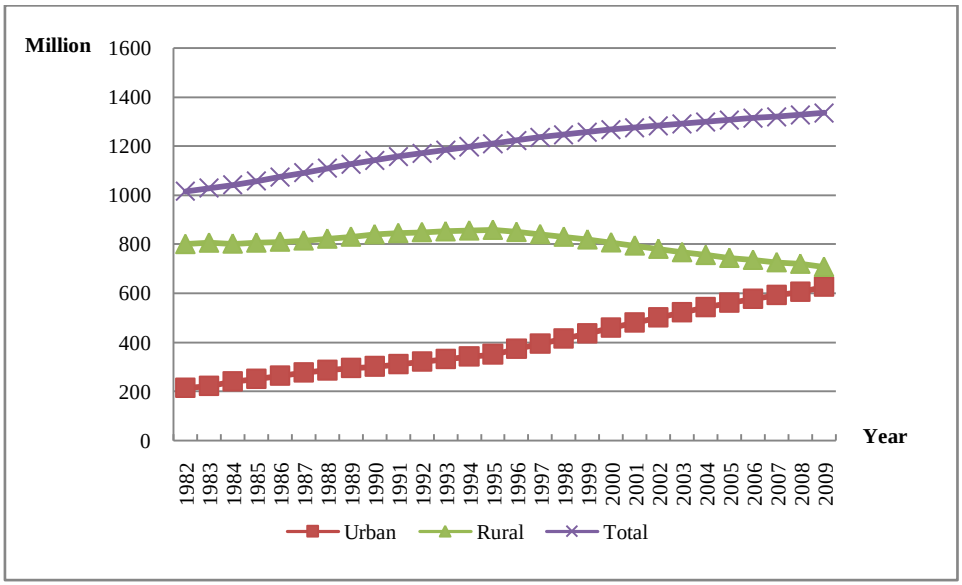


Figure 4.2.1 Population in China

Figure 4.2.2-4.2.4 shows the trend of national, urban and rural population classified by education attainment. The illiterate population was cut in half from 402 million in 1982 to 201 million in 2000, but was relatively stable from 2000 to 2009. The number of primary school graduates increased from 359 million in 1982 to the peak of 466 million in 1997, then declined gradually to 382 million in 2009. This decline is expected as more primary school graduates continue to receive higher education instead of terminating formal education. This is also shown in the rapid growth of junior middle school graduates.

Junior middle school students experienced the largest growth among all education levels: the number of junior middle school graduates increase from 181 million in 1982 to 489 million in 2008. This may be related to the implementation of 9-Year Compulsory Schooling Law since 1994 (9-year schooling amounts to completing junior middle school). However, growth slowed down after 2001. Senior middle school and college and over, both started from very low numbers, have grown significantly. Senior middle school graduates increased from 68 million in 1982 to 169 million in 2008,

while college and above increased from only 6 million in 1982 to 91 million in 2009. For the senior middle school and college and above level, the growth in rural areas is much slower than that in the urban areas.

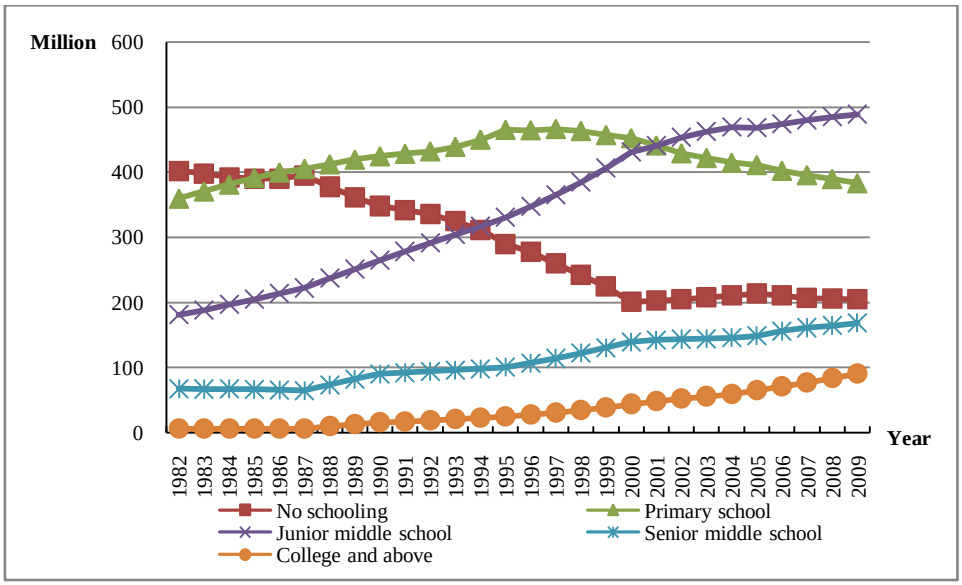


Figure 4.2.2 Population by Education Attainment in China

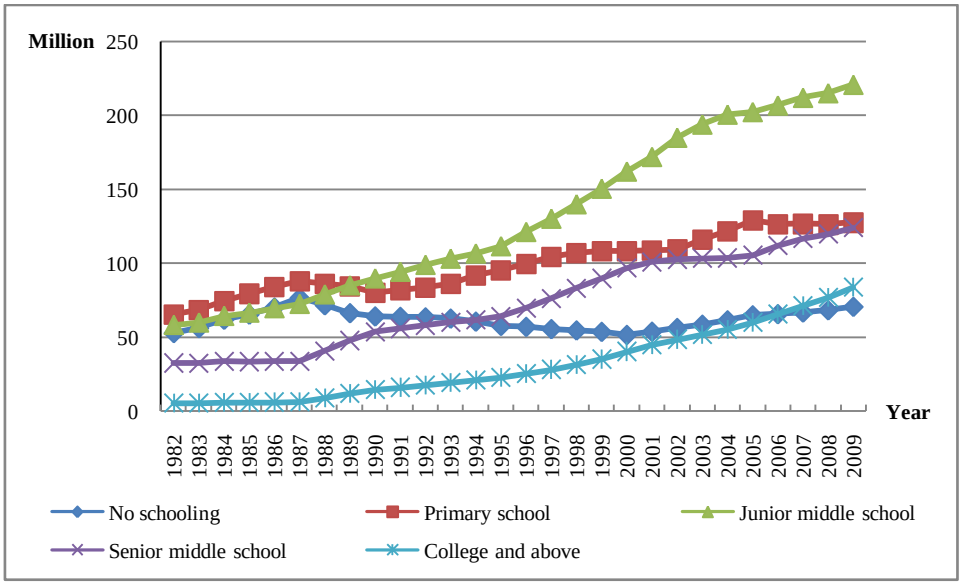


Figure 4.2.3 Urban Population by Educational Attainment

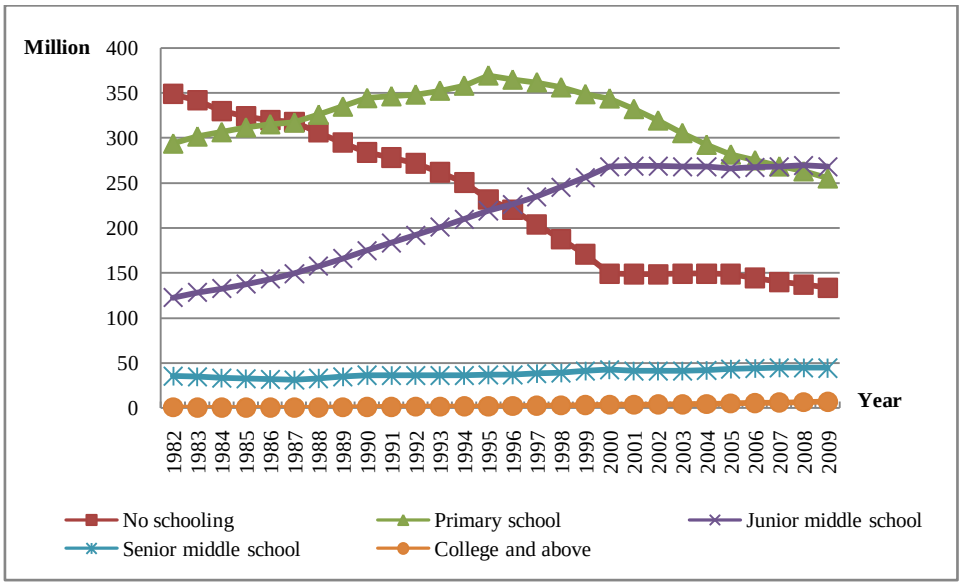


Figure 4.2.4 Rural Population by Educational Attainment

We next take a closer look at the changes in the distribution of education attainment in the population at different time points. Figures 4.2.5 to 4.2.7 show the rightward shift of the educational attainment distribution in the population. In 1985, among the five education levels, the illiterates and primary educated dominated the distribution. The 1995 distribution is dominated by people with primary and junior middle education, i.e. the distribution remains heavily skewed to the right. By 2009, junior middle has become the dominant education level. The distribution is still skewed to the right, but it is much less so than in 1985. Moreover, female educational attainment has improved more relative to that of males; the number of illiterate females decreased faster than that of illiterate males, while the gender gap at higher education levels shrunk considerably. As a result, the female educational attainment distribution is becoming similar to that of the male, despite the very large difference in 1985.

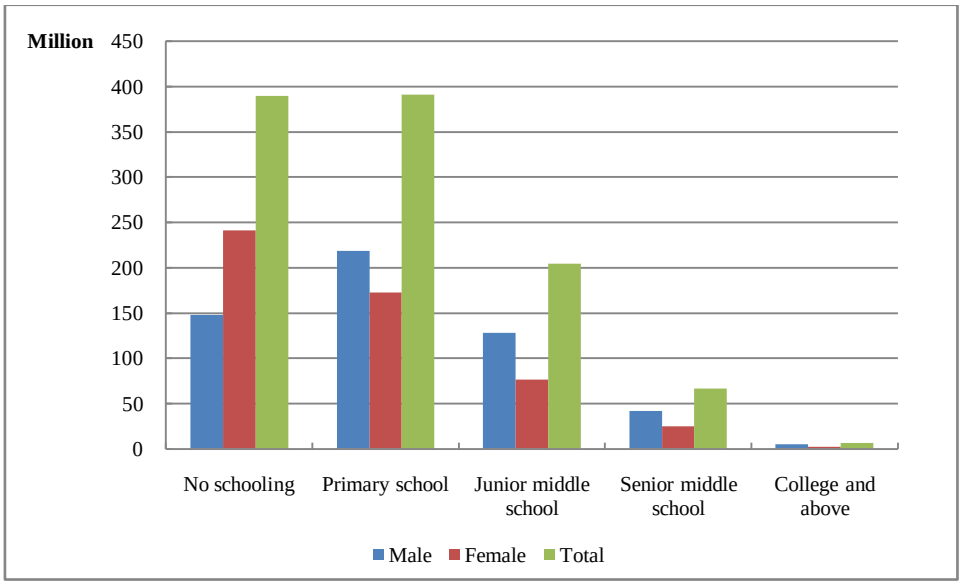


Figure 4.2.5 Population of Different Educational Levels by Gender, 1985

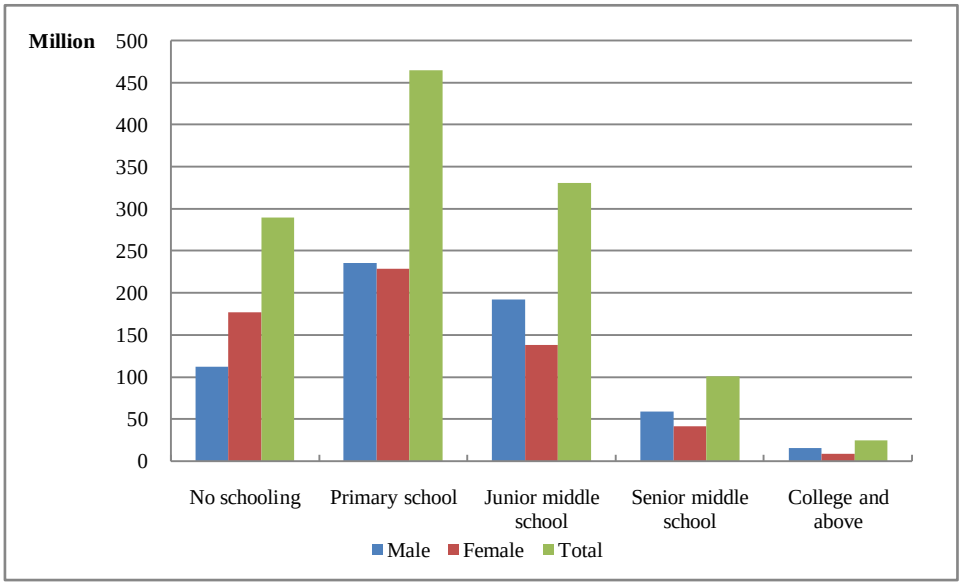


Figure 4.2.6 Population of Different Educational Levels by Gender, 1995

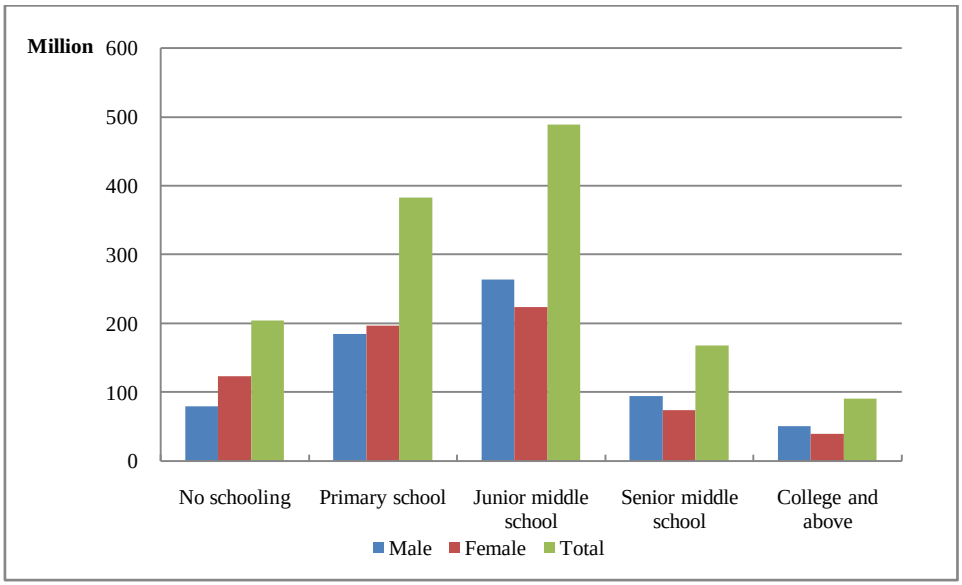


Figure 4.2.7 Population of Different Educational Levels by Gender, 2009

Figures 4.2.8 to 4.2.10 disaggregate the data into rural and urban subsamples. Not surprisingly, most of the illiterate population resided in the rural area. However, the rural illiterate population fell from 324 million in 1985 to 134 million in 2009. Although the urban illiterate population changed slightly in absolute terms, its share in the urban population fell from 26.06% in 1985 to 11.27% in 2009. In the meantime, in the highest three levels of education (junior middle, senior middle, and college and over), urban growth outpaced rural growth. For example, the urban junior middle school population increased from 66 million to 221 million, while the rural junior middle school population roughly doubled, from 140 million to 268 million. The comparison is more startling in the highest two education levels. The urban senior middle school population increased from 33 million to 124 million, while the rural senior middle school population only increased from 32 million to 44 million. The urban college and over population increased from 5 million to 83 million, while in rural areas, it grew from 0.63 million to 7.26 million.

Note that during most of the sample period, the rural population far

exceeded the urban population. Although both the urban and the rural distributions have improved, i.e. less skewed to the left, the improvement has certainly been more rapid and significant in the urban area. One caveat, however, is that the result might be caused by better educated people migrating from rural to urban areas. We take special measures to control for that effect (See Appendix A).[23]

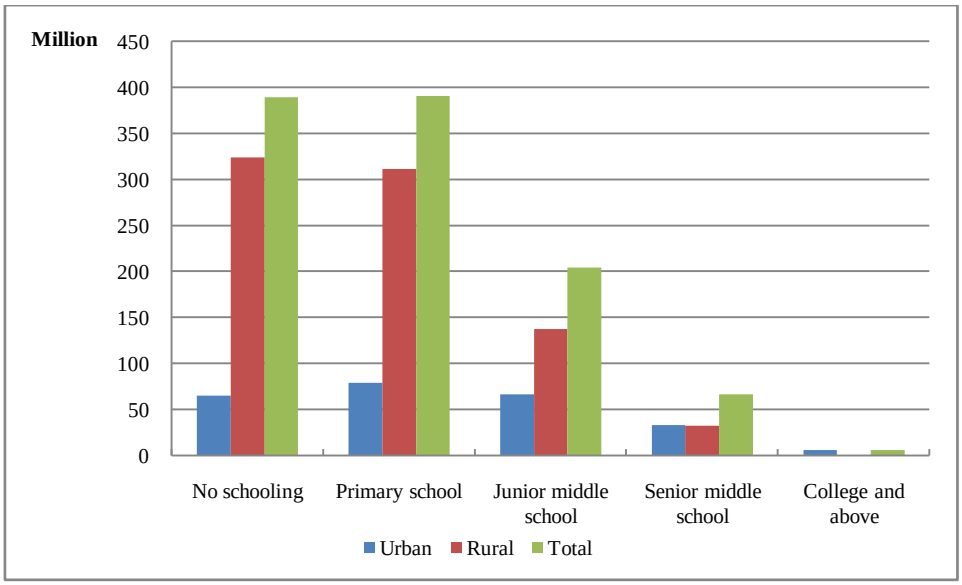


Figure 4.2.8 Population of Different Educational Levels by Region, 1985

[23] To take the migrants into account, we make the following adjustments in the population imputation part: under the assumption that the number of immigrants in each year is the same, we retrieve the average difference between imputed population data and the census data back to the estimated population data according to the structure of the population by age, gender and education level.

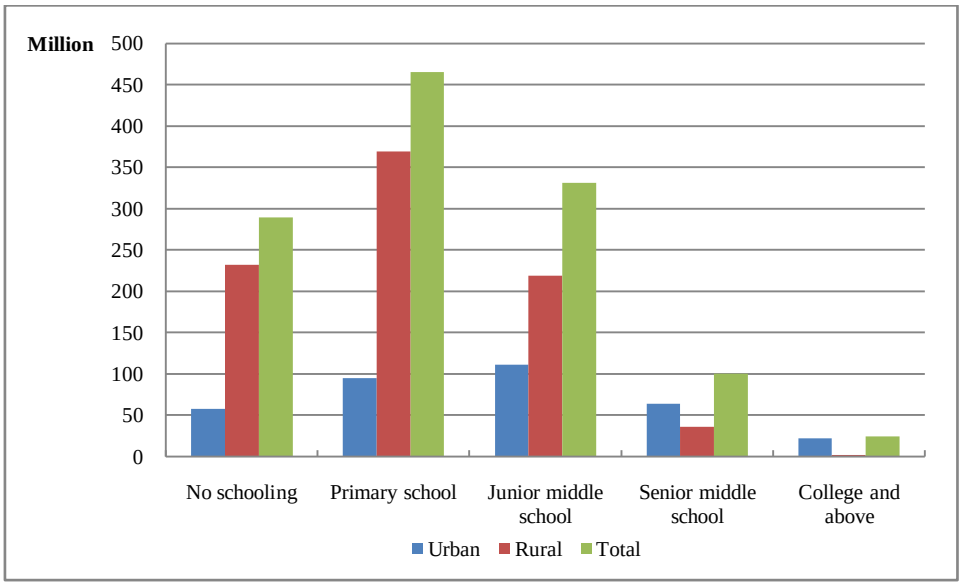


Figure 4.2.9 Population of Different Educational Levels by Region, 1995

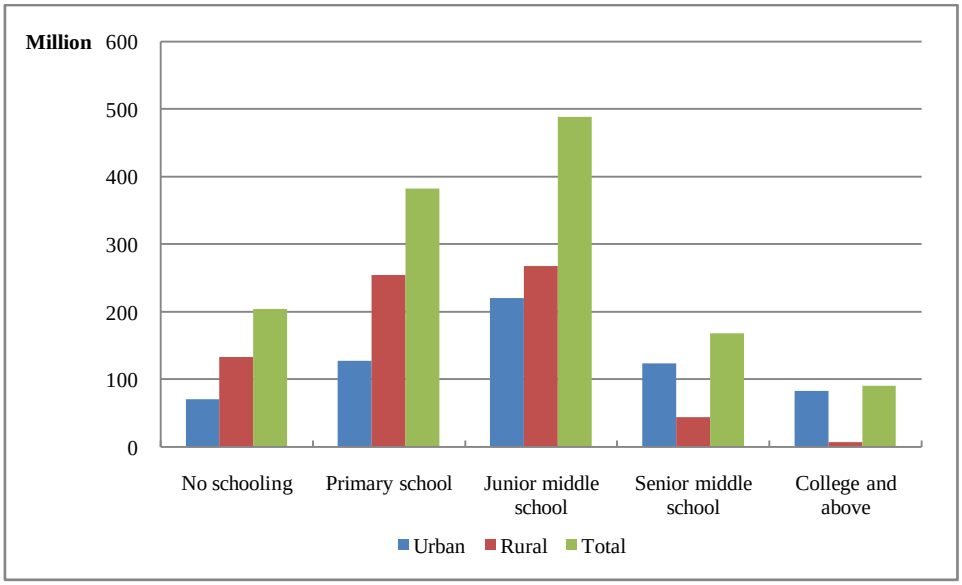


Figure 4.2.10 Population of Different Educational Levels by Region, 2009

Chapter 5 National human capital[24]

5.1 Human capital, GDP, and physical capital

Based on the Mincer income parameter estimates and population imputation data, with 4.58% as the discount rate, we calculated human capital at the national level for 1985-2009, the results are reported in Table 5.1.1. Before 2000, five education categories were reported by the National Bureau of Statistics of China. They are: no school, elementary school, junior middle school, senior middle school, and college and above. Starting from 2000, college and above was further divided into two categories: three-year college, and four-year university and above.[25] With this more detailed information on educational attainment, we create a separate human capital series starting from 2000. Columns 1 and 2 contain the national human capital measured in nominal terms by 5-6 education categories, and columns 3 and 4 present the national human capital measured in real terms (in 1985 Yuan) accordingly. National human capital becomes larger with six education categories. This is because the lifetime income of four-year university and above graduates is higher than the lifetime income of three-year college graduates. In this table, the real values are calculated using the CPI as a deflator.[26]

---

[24] The national and provincial human capital estimates are developed mainly based on Jorgenson-Fraumeni methodology as previously described in the previous chapter.

[25] When we estimate the Mincer equation to generate annual earnings, we assign 15 years of schooling for the category three-year college; and assign 16 years of schooling for the category four-year university and above. Because we use the lower bound of schooling for this education category, the amount of human capital is underestimated.

[26] Because the national human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Table 5.1.1 National Nominal and Real Human Capital, Nominal GDP

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	26,033		26,033		904	28.80
1986	29,581		27,783		1,027	28.79
1987	33,704		29,508		1,205	27.97
1988	38,556		28,415		1,504	25.64
1989	43,852		27,371		1,700	25.79
1990	50,234		30,397		1,872	26.84
1991	56,761		33,177		2,183	26.01
1992	64,160		35,227		2,694	23.82
1993	73,110		34,964		3,526	20.73
1994	82,870		31,905		4,811	17.23
1995	93,300		30,629		5,981	15.60
1996	107,900		32,613		7,014	15.38
1997	125,310		36,757		7,806	16.05
1998	144,760		42,689		8,302	17.44
1999	167,490		49,961		8,848	18.93
2000	193,460	193,820	57,353	57,416	9,800	19.74
2001	218,140	218,740	64,064	64,183	10,807	20.19
2002	247,890	248,770	73,170	73,390	11,910	20.81
2003	281,580	282,750	81,980	82,280	13,517	20.83
2004	318,320	319,740	89,100	89,460	15,959	19.95
2005	364,600	367,560	100,060	100,830	18,581	19.62
2006	402,790	404,930	108,920	109,450	21,752	18.52
2007	458,840	461,600	118,290	118,950	26,776	17.14
2008	525,050	528,950	127,730	128,610	31,623	16.60
2009	598,400	602,990	146,460	147,530	34,346	17.42

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure 5.1.1 graphs national real and nominal human capital reported in Table 5.1.1. As is seen from the figure, human capital in both nominal and real terms rises steadily and nominal human capital grows faster than real human capital.

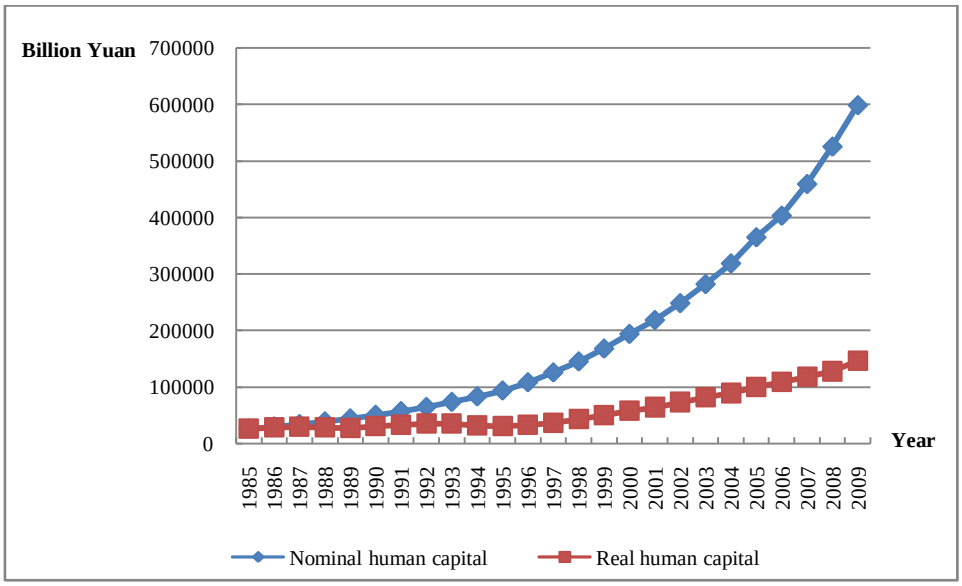


Figure 5.1.1 National Nominal and Real Human Capital

In order to get a sense of the magnitude of the estimated national human capital, we also report the ratio of human capital to GDP in Table 5.1.1.[27] Similar to physical capital, human capital stock plays an important role in GDP growth, so the ratio could also reflect human capital's influence on sustainable growth of GDP. As is seen from Figure 5.1.2 below, national nominal human capital is substantially higher than nominal GDP. The ratio of human capital to GDP drops over time from 29 in 1985 to 17 in 2009. Jorgenson and Fraumeni's (1992a) 1947 to 1986 estimates of the ratio of market human capital to GDP in the U.S. are between 18 and 22. The average annual growth for human capital in China from 1985 through 2009

[27] We use nominal values for calculating ratios throughout in order to prevent influences caused by using different deflators.

is 7.20% per year, considerably lower than economic growth.[28] Over the same period, the Chinese economy grew at an annual rate of 8.33%.[29] This helps explain the declining ratio of human capital to GDP. There are three stages in this series: Downwards from 1985 through 1995, upwards from 1995 through 2003, and finally downwards from 2003 through 2009. The period 1995 through 2009 overall is a period of rapid real human capital growth compared to earlier periods; however, this growth did slow down between 2003 and 2009. The downward trend in the most recent period is partly due to the confluence of continuing rapid economic growth with slower population growth. The decreasing ratio of human capital to GDP may also indicate possible constraints on China's future GDP growth.

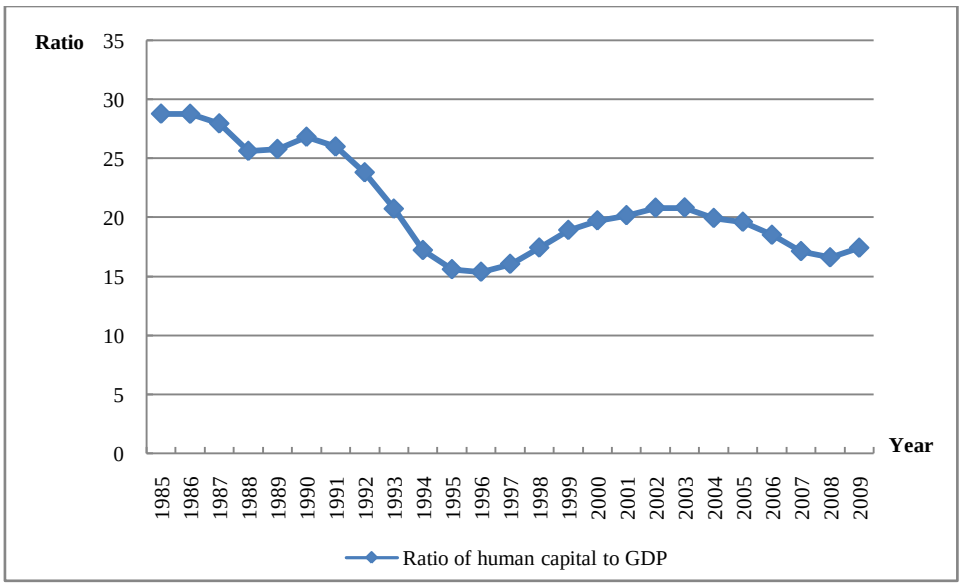


Figure 5.1.2 National Ratio of Human Capital to GDP

We also compare our human capital estimates with the estimated physical capital in China. There are a few estimates of China's physical

[28] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.
[29] The data come from "China Statistical Yearbook 2009", Table 2-1, 2-5.

capital. Table 5.1.2 reports physical capital estimated by Zhang, Wu and Zhang (2004). 30Table 5.1.3 reports physical capital estimates (fixed assets only) in Holz (2006). In both tables, we use deflators in Zhang, Wu and Zhang (2004) and Holz (2006) to calculate real capital.

Table 5.1.2 Human Capital and Physical Capital (Zhang et. al. 2004), 1985-2000

Year	Human capital	Physical capital	Ratio of human capital to physical capital
	Trillions of 1985 Yuan		
1985	26.03	1.42	18.33
1986	27.81	1.57	17.71
1987	30.08	1.76	17.09
1988	30.32	1.95	15.55
1989	31.78	2.08	15.28
1990	34.51	2.2	15.68
1991	35.95	2.37	15.17
1992	35.96	2.61	13.78
1993	32.77	2.94	11.14
1994	33.65	3.34	10.08
1995	35.76	3.8	9.41
1996	39.75	4.29	9.27
1997	45.40	4.79	9.48
1998	52.55	5.36	9.80
1999	61.05	5.92	10.31
2000	69.75	6.54	10.66

Note: We converted the real physical capital series from 1952 based to 1985 based (see Table C.9).

[30] These estimates were published in Economic Research, a leading academic journal in China.

Table 5.1.3 Human Capital and Mid-year Real Original Value of Fixed Assets of Holz (2006), 1985-2003

Year	Human capital	Mid-year real original value of fixed assets	Ratio of human capital to fixed assets
	Trillions of 1985 Yuan		
1985	26.03	1.73	15.05
1986	27.81	1.95	14.26
1987	30.10	2.18	13.81
1988	30.33	2.43	12.48
1989	31.78	2.7	11.77
1990	34.52	2.97	11.62
1991	35.62	3.26	10.93
1992	34.93	3.58	9.76
1993	31.43	3.94	7.98
1994	32.28	4.32	7.47
1995	34.31	4.75	7.22
1996	38.16	5.24	7.28
1997	43.58	5.78	7.54
1998	50.43	6.35	7.94
1999	58.58	6.94	8.44
2000	66.94	7.56	8.85
2001	75.17	8.19	9.18
2002	85.25	8.87	9.61
2003	94.76	9.66	9.81

Note: We converted real fixed assets series from 2000 based to 1985 based. See the deflators of fixed assets (2000=100) in Table C.9.

As can be seen in Figure 5.1.3 and Figure 5.1.4, in both cases human capital is much higher than physical capital. More specifically, human capital is about 7 to 18 times the amount of physical capital. This is not surprising, given that in most countries intangible capital, which is

predominantly human capital, accounts for over 60% of national wealth.[31] On the other hand, the ratio of human capital to physical capital is declining almost continuously, based on both estimates of physical capital and human capital. It is unclear whether such a trend indicates that the Chinese government has overly weighted towards physical capital investment relative to human capital investment.[32]

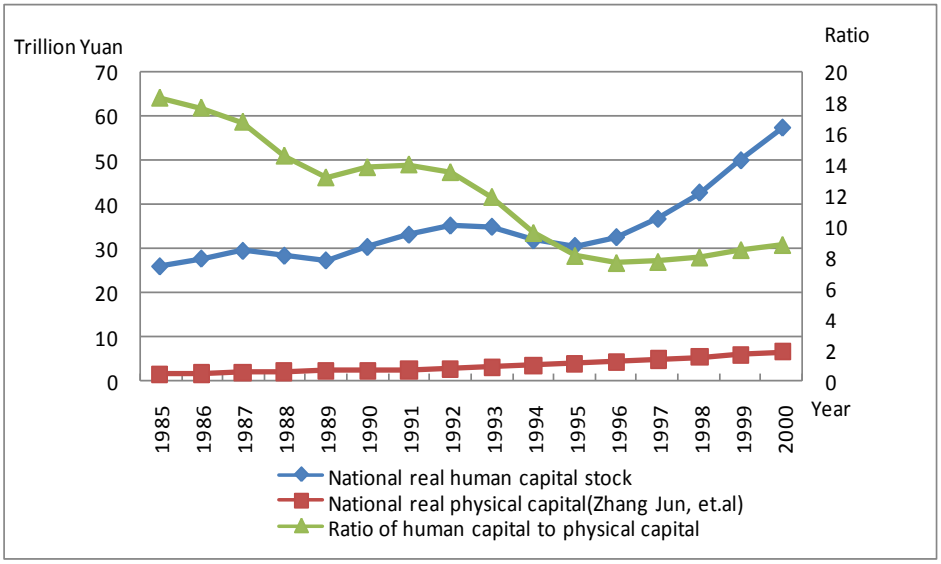


Figure 5.1.3 Human Capital and Physical Capital (Zhang et. al. 2004), 1985-2000

[31] World Bank (1997). The World Bank wealth estimates include physical capital, natural resources, and other forms of intangible capital besides human capital.

[32] Heckman (2005) and Liu (2007) also find over-investment of physical capital and under-investment of human capital in China during the reform period.

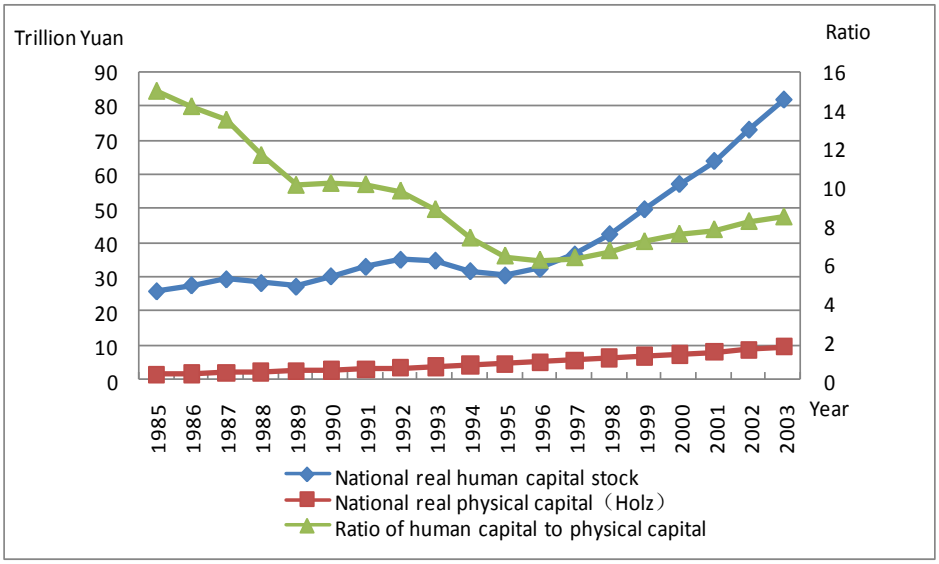


Figure 5.1.4 Human Capital and Physical Capital (Holz), 1985-2003

5.2 Trends in human capital

In order to discuss the trend of human capital in China, we use CPI as deflator to calculate the real values. One reason is that other published deflators are not available for later years; and the other reason is that, as can be seen above, the results based on CPI are smaller than that based on capital deflators reported in those two studies. Thus, we give more conservative estimates of human capital in China.

Table 5.2.1 shows real human capital for the country as a whole, by gender, and by region. From 1985 to 2009, the human capital increased from 26.03 trillion to 146.46 trillion Yuan, an increase of nearly five-fold. Moreover, based on Fleisher, Li and Zhao (2010), the Chinese economy exhibits a structural change after 1994. Such a change is also reflected in the trend of human capital growth. Specifically, the growth of human capital accelerated after 1994. The average annual growth for 1985-1994 is 2.26%, and for 1995-2009 is 10.16%.

Male real human capital is higher than female real human capital. Male real human capital increased from 15.76 trillion to 93.96 trillion Yuan; female real human capital increased from 10.27 trillion to 52.50 trillion Yuan. Male real human capital increased by about five-fold over this period while female real human capital increased by about four-fold.

Both urban and rural real human capital increased from 1985 to 2009. Rural real human capital increased from 15.89 trillion to 43.54 trillion Yuan; urban real human capital grew from 10.14 trillion to 102.92 trillion Yuan. The corresponding annual growth rates are 4.20% and 9.66% for rural and urban areas, respectively. From 1985 to 1996, urban real human capital is smaller than rural real human capital, but by 2009 it is more than twice as large. The region gap increased from 0.26 trillion in 1997 to over 59 trillion in 2009, growing at an annual rate of 45.42%. The gap is getting bigger from 1997 to 2009 as urban real human capital growth is much faster than rural real human capital growth, with an average annual growth rate of 7.25% for rural and 14.49% for urban.

Table 5.2.1 National Real Human Capital by Gender and Region[33]

Billions of 1985 Yuan

Year	National	Male	Female	Urban	Rural
1985	26,033	15,762	10,271	10,140	15,893
1986	27,783	16,895	10,888	11,051	16,732
1987	29,508	18,010	11,498	11,905	17,603
1988	28,415	17,448	10,967	11,517	16,898
1989	27,371	16,862	10,509	11,447	15,924
1990	30,397	18,816	11,581	13,228	17,169
1991	33,177	20,561	12,616	14,463	18,714
1992	35,227	21,852	13,375	15,377	19,850
1993	34,964	21,787	13,177	15,423	19,541

[33] Some discrepancy may exist when summing up male and female, urban and rural to get the national amount. This is mainly caused by rounding errors.

1994	31,905	19,965	11,940	14,227	17,678
1995	30,629	19,128	11,501	13,965	16,664
1996	32,613	20,410	12,203	15,648	16,965
1997	36,757	23,110	13,647	18,506	18,251
1998	42,689	26,990	15,699	22,447	20,242
1999	49,961	31,680	18,281	27,368	22,593
2000	57,353	36,470	20,883	32,430	24,923
2001	64,064	40,740	23,324	37,330	26,734
2002	73,170	46,580	26,590	44,230	28,940
2003	81,980	52,260	29,720	51,300	30,680
2004	89,100	56,780	32,320	57,350	31,750
2005	100,060	63,350	36,710	66,550	33,510
2006	108,920	69,840	39,080	72,440	36,480
2007	118,290	75,860	42,430	80,210	38,080
2008	127,730	81,840	45,890	88,340	39,390
2009	146,460	93,960	52,500	102,920	43,540

Figure 5.2.1 shows that real human capital stock by five education categories keeps growing, and it grew even faster during 1996-2009. One reason male real human capital is higher than female real human capital is the earlier retirement age for women (age 55 vs. age 60 for men based on China Labor Law). Accordingly, men have a longer time to generate income in the market. Another reason is higher educational attainment for men. Moreover, the male-female income gap has been on expanding. The results based on six education categories show similar trends.

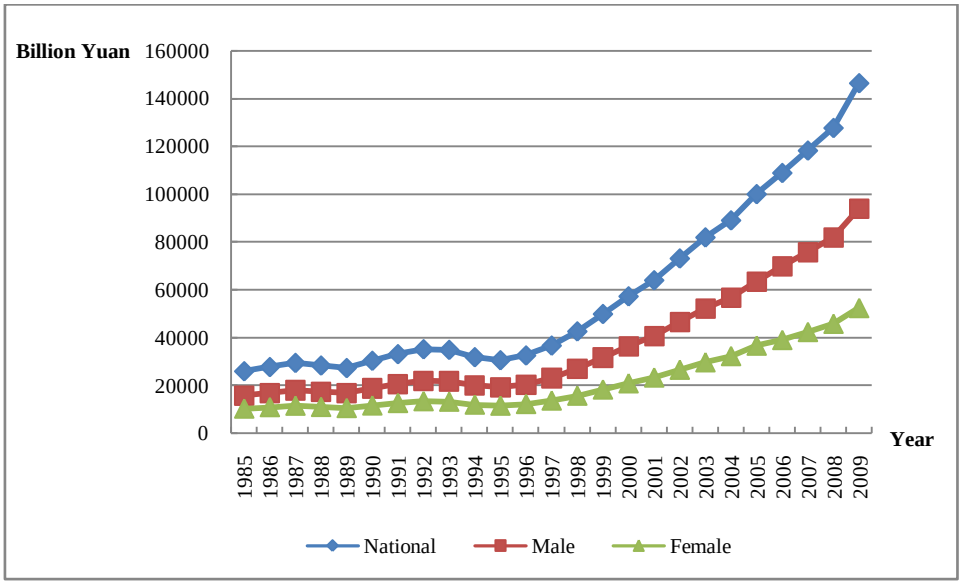


Figure 5.2.1 National Real Human Capital by Gender

Figure 5.2.2 shows real human capital for urban and rural China separately. As previously noted, before 1998, the amount of real human capital in both areas was very close. In fact, rural real human capital was even larger than that in the urban area until 1997. Since 1996, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grew quite slowly, which results in an increasing larger region gap.

There are several reasons for such a trend. First, in the early years, the rural population was significantly larger than the urban population, and thus had larger amount of human capital. For example, in 1985, there were 733 million people in rural areas, which were more than three times the urban population of 222 million. By 2009, however, the population in rural China reduced to 583 million, much closer to the urban population of 522 million. This change was, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the education gap between the urban and rural

population. Urban areas usually have a larger proportion of educated population than rural areas.

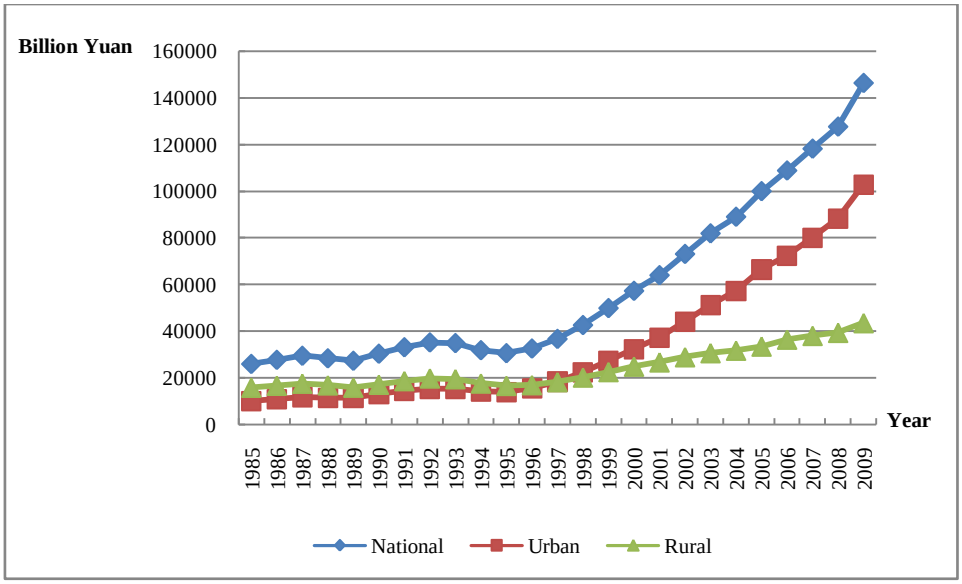


Figure 5.2.2 National Real Human Capital by Region

Figures 5.2.3 and 5.2.4 show the trends of male and female real human capital in urban and rural areas. Male and female real human capital estimates in the urban area exhibit similar trends, but the gender gap seems to be widening. The gender-based real human capital estimates for the rural population paint a somewhat different picture. In the later part of the period, the growth of male real human capital seems to have slowed down while that of females seems to have sped up; therefore the gender gap became narrower. This result is probably caused by two factors: i) A disproportionate rural-to-urban migration in favor of men; ii) An increase in education for women in rural areas. The reduction of gender gap in the rural area is consistent with the rising gender disparity in the urban area.

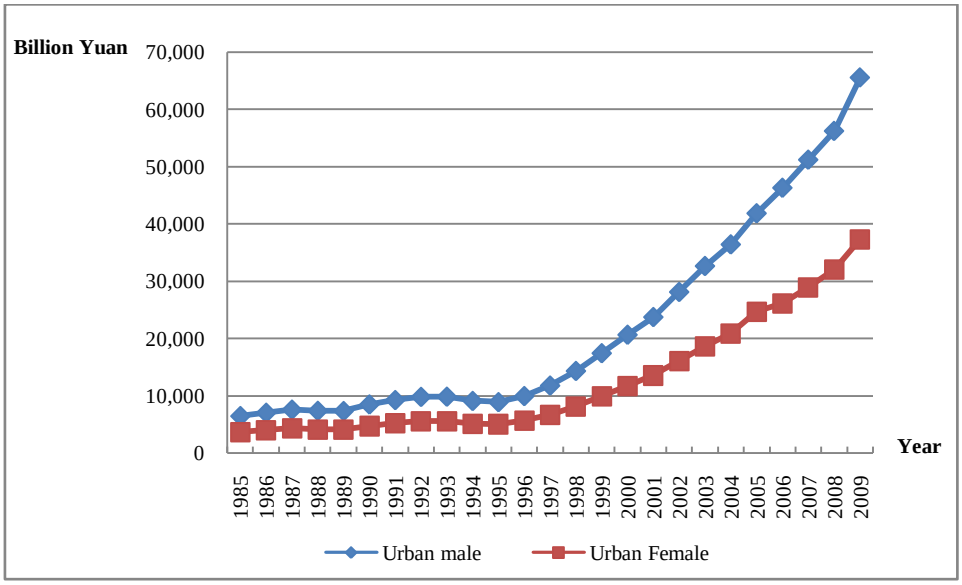


Figure 5.2.3 National Urban Real Human Capital by Gender

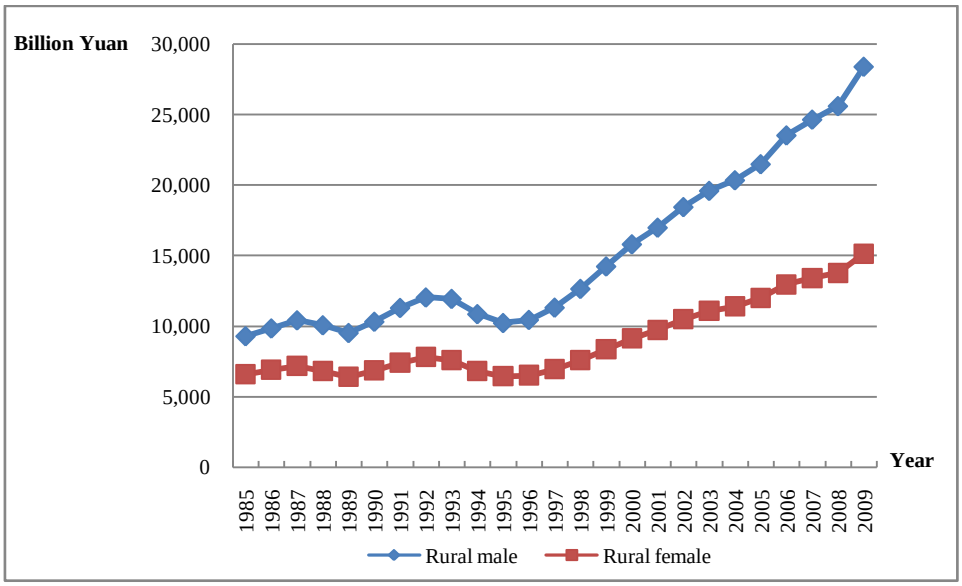


Figure 5.2.4 National Rural Real Human Capital by Gender

Finally we calculate real human capital indices by setting 1985 equal to 100. The results for each group are reported in Table 5.2.2.

Table 5.2.2 National Real Human Capital Index (1985=100)

Year	National	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.72	107.19	106.01	108.98	105.28
1987	113.35	114.26	111.95	117.41	110.76
1988	109.15	110.70	106.78	113.58	106.32
1989	105.14	106.98	102.32	112.89	100.20
1990	116.76	119.38	112.75	130.45	108.03
1991	127.44	130.45	122.83	142.63	117.75
1992	135.32	138.64	130.22	151.65	124.90
1993	134.31	138.22	128.29	152.10	122.95
1994	122.56	126.67	116.25	140.31	111.23
1995	117.65	121.36	111.98	137.72	104.85
1996	125.28	129.49	118.81	154.32	106.75
1997	141.19	146.62	132.87	182.50	114.84
1998	163.98	171.23	152.85	221.37	127.36
1999	191.91	200.99	177.99	269.90	142.16
2000	220.31	231.38	203.32	319.82	156.82
2001	246.09	258.47	227.09	368.15	168.21
2002	281.07	295.52	258.88	436.19	182.09
2003	314.91	331.56	289.36	505.92	193.04
2004	342.26	360.23	314.67	565.58	199.77
2005	384.36	401.92	357.41	656.31	210.85
2006	418.39	443.09	380.49	714.40	229.54
2007	454.38	481.28	413.10	791.03	239.60
2008	490.65	519.22	446.79	871.20	247.84
2009	562.59	596.12	511.15	1,014.99	273.96

Figure 5.2.5 shows the index of national human capital. Before 1997 the index grows quite steadily; it accelerates after that year. Figures 5.2.6 and 5.2.7 show the indices by gender and for urban and rural areas, respectively. A comparison of these three figures demonstrates that the growth in the urban index is the main catalyst for the acceleration of the

national index beginning in 1997 as the urban index reaches a maximum value of about 1000 in 2009 compared to a maximum value of less than 600 for any of the other indices.

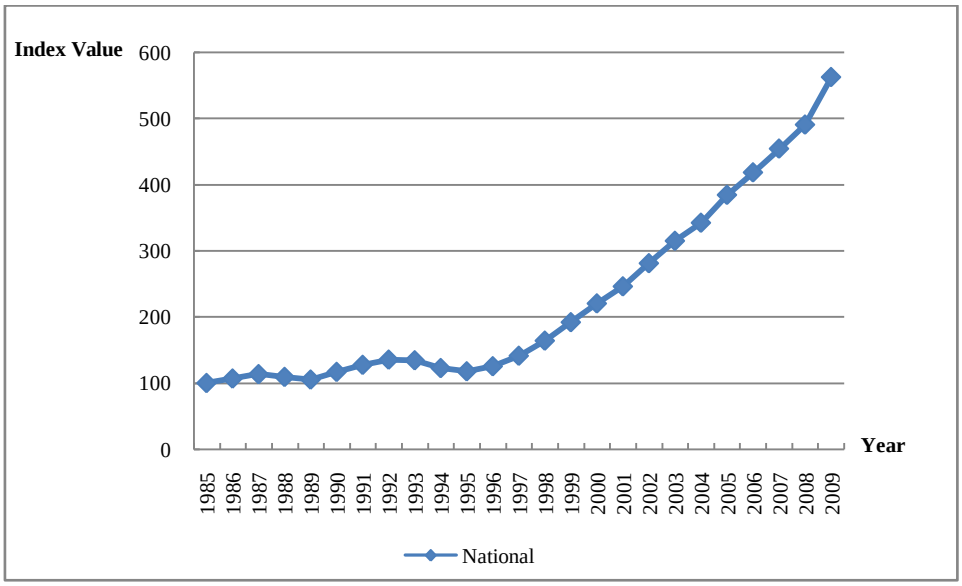


Figure 5.2.5 National Real Human Capital Index

Figure 5.2.6 National Real Human Capital Index by Gender

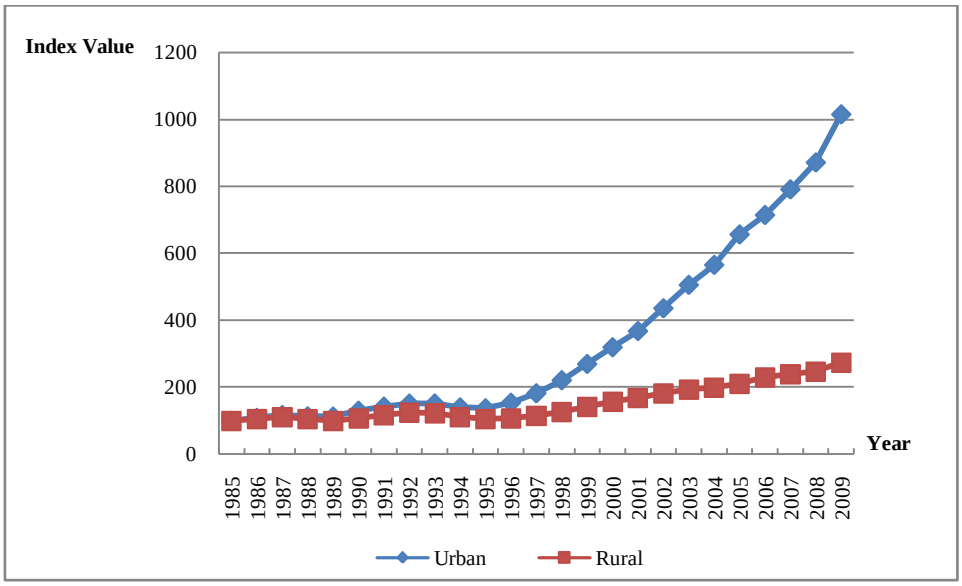


Figure 5.2.7 National Real Human Capital Index by Region

5.3 Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital in China, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population (Table 5.3.1).

Based on the 5-education category, the real human capital per capita was 27,119 Yuan in 1985, 28,579 Yuan in 1995, and 132,433 Yuan in 2009. From 1985 to 2009, real human capital per capita increased by around 4 times. Real human capital per capita growth accelerated from 1996. The average annual growth rate was 0.96% from 1985 to 1996, and 11.39% from

1997 to 2009. The growth rate in the later period is eleven times higher than that in the earlier period. These growth rates are very high. These high growth rates are probably a result of the dramatic economic growth since 1978, rapid expansion of education, transition toward market-oriented system (so that human capital can realize much higher values), and region migration. Real human capital per capita for male is higher than that for female; however real human capital per capita for male and female both exhibit an evident rising trend. Real human capital per capita for urban remains higher and grows faster than that for rural.

Table 5.3.1 National Real Human Capital Per Capita by Gender and Region

Thousands of 1985 Yuan

Year	National	Male	Female	Urban	Rural
1985	27.12	31.29	22.52	44.66	21.68
1986	28.56	33.05	23.58	46.50	22.76
1987	29.95	34.76	24.60	47.92	23.86
1988	28.36	33.03	23.14	44.70	22.71
1989	26.93	31.37	21.95	43.05	21.21
1990	29.46	34.40	23.89	48.58	22.61
1991	31.84	37.34	25.69	51.70	24.56
1992	33.51	39.32	26.99	53.64	26.00
1993	33.03	39.00	26.36	52.57	25.55
1994	29.95	35.59	23.67	47.35	23.10
1995	28.58	34.00	22.59	45.50	21.78
1996	30.13	35.95	23.71	47.85	22.45
1997	33.57	40.18	26.26	53.27	24.46
1998	38.69	46.44	30.06	61.10	27.52
1999	44.97	53.96	34.90	70.65	31.24
2000	51.30	61.61	39.70	79.69	35.03
2001	57.28	68.96	44.21	88.20	38.45
2002	65.40	79.07	50.20	100.43	42.62
2003	73.24	88.77	56.01	112.16	46.34

2004	79.79	96.92	60.88	122.01	49.12
2005	90.09	108.75	69.50	138.44	53.19
2006	98.06	119.79	74.06	147.63	58.88
2007	106.70	130.28	80.63	159.93	62.74
2008	115.34	140.43	87.47	172.46	66.26
2009	132.43	161.32	100.32	197.04	74.71

Figure 5.3.1 shows the trend of real human capital per capita by gender at the national level. Real human capital per capita shows a similar trend for males and females. Real human capital per capita for male and female both exhibit an accelerated growth after 1996. Specifically, the average annual growth rate during 1985-1996 was 1.26% for males and 0.47% for females; the average annual growth rate during 1997-2009 was 11.55% for males and 11.10% for females. As a result, the male-female gap has been widening.

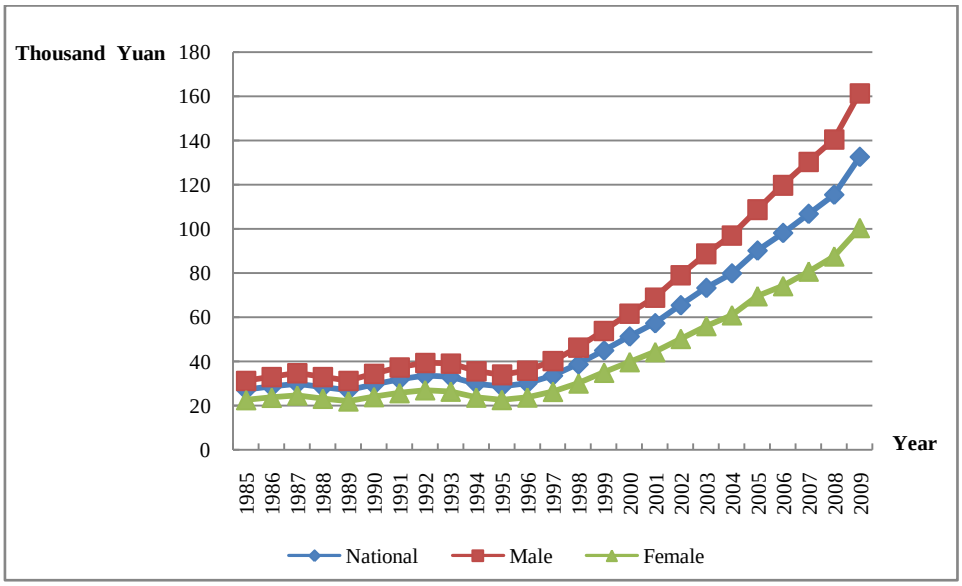


Figure 5.3.1 National Real Human Capital Per Capita by Gender

Figure 5.3.2 shows the trends in real human capital per capita in urban and rural areas. There is a similar trend for males and females (see Figure 5.3.3 and 5.3.4). During the period of 1985-2009, real human capital per

capita for urban and rural both exhibit an accelerated growth after 1996. Based on 5-education category, in 1985, real human capital per capita was 44,663 Yuan in the urban area and 21,684 Yuan in the rural area; the corresponding numbers become 197,043 Yuan and 74,713 Yuan, respectively, in 2009. The absolute size of the region gap has been on the rise. The annual growth rate was 6.18% for the urban area (0.63% during 1985-1996 and 10.89% during 1997-2009), and 5.15% for the rural area (0.31% during 1985-1996 and 9.25% during 1997-2009). Therefore, the region gap kept widening over the 1985-2009 period. The wide region gap raises concern for the increasing disparity between these two areas. Based on Fleisher, Li and Zhao (2009), human capital is a significant contributing factor to economic growth (total factor productivity). Therefore, such a trend in human capital can worsen the region inequality in China.

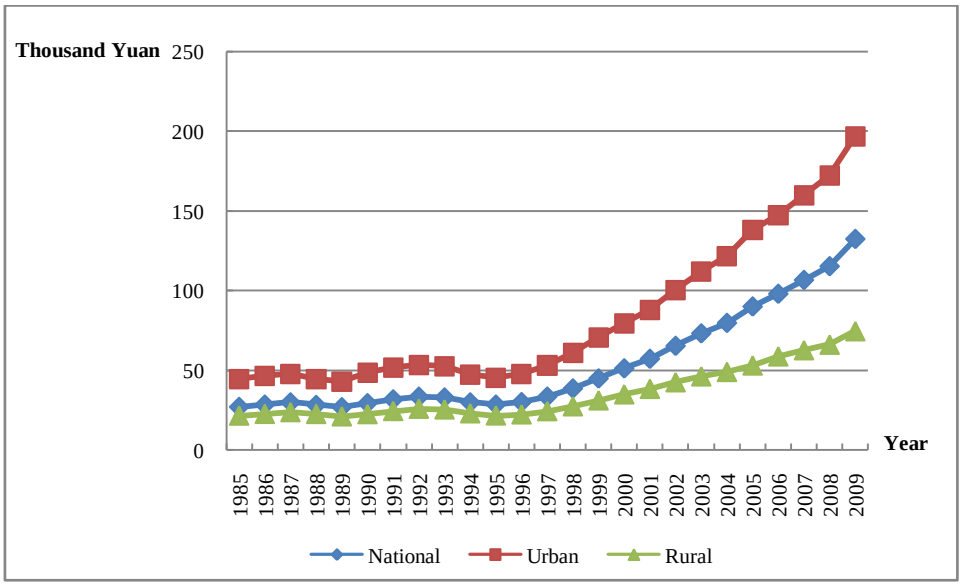


Figure 5.3.2 National Real Human Capital Per Capita by Region

Figures 5.3.3 and 5.3.4 show the gender differences for urban and rural areas, respectively. The patterns are similar to that of national human capital. In particular, real human capital per capita for male and female both show

similar trends in the urban area, but real human capital per capita grew faster for males than for females in the rural area in recent years.

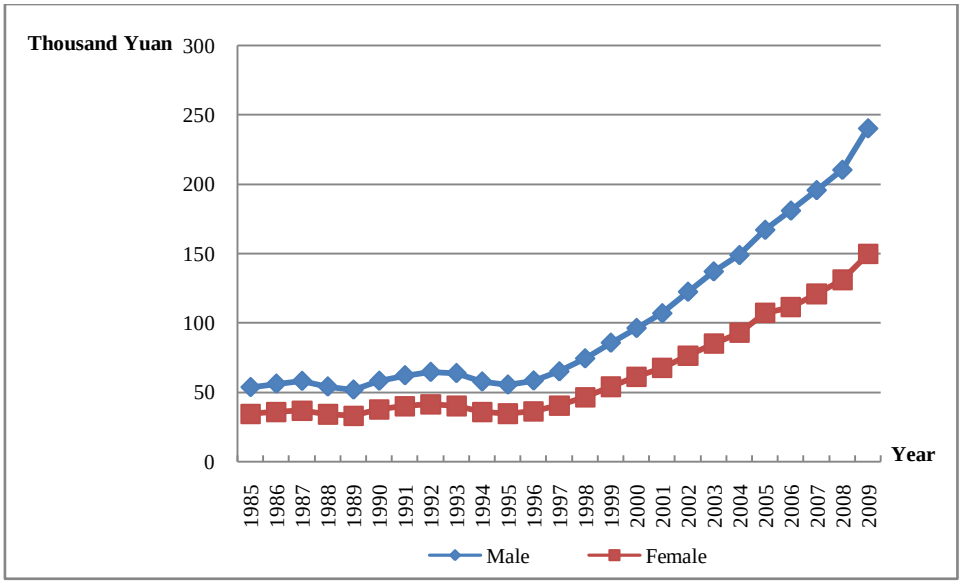


Figure 5.3.3 National Urban Real Human Capital Per Capita

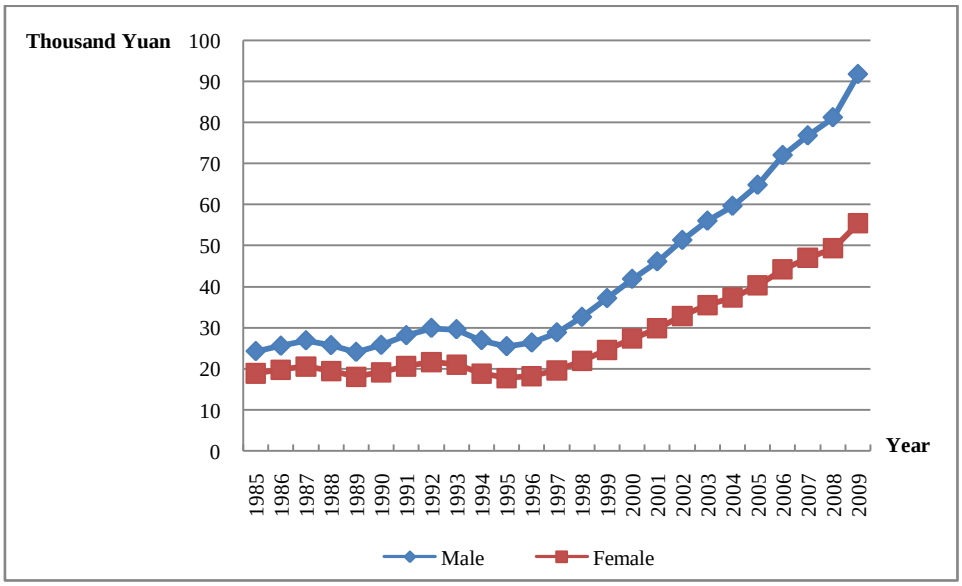


Figure 5.3.4 National Rural Real Human Capital Per Capita

We also construct real human capital per capita indices setting 1985 equal to 100 (Table 5.3.2).

Table 5.3.2 National Real Human Capital Per Capita Index (1985=100)

Year	National	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.30	105.65	104.70	104.12	104.98
1987	110.45	111.11	109.20	107.28	110.02
1988	104.57	105.58	102.73	100.09	104.71
1989	99.30	100.27	97.44	96.39	97.81
1990	108.65	109.95	106.07	108.77	104.27
1991	117.40	119.35	114.05	115.75	113.26
1992	123.56	125.68	119.83	120.09	119.89
1993	121.78	124.65	117.04	117.70	117.82
1994	110.44	113.75	105.10	106.02	106.53
1995	105.38	108.67	100.30	101.87	100.45
1996	111.12	114.91	105.26	107.13	103.51
1997	123.78	128.43	116.60	119.28	112.78
1998	142.66	148.45	133.45	136.81	126.91
1999	165.82	172.47	154.94	158.19	144.05
2000	189.16	196.92	176.28	178.43	161.55
2001	211.22	220.41	196.30	197.47	177.31
2002	241.15	252.73	222.87	224.87	196.56
2003	270.06	283.74	248.68	251.11	213.68
2004	294.20	309.80	270.29	273.17	226.50
2005	332.21	347.60	308.58	309.96	245.28
2006	361.60	382.88	328.82	330.54	271.54
2007	393.46	416.41	358.01	358.09	289.33
2008	425.32	448.88	388.38	386.14	305.56
2009	488.34	515.62	445.43	441.18	344.55

Figure 5.3.5-5.3.7 show trends of various real human capital per capita indices. As is seen from the graph below, real human capital per capita was essentially stable before 1996, but significant growth occurred after 1996. The patterns of the real human capital per capita indices by gender and by region are similar to that of national real human capital per capita index.

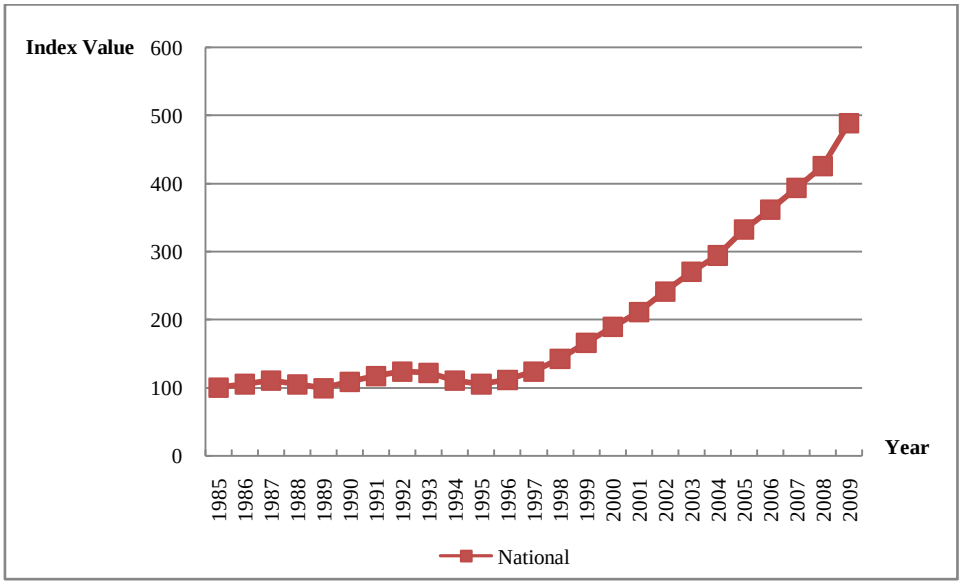


Figure 5.3.5 National Real Human Capital Per Capita Index

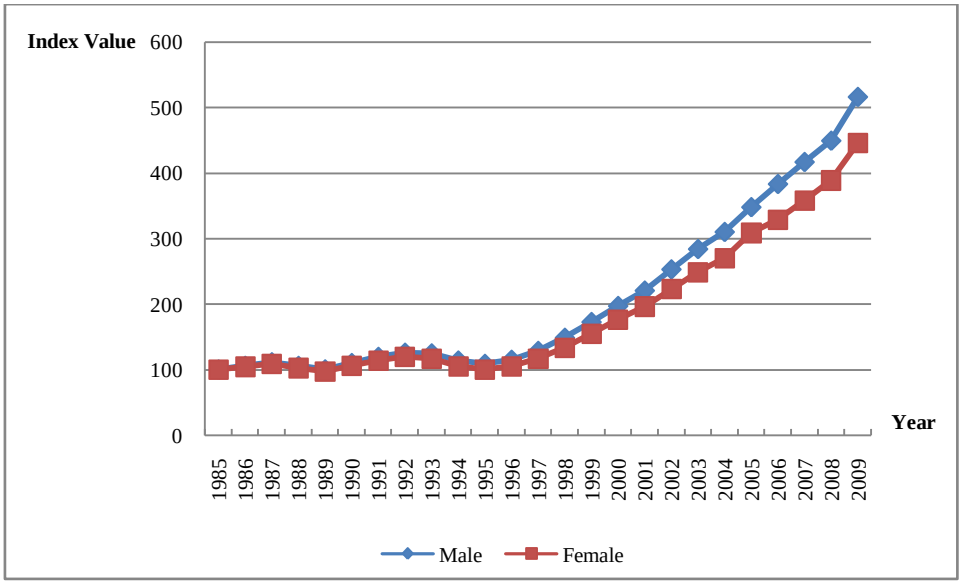


Figure 5.3.6 National Real Human Capital Per Capita Index by Gender

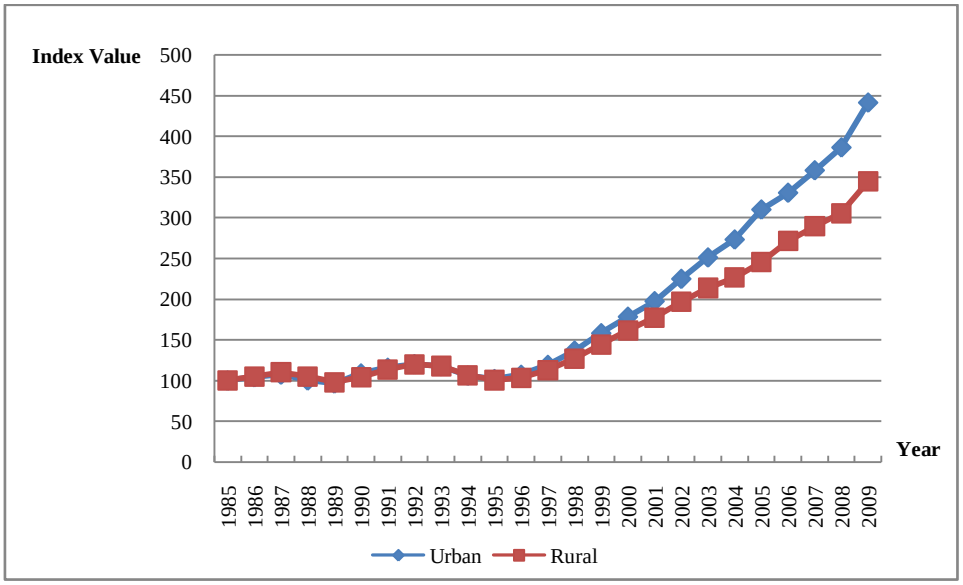


Figure 5.3.7 National Real Human Capital Per Capita Index by Region

5.4 Labor force human capital

5.4.1 National labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as national human capital. The national labor force human capital is reported in Table 5.4.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table 5.4.1 National Nominal and Real Labor Force Human Capital and Nominal GDP

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	12,727		12,727		904	14.08
1986	14,645		13,757		1,027	14.25
1987	16,902		14,811		1,205	14.03
1988	19,768		14,580		1,504	13.15
1989	22,993		14,354		1,700	13.52
1990	26,420		15,987		1,872	14.11
1991	30,163		17,640		2,183	13.82
1992	34,128		18,767		2,694	12.67
1993	38,555		18,480		3,526	10.93
1994	42,800		16,526		4,811	8.90
1995	47,693		15,703		5,981	7.97
1996	54,602		16,568		7,014	7.78
1997	63,300		18,646		7,806	8.11
1998	73,920		21,892		8,302	8.90
1999	85,180		25,522		8,848	9.63
2000	99,120	97,400	29,501	29,011	9,800	10.11
2001	110,360	108,820	32,558	32,108	10,807	10.21
2002	123,140	121,830	36,527	36,153	11,910	10.34
2003	138,130	137,290	40,445	40,193	13,517	10.22
2004	151,430	151,330	42,607	42,564	15,959	9.49
2005	168,410	168,360	46,477	46,437	18,581	9.06
2006	191,700	191,700	52,108	52,091	21,752	8.81
2007	215,860	215,870	55,960	55,941	26,776	8.06
2008	241,830	241,920	59,166	59,163	31,623	7.65
2009	274,310	274,420	67,508	67,499	34,346	7.99

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in national nominal and real labor force human capital are presented in Figure 5.4.1. Similar to the trend of national human capital, from 1985 to 2009, national labor force human capital both in nominal and real terms keeps on increasing.

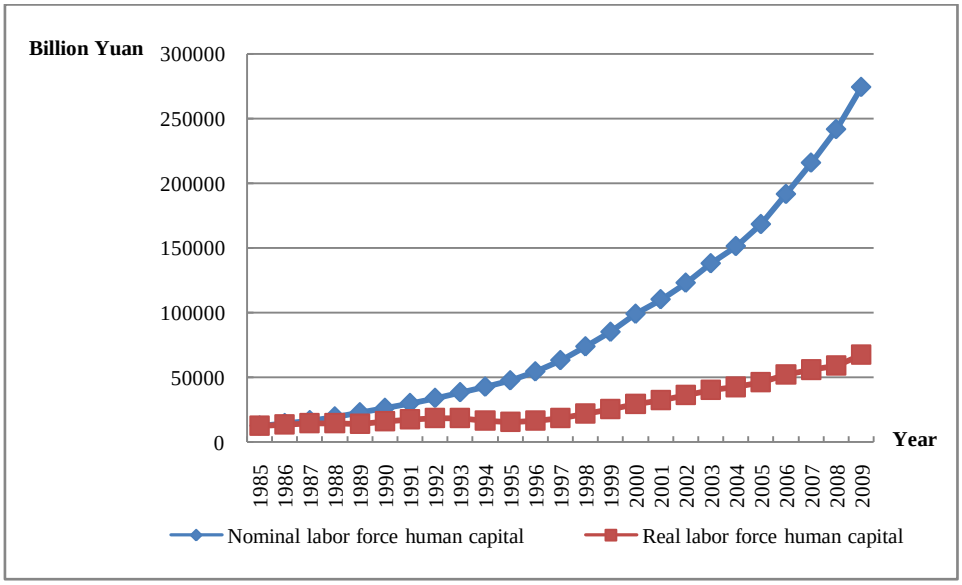


Figure 5.4.1 National Nominal and Real Labor Force Human Capital

We also calculate the ratio of labor force human capital to GDP for China. The results are reported in the last column of Table 5.4.1. As before, the ratio could reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure 5.4.2 shows the trend for the ratio. The pattern of the ratio for national labor force human capital is almost the same as that for national human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio remains between 7 and 14 and generally shows a decreasing trend from 1996. It indicates that although national human capital stock level still remains much higher than physical capital, the efficiency of human capital has improving, however, the decreasing trend may also indicate possible constraints on the future GDP growth in China.

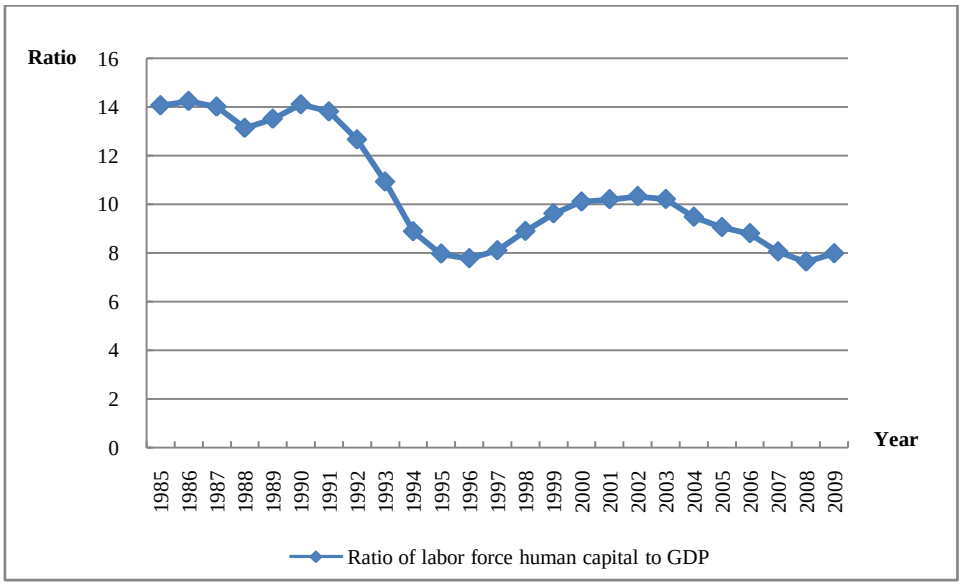


Figure 5.4.2 National Ratio of Labor Force Human Capital to GDP

Labor force human capital by gender is reported in Table 5.4.2. Both male and female real labor force human capital exhibit an increasing trend. Male real labor force human capital is larger than that of female throughout the whole period.

Table 5.4.2 National Nominal and Real Labor Force Human Capital by Gender[34]

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	National	Male	Female	National	Male	Female
1985	12,727	7,776	4,951	12,727	7,776	4,951
1986	14,645	8,962	5,683	13,757	8,417	5,340
1987	16,902	10,370	6,532	14,811	9,082	5,729
1988	19,768	12,207	7,561	14,580	8,994	5,586
1989	22,993	14,280	8,713	14,354	8,910	5,444
1990	26,420	16,508	9,912	15,987	9,989	5,998

[34] Some discrepancy may exist when summing up male and female, urban and rural to get the national amount. This is mainly caused by rounding errors.

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	National	Male	Female	National	Male	Female
1991	30,163	18,849	11,314	17,640	11,019	6,621
1992	34,128	21,345	12,783	18,767	11,727	7,040
1993	38,555	24,180	14,375	18,480	11,579	6,901
1994	42,800	26,890	15,910	16,526	10,371	6,155
1995	47,693	29,970	17,723	15,703	9,860	5,843
1996	54,602	34,570	20,032	16,568	10,480	6,088
1997	63,300	40,360	22,940	18,646	11,878	6,768
1998	73,920	47,470	26,450	21,892	14,050	7,842
1999	85,180	55,030	30,150	25,522	16,477	9,045
2000	99,120	64,470	34,650	29,501	19,176	10,325
2001	110,360	71,710	38,650	32,558	21,144	11,414
2002	123,140	80,000	43,140	36,527	23,720	12,807
2003	138,130	89,750	48,380	40,445	26,270	14,175
2004	151,430	98,450	52,980	42,607	27,690	14,917
2005	168,410	109,500	58,910	46,477	30,210	16,267
2006	191,700	125,470	66,230	52,108	34,100	18,008
2007	215,860	141,680	74,180	55,960	36,720	19,240
2008	241,830	159,050	82,780	59,166	38,910	20,256
2009	274,310	181,070	93,240	67,508	44,560	22,948

Figure 5.4.3 shows that both male and female real labor force human capital exhibit a rising trend from 1985 to 2009. Before 1997, male and female real labor force human capital grew quite slowly. Both increased significantly from 1997.The gender gap was fairly stable before 1997, but increased afterwards.

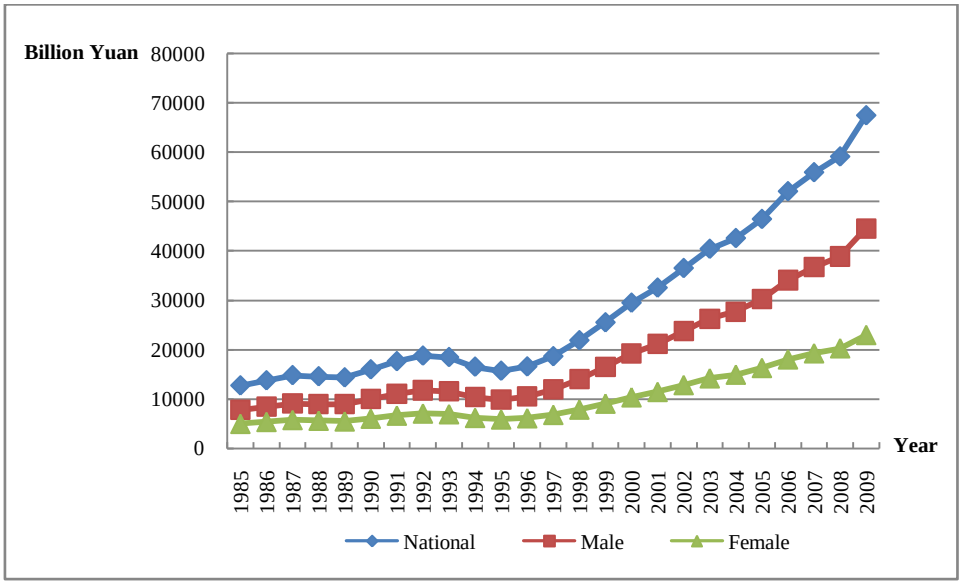


Figure 5.4.3 National Real Labor Force Human Capital by Gender

Table 5.4.3 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of national real labor force human capital is almost the same as that of the national real human capital. Urban real labor force human capital surpassed its rural counterpart for the first time in 1999. The region gap has increased from less than 1 trillion Yuan in 1999 to 16.25 trillion Yuan in 2009.

Table 5.4.3 National Nominal and Real Labor Force Human Capital by Region

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	National	Urban	Rural	National	Urban	Rural
1985	12,727	4,805	7,922	12,727	4,805	7,922
1986	14,645	5,678	8,967	13,757	5,306	8,451
1987	16,902	6,658	10,244	14,811	5,719	9,092
1988	19,768	8,018	11,750	14,580	5,706	8,874
1989	22,993	9,581	13,412	14,354	5,863	8,491

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	National	Urban	Rural	National	Urban	Rural
1990	26,420	11,110	15,310	15,987	6,711	9,276
1991	30,163	12,857	17,306	17,640	7,389	10,251
1992	34,128	14,756	19,372	18,767	7,809	10,958
1993	38,555	16,901	21,654	18,480	7,706	10,774
1994	42,800	18,953	23,847	16,526	6,913	9,613
1995	47,693	21,343	26,350	15,703	6,662	9,041
1996	54,602	25,562	29,040	16,568	7,334	9,234
1997	63,300	31,080	32,220	18,646	8,650	9,996
1998	73,920	38,080	35,840	21,892	10,662	11,230
1999	85,180	45,860	39,320	25,522	13,013	12,509
2000	99,120	55,680	43,440	29,501	15,670	13,831
2001	110,360	63,400	46,960	32,558	17,721	14,837
2002	123,140	72,470	50,670	36,527	20,456	16,071
2003	138,130	82,960	55,170	40,445	23,216	17,229
2004	151,430	92,520	58,910	42,607	25,060	17,547
2005	168,410	105,190	63,220	46,477	28,044	18,433
2006	191,700	120,010	71,690	52,108	31,520	20,588
2007	215,860	135,180	80,680	55,960	33,980	21,980
2008	241,830	151,840	89,990	59,166	36,140	23,026
2009	274,310	174,460	99,850	67,508	41,880	25,628

Figure 5.4.4 shows real labor force human capital for urban and rural respectively. The pattern of national labor force human capital is almost the same as that of national real human capital. The urban labor force human capital surpassed the rural one in 1999 and has grown much faster ever since.

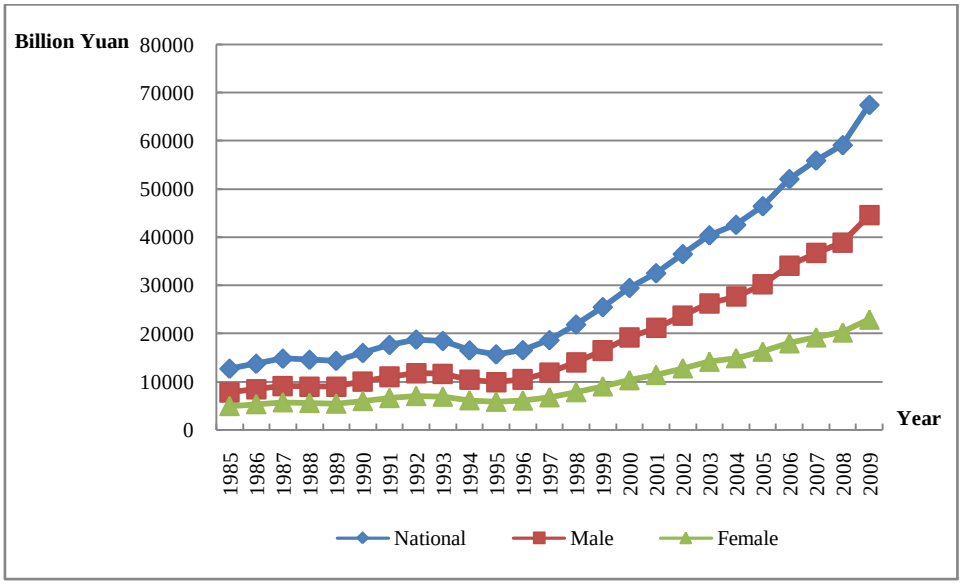


Figure 5.4.4 National Real Labor Force Human Capital by Region

Similarly, we construct a set of real labor force human capital indices with their corresponding values in 1985 set to 100. Table 5.4.4 shows various human capital indices.

Table 5.4.4 National Real Labor Force Human Capital Index（1985=100）

Year	National	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	108.09	108.24	107.86	110.43	106.68
1987	116.37	116.80	115.71	119.02	114.77
1988	114.56	115.66	112.83	118.75	112.02
1989	112.78	114.58	109.96	122.02	107.18
1990	125.61	128.46	121.15	139.67	117.09
1991	138.60	141.71	133.73	153.78	129.40
1992	147.46	150.81	142.19	162.52	138.32
1993	145.20	148.91	139.39	160.37	136.00
1994	129.85	133.37	124.32	143.87	121.35
1995	123.38	126.80	118.02	138.65	114.13
1996	130.18	134.77	122.97	152.63	116.56
1997	146.51	152.75	136.70	180.02	126.18

Year	National	Male	Female	Urban	Rural
1998	172.01	180.68	158.39	221.89	141.76
1999	200.53	211.90	182.69	270.82	157.90
2000	231.80	246.60	208.54	326.12	174.59
2001	255.82	271.91	230.54	368.80	187.29
2002	287.00	305.04	258.68	425.72	202.87
2003	317.79	337.83	286.31	483.16	217.48
2004	334.78	356.10	301.29	521.54	221.50
2005	365.18	388.50	328.56	583.64	232.68
2006	409.43	438.53	363.72	655.98	259.88
2007	439.70	472.22	388.61	707.18	277.46
2008	464.89	500.39	409.13	752.13	290.66
2009	530.43	573.05	463.50	871.59	323.50

Figure 5.4.5 shows the index of national real labor force human capital. It follows the same trend of national real human capital. Growth in real labor force human capital has accelerated since 1997.

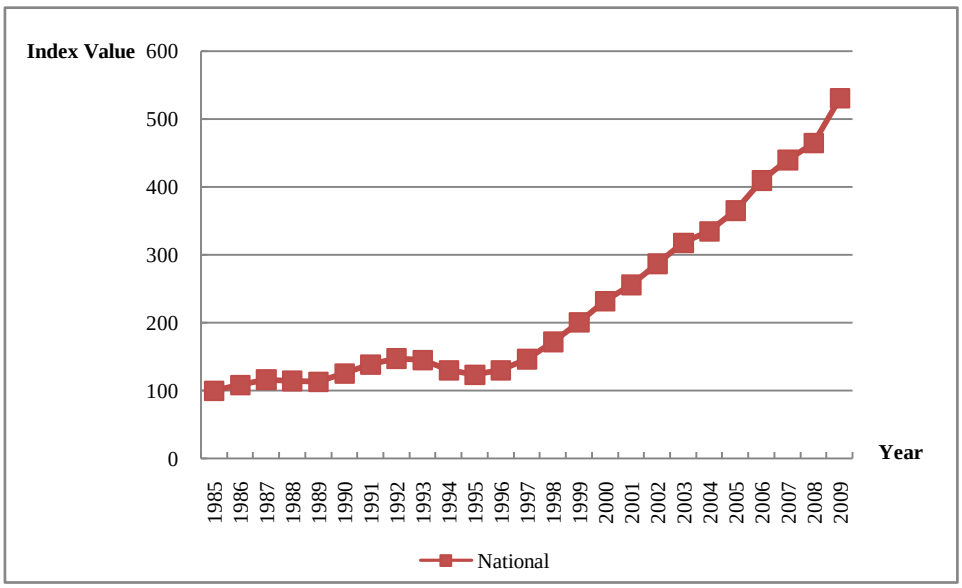


Figure 5.4.5 National Real Labor Force Human Capital Index

Figure 5.4.6 shows the national ratio of labor force human capital to total human capital by five education categories. The ratios reflect age structures as human capital for the young and often highly-educated population will be higher than that for the older and less-educated population. As is seen from the graph, before 1993, the ratio grew steadily, but it dropped dramatically after that. The decreasing trend may indicate that the proportion of young generation in total population is getting smaller, and the aging population phenomenon is becoming clear. Moreover, it may indicate constraints on the productivity efficiency improvement in future China.

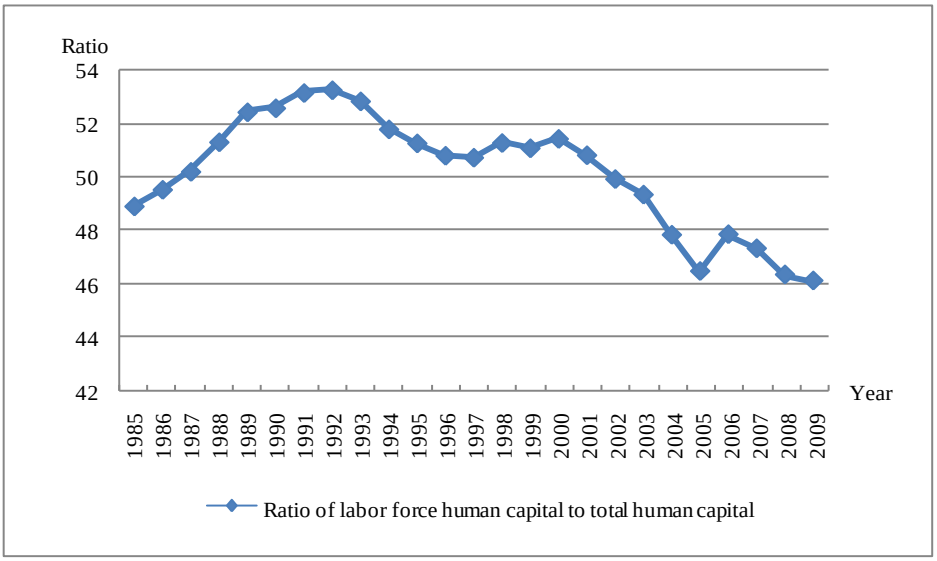


Figure 5.4.6 National Ratio of Labor Force Human Capital to Total Human Capital

5.4.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the real average labor force human capital. Here the average labor force human capital means national labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of

school. Table 5.4.5 shows that the average labor force human capital both in real and nominal terms have kept increasing.

Table 5.4.5 National Nominal and Real Average Labor Force Human Capital

Year	Nominal average labor force human capital (Thousands of Yuan)		Real average labor force human capital (Thousands of 1985 Yuan)	
	By five education categories	By six education categories	By five education categories	By six education categories
1985	22.30		22.30	
1986	25.06		23.54	
1987	28.17		24.69	
1988	31.85		23.49	
1989	36.01		22.48	
1990	40.41		24.45	
1991	45.02		26.32	
1992	49.99		27.49	
1993	55.80		26.73	
1994	61.73		23.84	
1995	68.23		22.46	
1996	77.34		23.47	
1997	87.92		25.90	
1998	100.43		29.74	
1999	113.89		34.12	
2000	129.90	128.84	38.66	38.37
2001	143.70	142.81	42.40	42.14
2002	159.92	159.48	47.44	47.32
2003	178.46	178.31	52.24	52.18
2004	197.17	198.09	55.48	55.72
2005	219.58	220.93	60.60	60.94
2006	247.34	249.00	67.24	67.65
2007	277.84	279.96	72.02	72.56
2008	311.59	314.22	76.24	76.84
2009	353.54	356.39	87.00	87.68

Table 5.4.6 reports the real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female was smaller than that for male.

Table 5.4.6 National Nominal and Real Average Labor Force Human Capital by Gender

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	National	Male	Female	National	Male	Female
1985	22.30	25.85	18.35	22.30	25.85	18.35
1986	25.06	29.16	20.50	23.54	27.39	19.26
1987	28.17	32.96	22.90	24.69	28.87	20.08
1988	31.85	37.41	25.69	23.49	27.56	18.98
1989	36.01	42.26	28.99	22.48	26.37	18.11
1990	40.41	47.56	32.32	24.45	28.78	19.56
1991	45.02	53.25	35.79	26.32	31.13	20.95
1992	49.99	59.29	39.60	27.49	32.58	21.81
1993	55.80	66.61	43.81	26.73	31.90	21.03
1994	61.73	74.28	48.04	23.84	28.65	18.58
1995	68.23	82.34	52.90	22.46	27.09	17.44
1996	77.34	93.69	59.44	23.47	28.40	18.07
1997	87.92	107.06	66.88	25.90	31.51	19.73
1998	100.43	122.98	75.57	29.74	36.40	22.41
1999	113.89	139.67	85.17	34.12	41.82	25.55
2000	129.90	159.98	96.25	38.66	47.58	28.68
2001	143.70	177.50	106.18	42.40	52.34	31.36
2002	159.92	198.51	117.55	47.44	58.86	34.90
2003	178.46	222.15	130.76	52.24	65.02	38.31
2004	197.17	246.74	143.58	55.48	69.40	40.43
2005	219.58	275.13	159.65	60.60	75.90	44.08
2006	247.34	311.34	178.04	67.24	84.62	48.41
2007	277.84	349.83	199.41	72.02	90.67	51.72
2008	311.59	391.75	223.73	76.24	95.84	54.75
2009	353.54	444.89	252.68	87.00	109.48	62.19

Table 5.4.7 reports the real average labor force human capital by location. The real average labor force human capital was much smaller in rural area than in urban area.

Table 5.4.7 National Nominal and Real Average Labor Force Human Capital by Region

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	National	Urban	Rural	National	Urban	Rural
1985	22.30	33.71	18.50	22.30	33.71	18.50
1986	25.06	37.71	20.67	23.54	35.24	19.48
1987	28.17	42.16	23.14	24.69	36.22	20.54
1988	31.85	47.84	25.96	23.49	34.05	19.60
1989	36.01	54.28	29.01	22.48	33.22	18.37
1990	40.41	61.43	32.38	24.45	37.11	19.62
1991	45.02	68.27	35.93	26.32	39.24	21.28
1992	49.99	75.84	39.75	27.49	40.14	22.49
1993	55.80	84.64	44.10	26.73	38.59	21.94
1994	61.73	93.59	48.57	23.84	34.13	19.58
1995	68.23	103.11	53.54	22.46	32.19	18.37
1996	77.34	116.96	59.51	23.47	33.56	18.92
1997	87.92	133.64	66.28	25.90	37.20	20.56
1998	100.43	152.54	73.79	29.74	42.71	23.12
1999	113.89	172.33	81.64	34.12	48.89	25.97
2000	129.90	195.75	90.70	38.66	55.10	28.89
2001	143.70	214.49	99.37	42.40	59.95	31.39
2002	159.92	237.32	108.95	47.44	67.00	34.56
2003	178.46	263.65	120.13	52.24	73.77	37.50
2004	197.17	289.35	131.48	55.48	78.38	39.17
2005	219.58	318.61	144.66	60.60	84.94	42.17
2006	247.34	354.24	164.56	67.24	93.05	47.26
2007	277.84	392.41	186.56	72.02	98.63	50.83
2008	311.59	436.53	210.54	76.24	103.91	53.86
2009	353.54	491.33	237.54	87.00	117.96	60.96

Finally we calculate a set of real average labor force human capital indices using 1985 as the base year and setting its values at 100. Table 5.4.8

reports the results.

Table 5.4.8 National Real Average Labor Force Human Capital Index (1985=100)

Year	National	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.54	105.95	104.98	104.55	105.31
1987	110.70	111.67	109.43	107.45	110.99
1988	105.34	106.62	103.43	101.01	105.96
1989	100.80	102.00	98.69	98.54	99.27
1990	109.64	111.32	106.57	110.10	106.03
1991	118.03	120.41	114.14	116.42	115.02
1992	123.25	126.01	118.85	119.08	121.53
1993	119.87	123.39	114.62	114.48	118.58
1994	106.89	110.82	101.27	101.26	105.82
1995	100.73	104.78	95.05	95.51	99.28
1996	105.23	109.86	98.45	99.58	102.27
1997	116.13	121.88	107.53	110.36	111.13
1998	133.35	140.80	122.10	126.73	124.98
1999	152.97	161.77	139.24	145.06	140.38
2000	173.36	184.07	156.29	163.46	156.12
2001	190.09	202.45	170.88	177.87	169.67
2002	212.72	227.68	190.16	198.79	186.78
2003	234.21	251.54	208.77	218.87	202.70
2004	248.77	268.46	220.29	232.54	211.69
2005	271.71	293.62	240.23	252.02	227.90
2006	301.48	327.32	263.80	276.05	255.42
2007	322.92	350.73	281.85	292.64	274.73
2008	341.83	370.73	298.33	308.27	291.13
2009	390.07	423.52	338.90	349.96	329.48

5.5 International comparison

Jorgenson-Fraumeni lifetime earnings approach has been adopted by many countries for human capital estimation, for example for Canada (Gu and Ambrose, 2008), New Zealand (Le, Gibson and Oxley, 2005), Norway (Greaker and Liu, 2008), Sweden (Alroth, 1997), and the United States of America (Jorgenson and Fraumeni, 1989, 1992a, 1992b and Christian, 2009). A summary of international comparison of human capital estimates is reported in Table 5.5.1. China's human capital is quite large, second only to the United States. However, China's human capital per capita is still very small. In 2001, the human capital in China is around 15 times of that in Australia and about 144 times of that in New Zealand. In 2006, China's human capital is about 78 times of Norway's, and in 2007, China's human capital is 10.6 times of Canada's. However, human capital per capita in China is one-fifth of that in Australia, less than one-fourth of that in Canada and one-sixth of that in US. The large gap in human capital per capita between China and these selected developed economies may suggest that it is necessary for China to invest more in human capital as it further develops.[35]

[35] More recent estimates include those for Argentina (Coremberg, 2010) and the United States (Abraham 2010 and Christian 2010).

Table 5.5.1 International Comparison of Human Capital Estimates

Currency unit: US Dollars

	Canada	**Norway**	**New Zealand**	**U.S.A**	**Australia**	**China**[36]		
	2007	2006	2001	2006	2001	2001	2006	2007
Age Range	15-74	15-67	21-65	0-80	18-65	male 0-60, female 0-55		
Human capital per capita (Thousands)	54.85		32.32	about 70	35.56	6.57	11.74	13.06
National human capital (Trillions)	13.61	1.66	0.51	212	4.86	73.4	130.4	144.7
Ratio of human capital to GDP	11	8	6	>15	10	20.19	18.52	17.14

Note: The PPP exchange rates are from Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.0 (China version 1), Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011. The website link is http://pwt.econ.upenn.edu/php_site/pwt_index.php.

[36] We use the national nominal human capital in Table 5.1.1 to calculate the internationally comparable results for China.

Chapter 6 Cross-province comparison

In order to see the differences in human capital accumulation between provinces, in this chapter we compare nominal and real human capital, labor force human capital, real human capital per capita, real average labor force human capital, and the ratios of labor force human capital to human capital and several sensitivity indicators across provinces. Detailed data can be found in Chinese appendix C and D, here we only choose 1985, 1995, 2005 and 2009 to conduct the comparison.

6.1 Cross-province human capital comparison

Figure 6.1.1 shows the provincial comparison of nominal human capital. [37]Guangdong ranks the highest, followed by Jiangsu, and Gansu ranks the lowest. The notable features of the differences across provinces are: (1) Population plays a dominant role in influencing total human capital, in spite of other provincial differences in educational attainment, age structure, and income level. Provinces with larger populations such as Jiangsu, Henan, Shandong, Guangdong, and Hunan rank relatively higher. (2) The relative ranking of provinces basically remains the same, although the gap keeps growing. As shown in the figure, the ranking of human capital in 2009 is quite similar to that in 1985, 1995 and 2005. This implies that it might be difficult for one province to surpass another over time. In addition, the gap enlarges over time.

[37] We order provinces by the size of 2009 human capital indicators in all the cross-province comparison figures below.

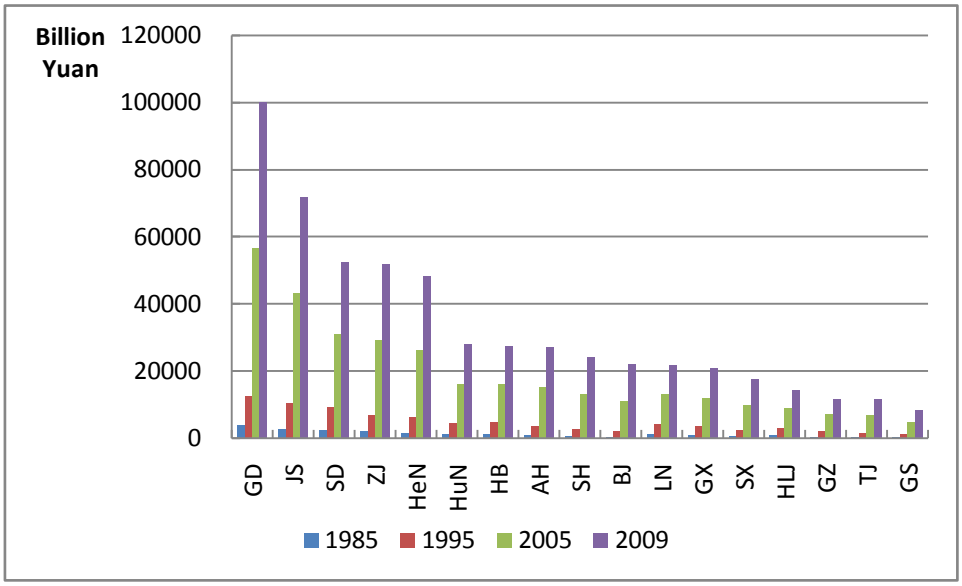


Figure 6.1.1 Provincial Nominal Human Capital

Figure 6.1.2 presents the provincial comparison of real human capital. Real human capital is created by deflating nominal human capital by a living cost index based on Brandt and Holz (2006).[38,39]We use their living cost index and update it over time using provincial CPI to construct a deflator that is comparable across provinces and over time. Accordingly, the real values of provincial human capital using the above deflator are comparable. The ranking of real human capital is similar to the nominal ranking: Guangdong has the largest real human capital, followed by Jiangsu, and Gansu ranks the lowest. As the living cost index is positively correlated with the stage of development, adjustments by a living cost index to some extent narrow the gap between developed and developing provinces. For example, Shanghai and Beijing's rankings clearly drop compared with their nominal human capital rankings.

[38] Brandt, Loren, Holz, Carsten, 2006. Spatial price differences in China: estimates and implications. Economic Development and Cultural Change 55, 43–86.

[39] Specifically, the living cost index we use here is based on a package of commodities of 1985 in Beijing, other provinces and years are adjusted correspondingly.

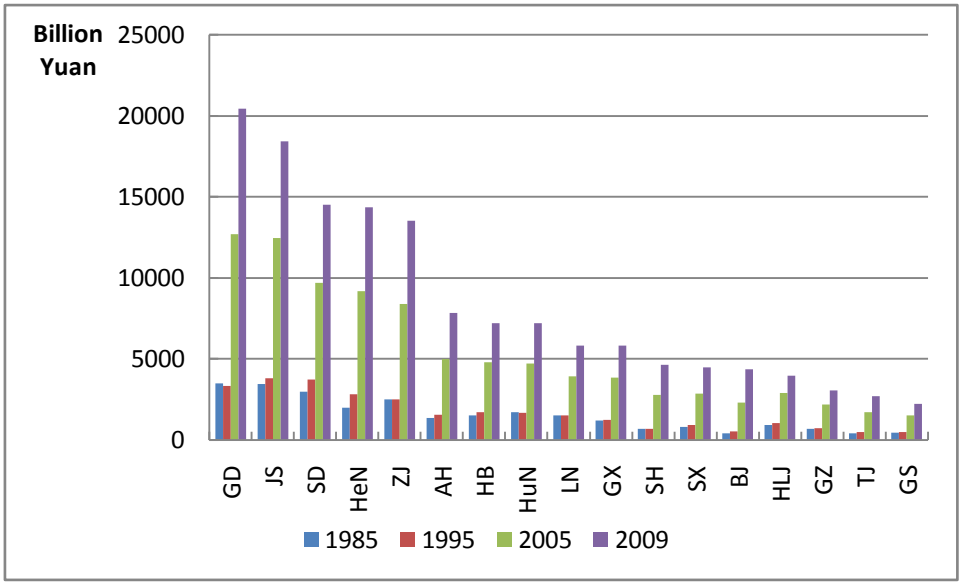


Figure 6.1.2 Provincial Real Human Capital

Figure 6.1.3 shows the provincial comparison of real human capital per capita. The provincial ranking of real human capital per capita is obviously different from that of provincial real human capital. Shanghai, Zhejiang and Beijing rank the top three, Guizhou ranks the last. We conclude that the ranking is closely related to the development stage of the provinces. Real human capital per capita is directly influenced by income level and income growth rates. The ranking is also influenced by education level and population structure.

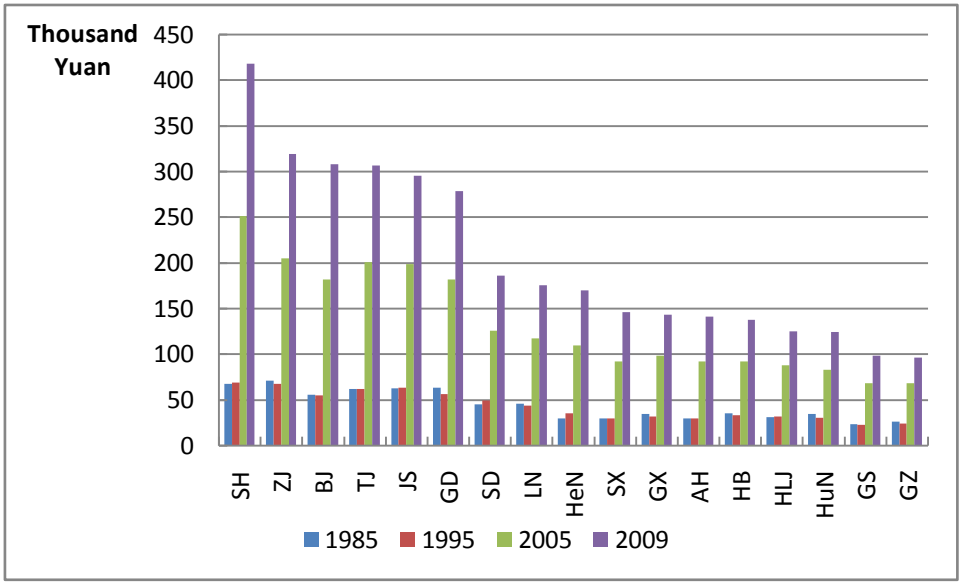


Figure 6.1.3 Provincial Real Human Capital Per Capita

6.2 Cross-province labor force human capital comparison

Figure 6.2.1 displays provincial real labor force human capital. Overall, Guangdong has the largest real labor force human capital, followed by Shandong and Jiangsu; Gansu has the least. Real labor force human capital ranking could change because of the different sizes of the provincial labor force population and the human capital population. This might explain why Shandong ranks higher than Jiangsu in this category.

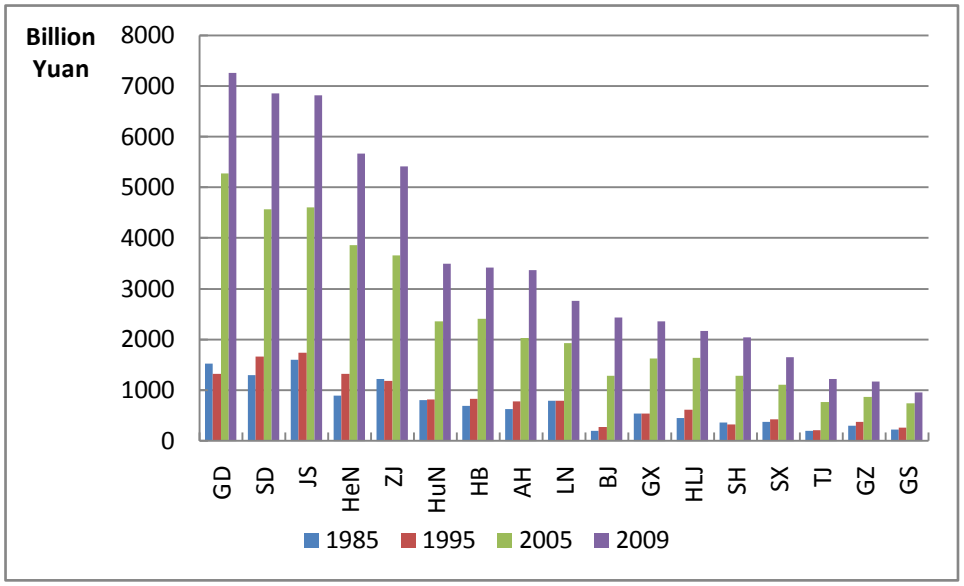


Figure 6.2.1 Provincial Real Labor Force Human Capital

Figure 6.2.2 shows the provincial comparison for real average labor force human capital. Average labor force human capital rankings are almost the same as those for real human capital per capita: Shanghai remains first, Beijing and Tianjin follow, Guizhou stays in the last place.

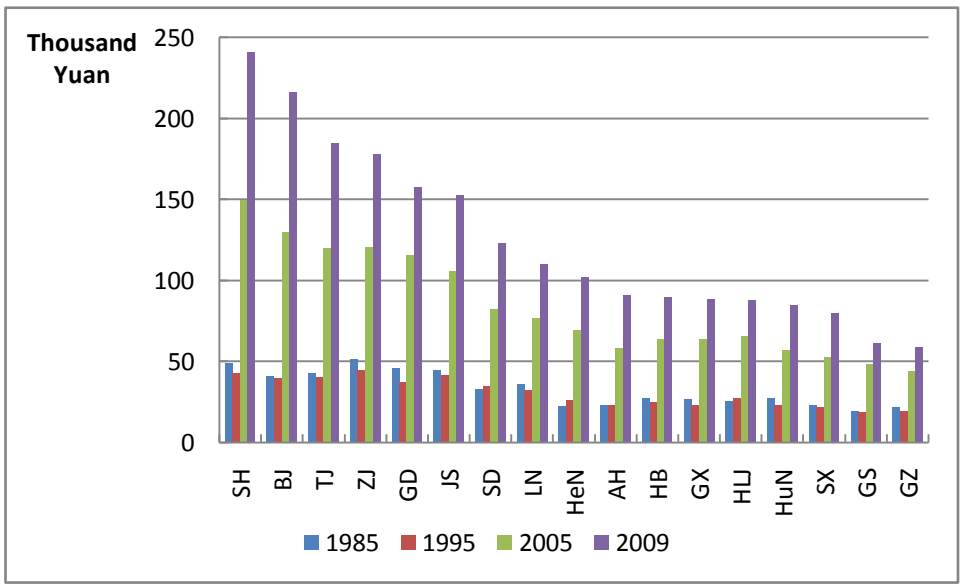


Figure 6.2.2 Provincial Real Average Labor Force Human Capital

6.3 Relative trend of human capital

Figure 6.3.1 shows the ratios of nominal labor force human capital to total nominal human capital by province. The ratios reflect age structures, as human capital of the young and more-educated population will be higher than that of the old and less-educated population. In general, for provinces with low ratios and relatively small young populations, the development of the province might rely to a greater extent on inflows from other provinces. On the other hand, labor forces in more developed provinces tend to be more educated, and therefore the ratio is usually larger. In 2009 Beijing ranks the first; Heilongjiang follows, Guangdong ranks the last.

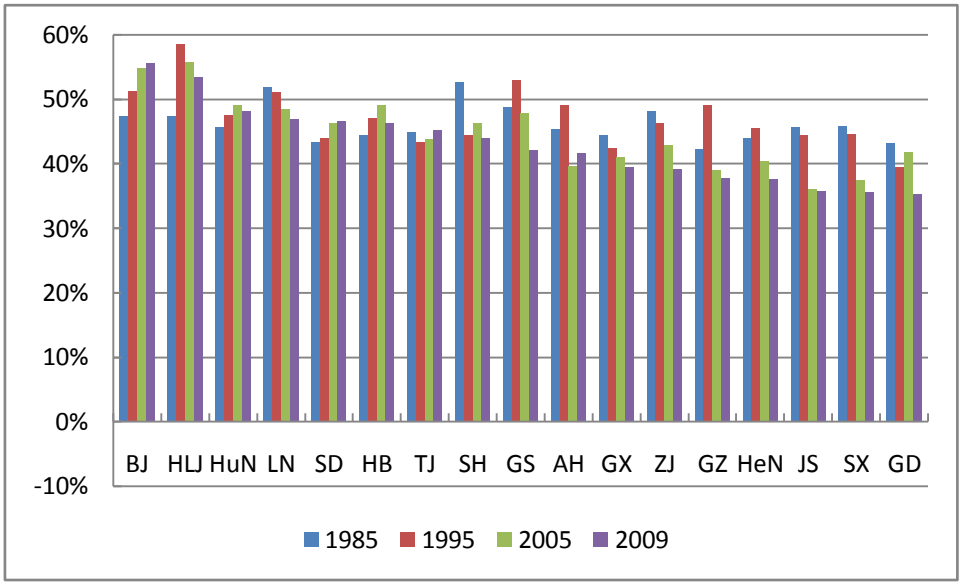


Figure 6.3.1 Ratio of Nominal Labor Force Human Capital to Total Nominal Human Capital

Figure 6.3.2 shows ratios of provincial nominal GDP to nominal labor force human capital. Liaoning ranks the first in 2009, Tianjin and

Shanghai follow, Guizhou ranks the last. This indicates that more developed provinces have higher human capital productivity. The ratios for most provinces are rising, reflecting increases in human capital productivity.

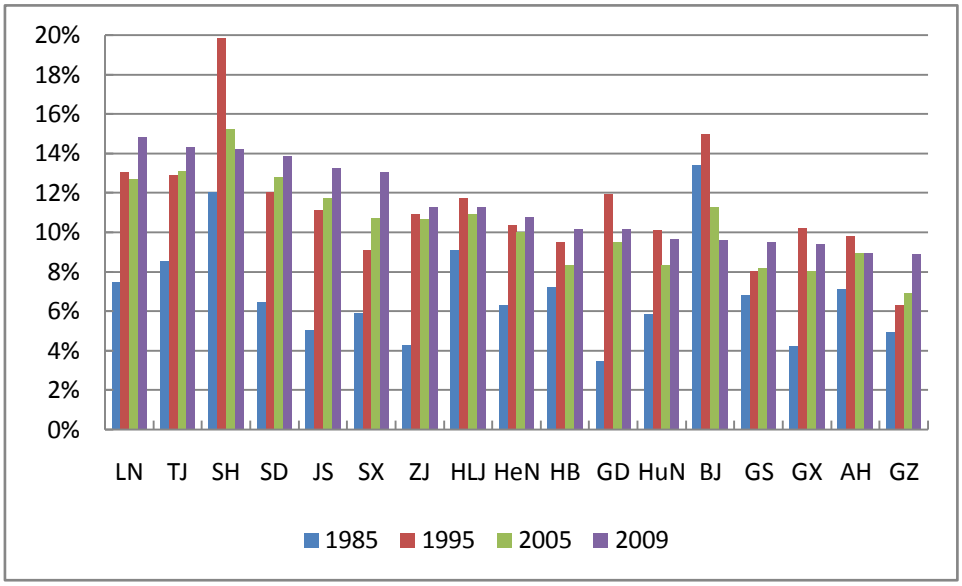


Figure 6.3.2 Ratio of Nominal GDP to Nominal Labor Force Human Capital

Figure 6.3.3 shows the ratios of nominal human capital to nominal fixed asset for five provinces. Shanghai, Tianjin, Liaoning, Anhui, and Guizhou are chosen based on their rankings of average real human capital. The ratios keep falling before 1995, and then change little afterwards; Anhui's ratio rises and the ratio for Guizhou, the least developed province, keeps falling.

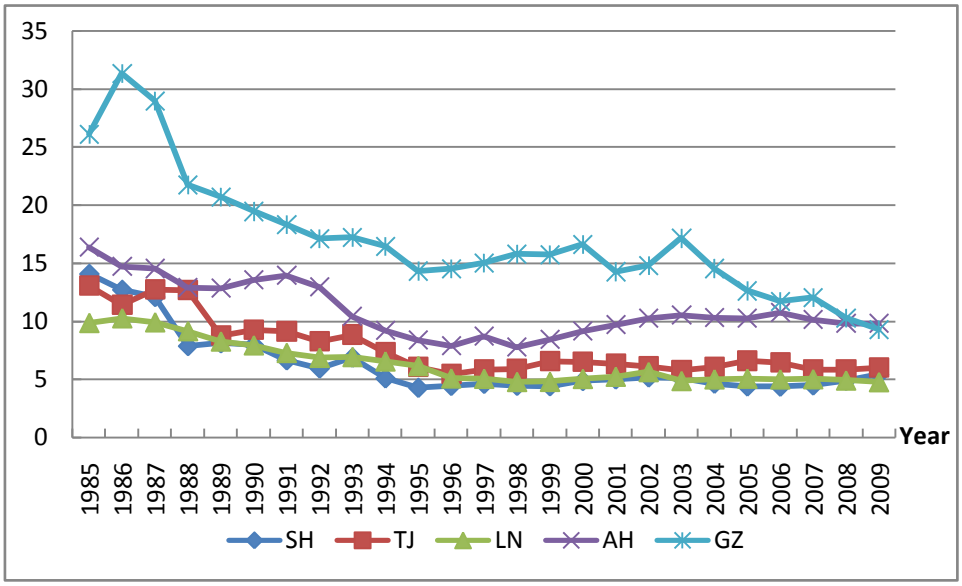


Figure 6.3.3 Ratio of Nominal Human Capital to Nominal Fixed Asset for Five Provinces

Figure 6.3.4 shows the ratios of nominal fixed asset to nominal GDP for the five provinces, indicating fixed assets used in creating each unit of GDP. Although initial ratios vary, they seem to converge over time.

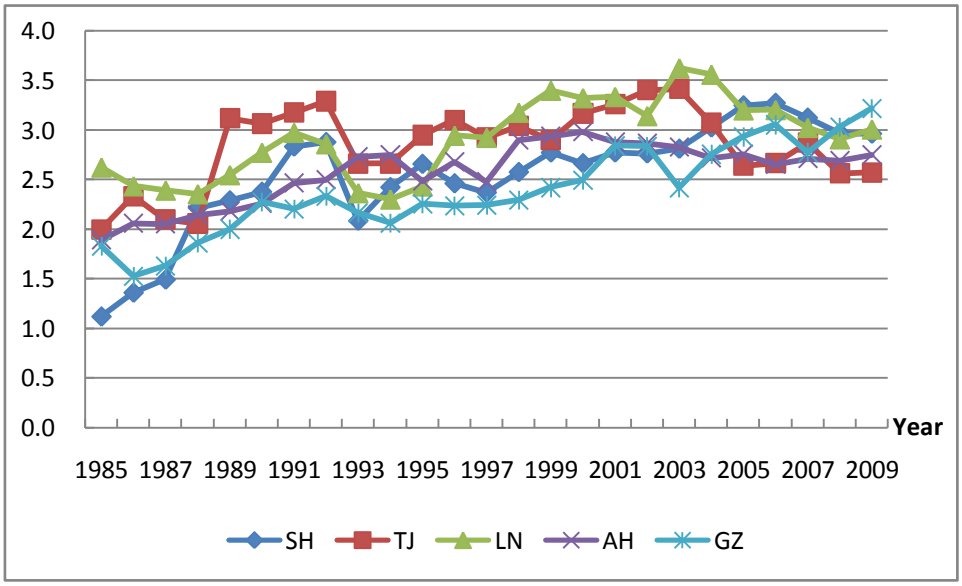


Figure 6.3.4 Ratio of Fixed Asset to Nominal GDP for Five Provinces

Figure 6.3.5 shows ratios of nominal labor force human capital to GDP for the five provinces. Compared with 1985, the ratios have fallen in 2009; relatively more developed provinces have lower ratios, implying higher human capital productivity in creating GDP.

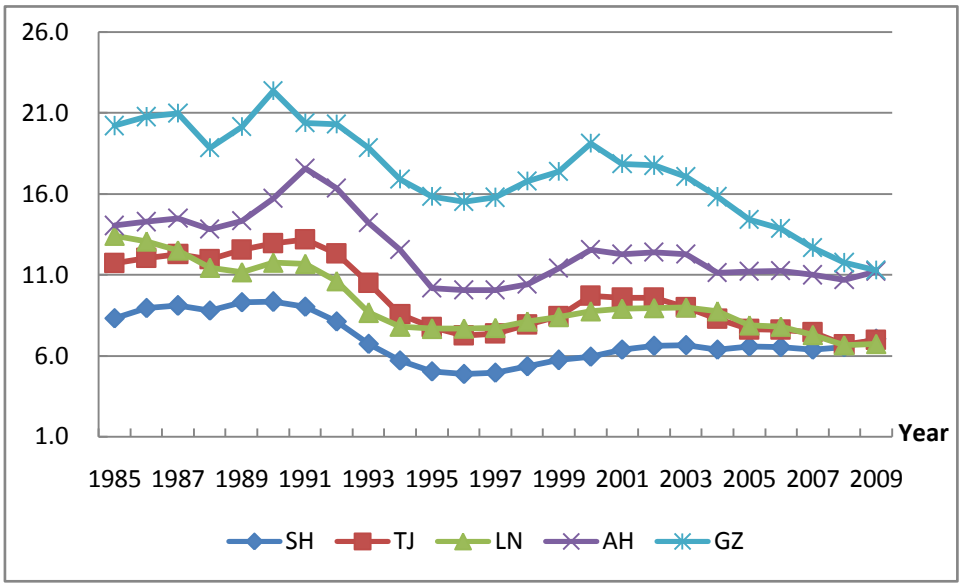


Figure 6.3.5 Ratio of Labor Force Human Capital to GDP for Five Provinces

Chapter 7 Human capital for Beijing

1. Total human capital

Human capital stocks of Beijing are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table BJ-1.1. Column 1 and 2 contain the nominal human capital, and column 3 and 4 contain the real human capital deflated by CPI(in 1985 Yuan).[40]

Table BJ-1.1 Nominal and Real Human Capital, Nominal GDP for Beijing

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	418		418		26	16.25
1986	487		456		28	17.09
1987	561		483		33	17.16
1988	677		485		41	16.50
1989	810		495		46	17.76
1990	973		564		50	19.42
1991	1,110		575		60	18.53
1992	1,274		600		71	17.96
1993	1,472		583		89	16.62
1994	1,701		540		115	14.86

[40] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	1,938		524		151	12.85
1996	2,304		558		179	12.88
1997	2,749		632		208	13.23
1998	3,288		739		238	13.83
1999	3,914		874		268	14.61
2000	4,668	4,923	1,007	1,062	316	14.76
2001	5,435	5,733	1,138	1,200	371	14.66
2002	6,388	6,751	1,361	1,439	432	14.80
2003	7,545	7,863	1,605	1,673	501	15.07
2004	8,984	9,410	1,892	1,982	603	14.89
2005	10,377	10,943	2,153	2,271	697	14.89
2006	12,296	12,801	2,529	2,632	812	15.15
2007	14,445	15,084	2,901	3,029	985	14.67
2008	17,244	18,061	3,295	3,451	1,112	15.51
2009	20,281	21,297	3,936	4,133	1,215	16.69

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure BJ-1.1 graphs real and nominal human capital for Beijing reported in Table BJ-1.1. As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

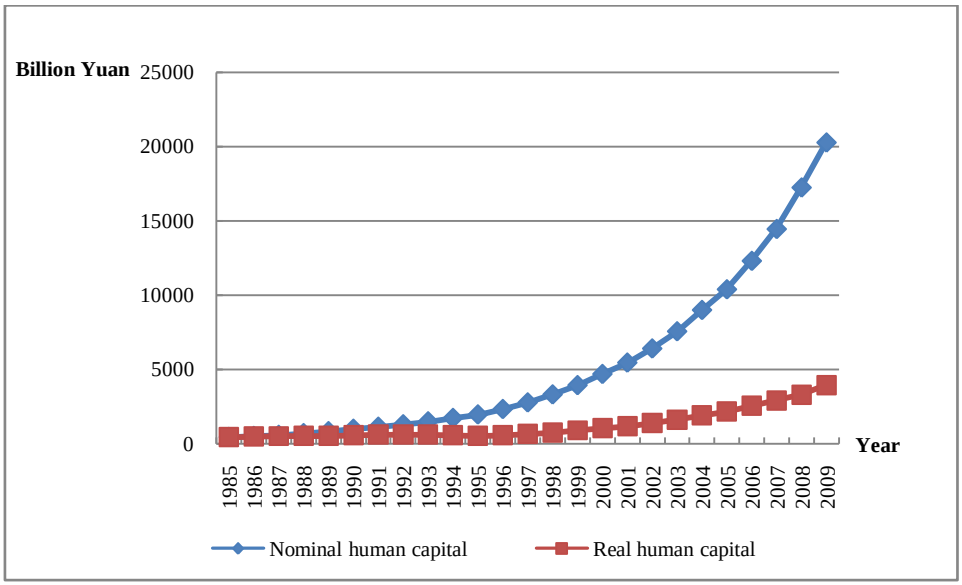


Figure BJ-1.1 Nominal and Real Human Capital for Beijing

In order to get a sense of the magnitude of the human capital in Beijing, we also present the ratio of nominal human capital to nominal GDP in Table BJ-1.1.[41] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio could also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure BJ-1.2, nominal human capital is substantially higher than nominal GDP for Beijing. There are three stages in this series: Upwards from 1985 through 1990, downwards from 1990 through 1995, and finally an upward from 2003 through 2009.

[41] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

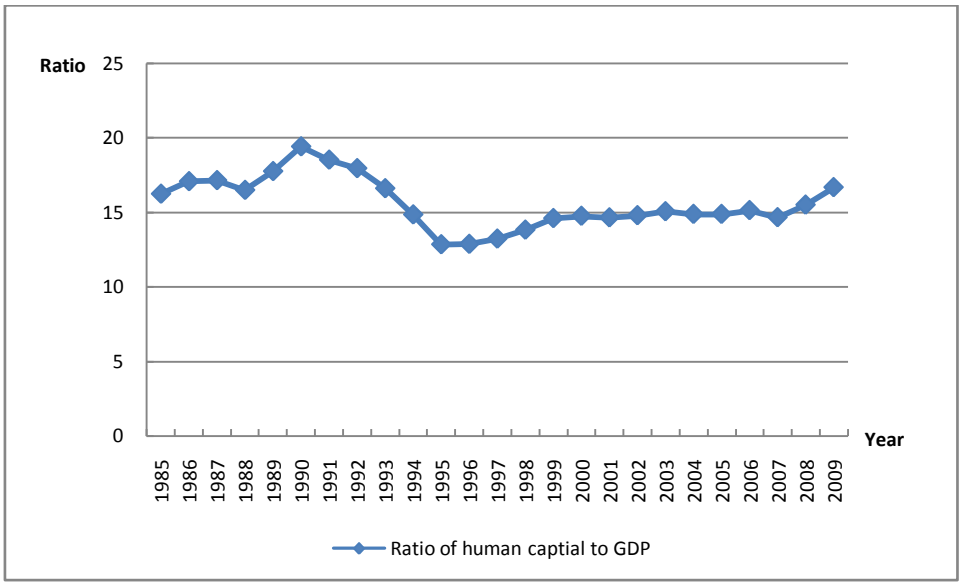


Figure BJ-1.2 Ratio of Human Capital to GDP for Beijing

In order to discuss the trend of human capital, we often need to adjust the nominal value into real value by using adjustment index. We calculate the real values here using CPI. Table BJ-1.2 reports the human capital real values for Beijing by gender and region. The results based on five education categories show that the human capital for Beijing during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Beijing increases from 0.42 trillion Yuan to 3.94 trillion Yuan (based on 1985), it has increased by 9 times, the annual growth rate of human capital over this period increases to 9.35%.[42]

From 1985 to 2009, male human capital in Beijing increases from 0.265 trillion Yuan to 2.538 trillion Yuan, the human capital for female in Beijing increases from 0.153 trillion Yuan to 1.398 trillion Yuan. During the same period, the annual growth rates of human capital are 9.42% and 9.22% for male and female respectively. The gender gap in the estimated human

[42] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

capital increases from 0.112 trillion Yuan in 1985 to 1.141 trillion Yuan in 2009. In 2009, the male human capital is about 1.8 times the amount of that for female in Beijing.

From 1985 to 2009, rural human capital for Beijing increases from 0.121 trillion Yuan to 0.264 trillion Yuan, urban human capital for Beijing increases from 0.297 trillion Yuan to 3.672 trillion Yuan. During the same period, the annual growth rates of human capital are 3.25% and 10.48% for rural and urban areas respectively. The region gap in the estimated human capital increases from 0.176 trillion Yuan in 1985 to 3.408 trillion Yuan in 2009. In 2009, the urban human capital is about 14 times the amount of that for rural in Beijing.

Table BJ-1.2 Real Human Capital by Gender and Region for Beijing[43]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	418	265	153	297	121
1986	456	289	166	329	127
1987	483	308	175	354	129
1988	485	308	176	361	124
1989	495	314	181	375	120
1990	564	356	207	435	129
1991	575	363	212	447	128
1992	600	378	222	471	129
1993	583	368	216	462	121
1994	540	340	200	432	107
1995	524	330	194	421	103
1996	558	353	205	457	101
1997	632	409	224	526	106
1998	739	477	261	624	115
1999	874	567	307	747	127

[43] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
2000	1,007	654	353	869	138
2001	1,138	736	402	998	140
2002	1,361	878	483	1,212	150
2003	1,605	1,035	570	1,447	158
2004	1,892	1,213	679	1,724	168
2005	2,153	1,376	777	1,976	177
2006	2,529	1,622	907	2,336	193
2007	2,901	1,865	1,036	2,687	214
2008	3,295	2,122	1,173	3,066	229
2009	3,936	2,538	1,398	3,672	264

Figure BJ-1.3 shows that the human capital real values for male and female for Beijing exhibit a rising trend from 1985 to 2009. Before 1997, different human capital all grow quite slowly, starting from 1997, both the growth of human capital for male and female accelerate, the gender gap, which has been fairly stable, then appears to be expanding.

The situation that the human capital for male is higher than that for female is consistent with that at the national level. One reason is the older retirement age for male; male has longer time to generate income from market, and thus ends up with a higher lifetime income relative to female[44]. Also the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[44] To ensure the consistence of urban and rural, we define the retirement age for male and female in rural areas as 60 and 55.

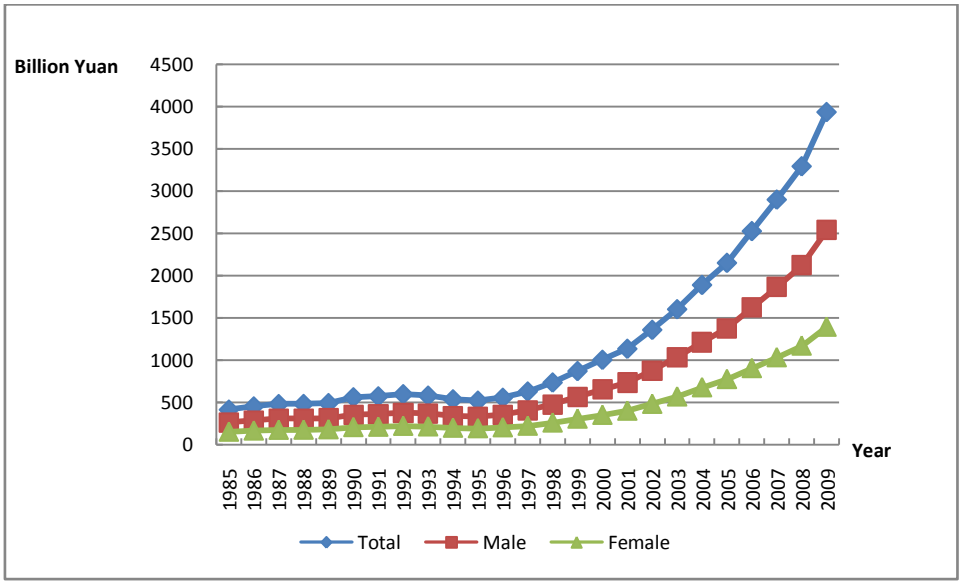


Figure BJ-1.3 Real Human Capital by Gender for Beijing

Figure BJ-1.4 shows the human capital real values for urban and rural separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1997, the urban human capital is about 3-4 times the amount of that for rural. Starting from 1997, however, the urban human capital is rising much more rapidly while rural human capital keeps growing quite slowly, which results in an increasingly larger gap between rural and urban. Thus we can see that human capital changes almost simultaneously with urban human capital. Moreover, the gap shows a trend of further expansion as the human capital for urban increases much faster in later periods.

One reason that results in the gap between rural and urban is the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another one is the education gap between the rural and urban population.

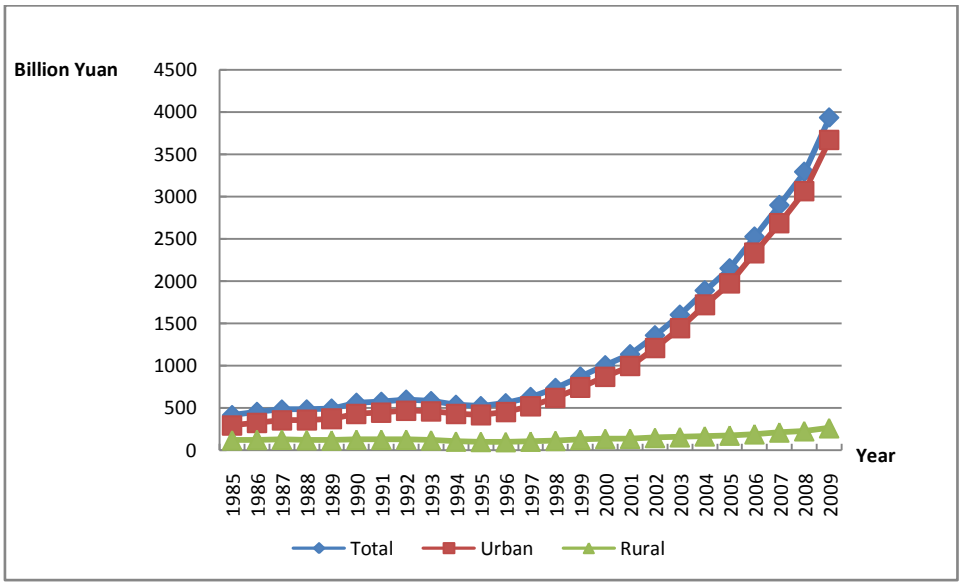


Figure BJ-1.4 Real Human Capital by Region for Beijing

Human capital index can reflect the trend of human capital directly. Table BJ-1.3 reports a set of indices of real human capital classified by gender and region for Beijing from 1985 to 2009. We calculate them using 1985 as the base year and setting its value at 100.

Table BJ-1.3 Real Human Capital Index for Beijing (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	109.13	109.27	108.88	110.95	104.65
1987	115.73	116.33	114.70	119.28	107.04
1988	116.05	116.40	115.45	121.51	102.65
1989	118.50	118.46	118.56	126.40	99.12
1990	135.01	134.60	135.71	146.66	106.41
1991	137.65	137.18	138.46	150.52	106.06
1992	143.74	142.76	145.44	158.74	106.93
1993	139.64	138.83	141.05	155.82	99.96
1994	129.20	128.23	130.87	145.73	88.64

1995	125.46	124.68	126.81	141.97	84.93
1996	133.67	133.36	134.20	154.11	83.50
1997	151.41	154.34	146.33	177.33	87.80
1998	176.89	180.31	170.97	210.21	95.14
1999	209.28	213.98	201.14	251.68	105.27
2000	241.16	247.13	230.81	293.00	113.97
2001	272.35	277.81	262.90	336.34	115.35
2002	325.96	331.67	316.07	408.38	123.73
2003	384.27	390.66	373.20	487.72	130.45
2004	453.02	457.94	444.48	580.87	139.31
2005	515.53	519.71	508.30	665.84	146.72
2006	605.39	612.40	593.23	787.12	159.48
2007	694.55	704.40	677.48	905.43	177.10
2008	788.89	801.16	767.64	1,033.24	189.33
2009	942.34	958.56	914.24	1,237.38	218.39

Figure BJ-1.5 shows the index of real human capital. It's obvious that the human capital has been rising much more rapidly since 1997.

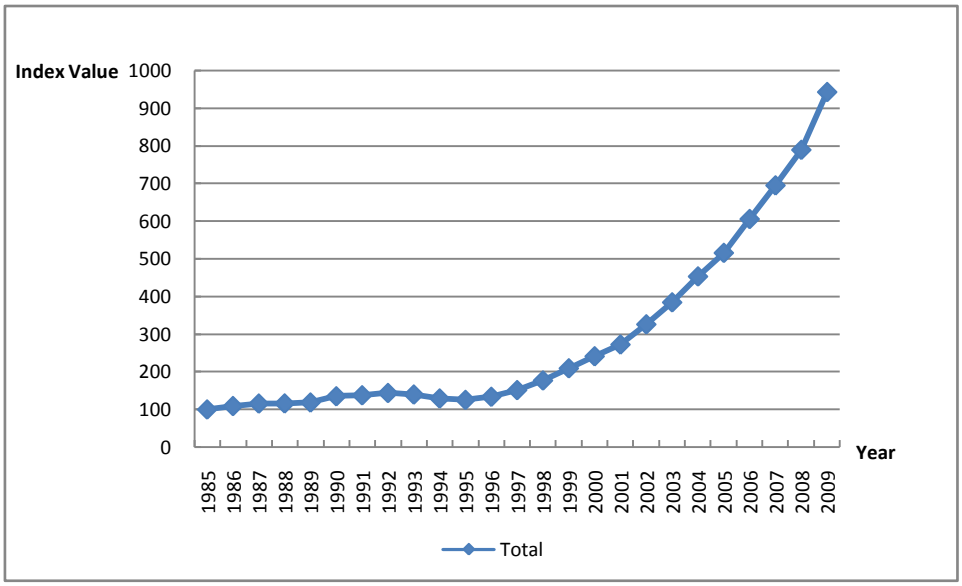


Figure BJ-1.5 Real Human Capital Index for Beijing

2. Human capital per capita

The increase in the human capital can be caused by population growth, demographic change (like retirement population scale), urbanization (like region migration), higher educational attainment, higher return to education, higher return to on-the-job training, etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital divided by non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it could exclude the influence of population factors to a large extent, thus it could serve as a better indicator of the average human capital.

Table BJ-2.1 presents the trends of human capital per capita measured in nominal and real terms for Beijing by gender. Human capital per capita for male remains higher than that for female. Real human capital per capita for male increases from 63,449 Yuan to 335,975 Yuan, increasing by around 5 times; real human capital per capita for female increases from 43,640 Yuan to 210,316 Yuan, increasing by around 5 times as well. From 1985 to 2009, the annual growth rate is 6.95% for male, and 6.55% for female.

Table BJ-2.1 Nominal and Real Human Capital Per Capita by Gender for Beijing

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	**Male**	**Female**	**Total**	**Male**	**Female**
1985	54.41	63.45	43.64	54.41	63.45	43.64
1986	61.42	71.97	48.95	57.51	67.39	45.83
1987	68.76	81.10	54.26	59.29	69.92	46.79
1988	77.62	92.21	60.82	55.59	66.03	43.56
1989	87.47	104.16	68.48	53.44	63.64	41.84
1990	99.26	118.46	77.63	57.54	68.67	45.00

1991	112.75	134.88	87.97	58.41	69.88	45.57
1992	128.99	154.39	100.79	60.80	72.78	47.51
1993	148.88	179.03	115.67	58.98	70.92	45.82
1994	171.57	206.65	133.19	54.41	65.54	42.24
1995	193.55	234.92	148.89	52.33	63.52	40.26
1996	222.97	270.65	171.09	54.02	65.57	41.45
1997	257.80	313.60	194.56	59.32	72.15	44.76
1998	299.62	363.12	227.08	67.32	81.59	51.02
1999	346.45	418.94	262.69	77.38	93.57	58.67
2000	401.43	482.62	305.96	86.63	104.15	66.02
2001	457.46	551.84	348.38	95.75	115.50	72.92
2002	525.59	636.45	399.18	112.02	135.65	85.08
2003	607.44	739.16	459.09	129.21	157.23	97.66
2004	709.00	862.79	537.88	149.32	181.71	113.28
2005	804.59	981.02	610.21	166.95	203.56	126.62
2006	933.71	1,137.36	707.24	192.01	233.89	145.44
2007	1,071.35	1,303.70	811.00	215.15	261.82	162.87
2008	1,240.62	1,506.15	940.76	237.06	287.80	179.76
2009	1,428.18	1,731.17	1,083.69	277.17	335.97	210.32

Figure BJ-2.1 shows that the real human capital per capita for male is higher than that for female for Beijing from 1985 to 2009. Before 1997, different human capital all grow quite slowly, starting from 1997, both the growth of human capital for male and female accelerate, the gender gap, which has been fairly stable, then appears to be expanding.

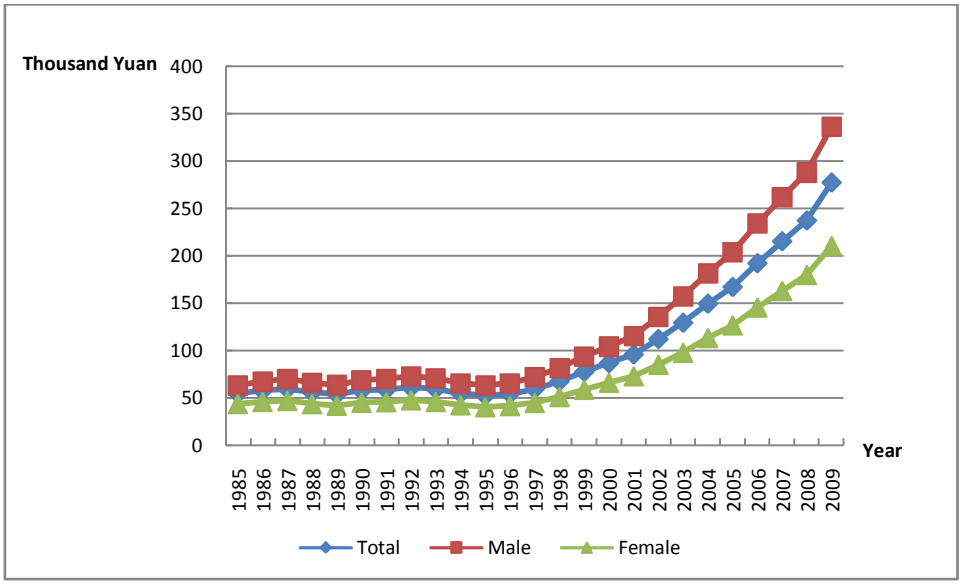


Figure BJ-2.1 Real Human Capital Per Capita by Gender for Beijing

Table BJ-2.2 reports the results of human capital per capita measured in nominal and real terms for Beijing classified by region. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The urban human capital per capita increases from 55,285 to 303,798, the rural human capital per capita increases from 55,376 to 124,941. The human capital per capita in urban areas grows much faster than the one for rural.

Table BJ-2.2 Nominal and Real Human Capital Per Capita by Region for Beijing

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	54.41	55.28	52.38	54.41	55.28	52.38
1986	61.42	62.77	58.18	57.51	58.77	54.47
1987	68.76	70.51	64.41	59.29	60.79	55.54
1988	77.62	79.76	72.03	55.59	57.11	51.58
1989	87.47	90.37	79.48	53.44	55.22	48.57

1990	99.26	103.56	87.02	57.54	60.04	50.44
1991	112.75	118.64	96.11	58.41	61.46	49.79
1992	128.99	137.27	105.73	60.80	64.71	49.84
1993	148.88	160.26	117.08	58.98	63.48	46.38
1994	171.57	186.75	129.20	54.41	59.23	40.98
1995	193.55	212.29	142.09	52.33	57.40	38.42
1996	222.97	246.05	156.51	54.02	59.61	37.92
1997	257.80	285.65	173.84	59.32	65.72	40.00
1998	299.62	333.41	193.39	67.32	74.91	43.45
1999	346.45	386.22	215.98	77.38	86.26	48.24
2000	401.43	448.18	242.11	86.63	96.71	52.25
2001	457.46	509.57	264.18	95.75	106.65	55.29
2002	525.59	583.73	290.91	112.02	124.42	62.01
2003	607.44	672.47	321.90	129.21	143.04	68.47
2004	709.00	781.51	363.73	149.32	164.59	76.60
2005	804.59	881.84	407.28	166.95	182.98	84.51
2006	933.71	1,021.76	456.87	192.01	210.12	93.95
2007	1,071.35	1,173.13	512.99	215.15	235.60	103.02
2008	1,240.62	1,357.60	576.00	237.06	259.41	110.06
2009	1,428.18	1,565.38	643.78	277.17	303.80	124.94

Figure BJ-2.2 reflects the trend of human capital per capita measured in real terms and classified by region. As is shown in the graph, the size of the difference between urban and rural expanded rapidly after 1997; this is partly due to the long-term stagnant status in the rural area before 2002. Based on five education categories, the ratio of urban to rural increases from 1.05 in 1985 to 2.43 in 2009, which indicates a rising size of region gap on human capital per capita. From 1985 to 2009, the annual growth rate is 7.10% for the urban area, and 3.62% for the rural area.

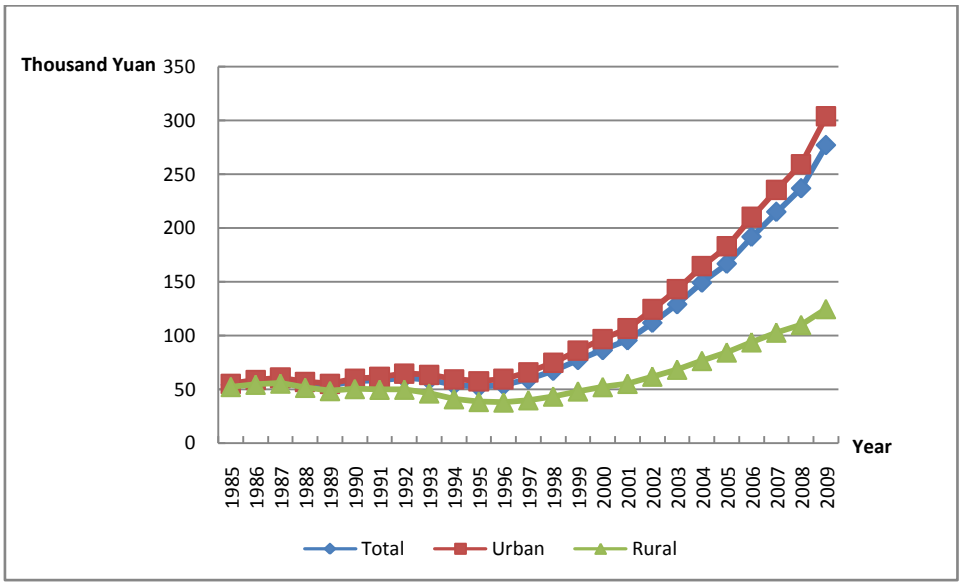


Figure BJ-2.2 Real Human Capital Per Capita by Region for Beijing

Figure BJ-2.3 shows the real human capital per capita index for Beijing. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

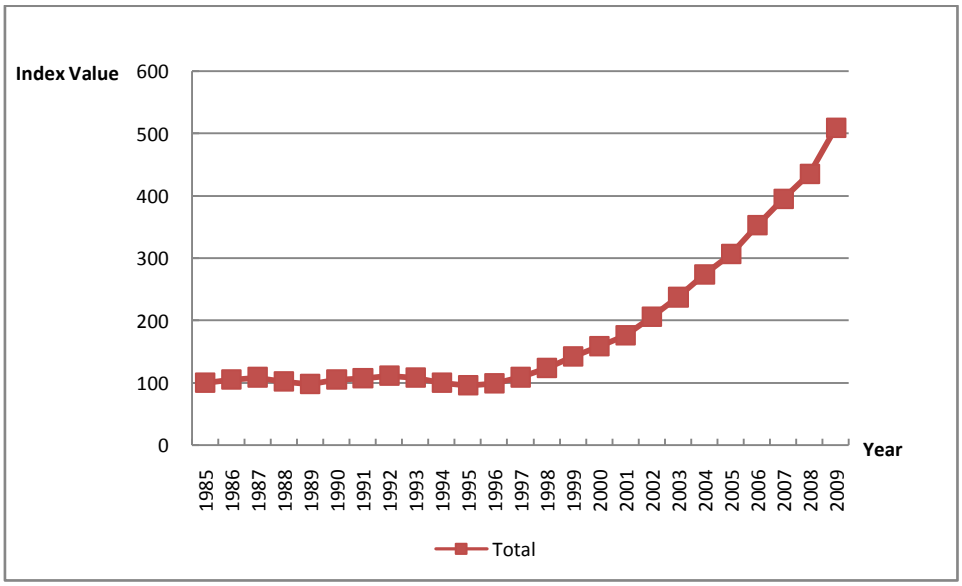


Figure BJ-2.3 Real Human Capital Per Capita Index for Beijing

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimated approach of labor force human capital is the same as that of human capital we illustrate above. Based on the income parameter for Beijing and the discount rate valued at 4.58%，the labor force human capital for Beijing is reported in Table BJ-3.1. The real values in this table are calculated by using CPI as the deflator with respect to nominal values. We also calculate the ratio of labor force human capital measured in nominal terms to nominal GDP. The results are reported in the last column of Table BJ-3.1.

Table BJ-3.1 Labor Force Human Capital and Nominal GDP for Beijing

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	198		198		26	7.71
1986	231		216		28	8.11
1987	272		234		33	8.32
1988	339		243		41	8.26
1989	420		256		46	9.20
1990	522		303		50	10.43
1991	598		310		60	9.99
1992	681		321		71	9.61
1993	777		308		89	8.76
1994	874		277		115	7.63
1995	991		268		151	6.57

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1996	1,183		287		179	6.61
1997	1,473		339		208	7.09
1998	1,825		410		238	7.68
1999	2,207		493		268	8.24
2000	2,686	2,589	580	559	316	8.49
2001	3,066	2,989	642	626	371	8.27
2002	3,604	3,559	768	758	432	8.35
2003	4,273	4,282	909	911	501	8.53
2004	4,884	4,979	1,029	1,049	603	8.09
2005	5,683	5,812	1,179	1,206	697	8.15
2006	6,771	6,941	1,392	1,427	812	8.34
2007	7,976	8,199	1,602	1,646	985	8.10
2008	9,470	9,759	1,809	1,865	1,112	8.52
2009	11,265	11,650	2,186	2,261	1,215	9.27

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends of labor force human capital in both real and nominal terms for Beijing are presented in Figure BJ-3.1. From 1985 to 2009, labor force human capital keeps rising.

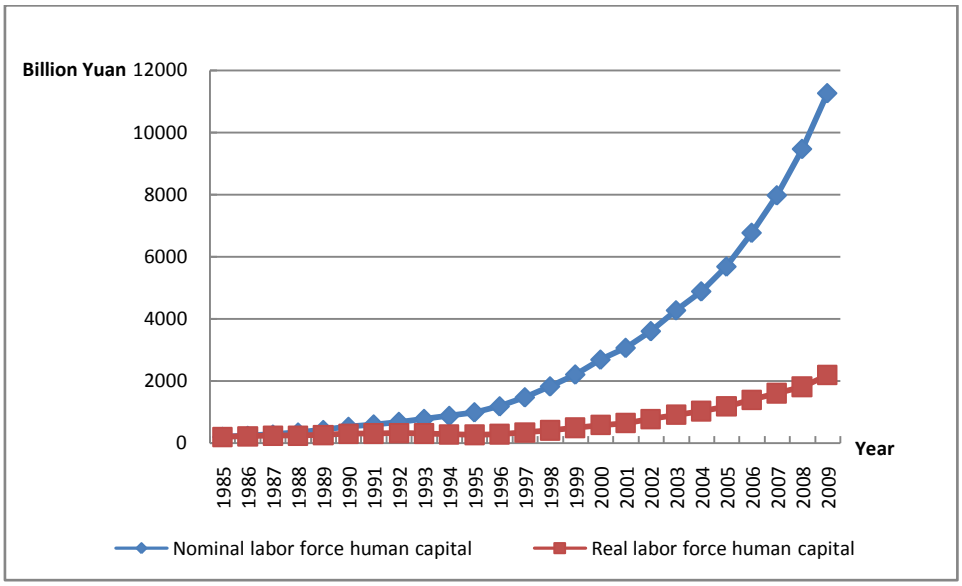


Figure BJ-3.1 Nominal and Real Labor Force Human Capital for Beijing

Similar to the analysis of human capital, in order to get a sense of the magnitude of the labor force human capital, we construct the ratio of labor force human capital measured in nominal terms to nominal GDP. It is shown in Figure BJ-3.2. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of annual labor force human capital is much higher than that of GDP. There is an increase during 1985 to 1989, the ratio of labor force human capital to GDP in Beijing from 1990 to 1994 decreases at a considerable rate, the ratio increases slowly in small scale after 1994.

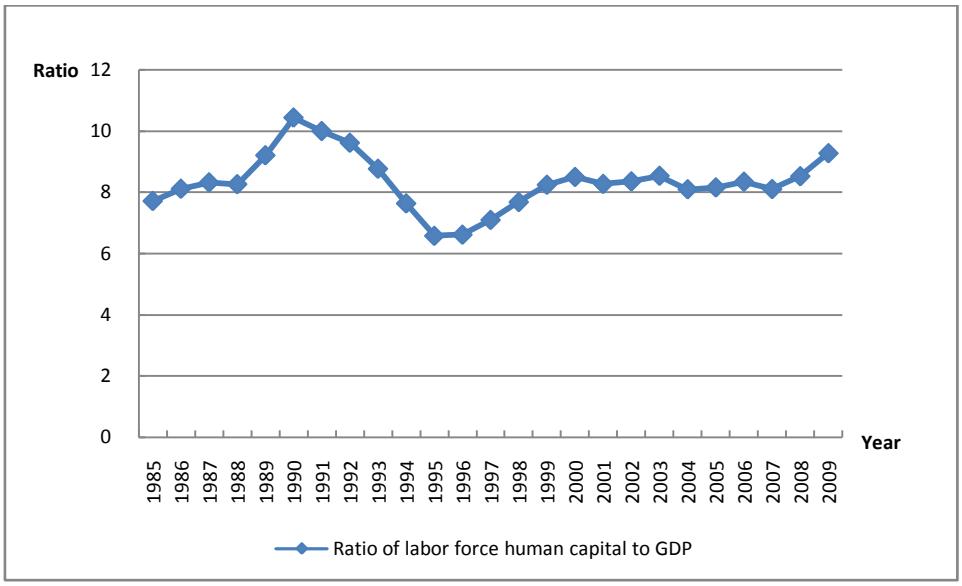


Figure BJ-3.2 Ratio of Labor Force Human Capital to GDP for Beijing

Table BJ-3.2 shows the labor force human capital real values for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table BJ-3.2 Nominal and Real Labor Force Human Capital by Region for Beijing

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	198	147	51	198	147	51
1986	231	173	58	216	162	54
1987	272	206	66	234	178	57
1988	339	262	77	243	188	55
1989	420	330	89	256	202	54
1990	522	416	106	303	241	62
1991	598	477	121	310	247	63
1992	681	544	138	321	256	65
1993	777	620	157	308	246	62

1994	874	699	176	277	222	56
1995	991	791	200	268	214	54
1996	1,183	956	227	287	232	55
1997	1,473	1,213	260	339	279	60
1998	1,825	1,524	301	410	342	68
1999	2,207	1,865	343	493	416	77
2000	2,686	2,299	387	580	496	84
2001	3,066	2,645	420	642	554	88
2002	3,604	3,143	461	768	670	98
2003	4,273	3,768	505	909	802	107
2004	4,884	4,344	540	1,029	915	114
2005	5,683	5,103	580	1,179	1,059	120
2006	6,771	6,116	654	1,392	1,258	135
2007	7,976	7,230	746	1,602	1,452	150
2008	9,470	8,629	840	1,809	1,649	161
2009	11,265	10,294	971	2,186	1,998	188

Figure BJ-3.3 shows the labor force human capital real values for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The rural labor force human capital grows quite slowly and much less than the one for urban, this has much to do with relatively few rural population and a correspondingly few labor force rural population in Beijing.

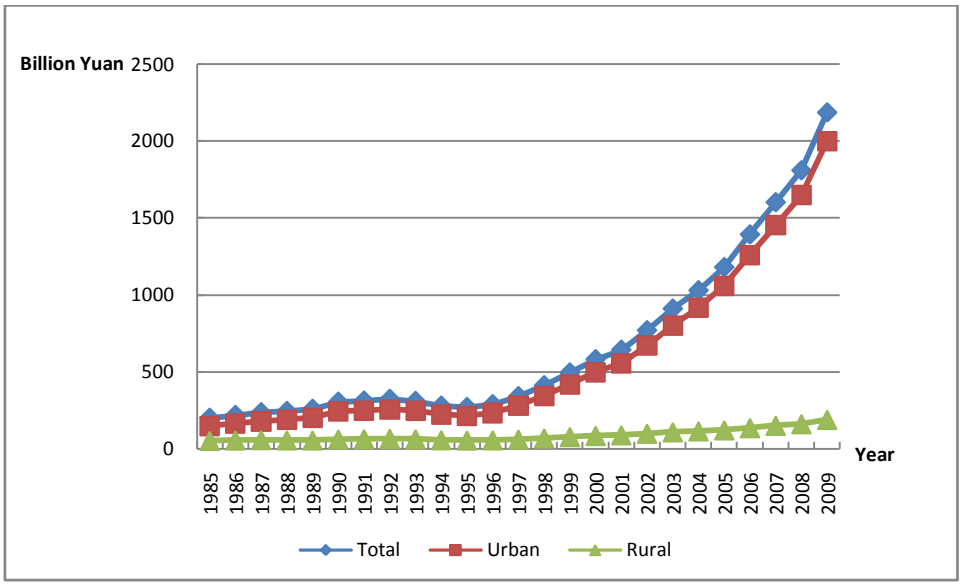


Figure BJ-3.3 Real Labor Force Human Capital by Region for Beijing

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table BJ-3.3 reports the real average labor force human capital classified by gender. And the average labor force human capital for female is smaller than that for male. More specifically, the number for male is about 1.8 times that for female in 2009.

Table BJ-3.3 Nominal and Real Labor Force Human Capital by Gender for Beijing

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	40.23	47.65	31.40	40.23	47.65	31.40
1986	45.09	53.88	34.70	42.22	50.45	32.49
1987	50.62	60.97	38.43	43.64	52.56	33.13
1988	57.59	69.68	43.71	41.24	49.90	31.30
1989	65.68	79.66	49.92	40.13	48.67	30.50
1990	75.31	91.66	57.06	43.66	53.14	33.08
1991	85.30	103.75	64.88	44.19	53.75	33.61
1992	96.42	117.25	73.58	45.45	55.27	34.68
1993	109.78	133.75	83.78	43.48	52.98	33.19
1994	124.00	151.24	94.90	39.33	47.97	30.10
1995	140.52	171.82	107.41	37.99	46.46	29.04
1996	161.74	198.23	122.75	39.19	48.03	29.74
1997	190.97	236.22	139.82	43.94	54.35	32.17
1998	222.61	275.80	161.70	50.02	61.97	36.33
1999	256.53	317.52	185.27	57.29	70.92	41.38
2000	299.97	371.16	214.61	64.73	80.09	46.31
2001	335.44	416.03	240.64	70.21	87.08	50.37
2002	382.66	475.70	275.49	81.56	101.39	58.72
2003	441.71	550.83	317.26	93.96	117.17	67.49
2004	500.34	625.33	359.72	105.38	131.70	75.76
2005	572.93	715.68	414.14	118.88	148.50	85.93
2006	661.98	828.74	474.34	136.13	170.43	97.55
2007	756.96	946.32	542.31	152.02	190.05	108.91
2008	865.65	1,080.06	620.48	165.41	206.38	118.56
2009	998.40	1,244.60	713.22	193.76	241.54	138.42

Table BJ-3.4 reports the real average labor force human capital classified by region separately. The average labor force human capital is much smaller in rural area than in urban area. The number for urban is about 1.9

times that for rural.

Table BJ-3.4 Nominal and Real Average Labor Force Human Capital by Region for Beijing

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	40.23	40.65	39.09	40.23	40.65	39.09
1986	45.09	45.71	43.30	42.22	42.80	40.55
1987	50.62	51.52	47.98	43.64	44.42	41.37
1988	57.59	58.92	53.47	41.24	42.19	38.29
1989	65.68	67.60	59.43	40.13	41.30	36.31
1990	75.31	78.00	66.35	43.66	45.22	38.46
1991	85.30	88.90	73.61	44.19	46.06	38.13
1992	96.42	101.23	81.17	45.45	47.72	38.26
1993	109.78	116.17	90.14	43.48	46.02	35.70
1994	124.00	132.37	99.08	39.33	41.98	31.42
1995	140.52	151.54	109.18	37.99	40.97	29.52
1996	161.74	175.31	121.92	39.19	42.47	29.54
1997	190.97	208.34	137.52	43.94	47.93	31.64
1998	222.61	243.24	155.67	50.02	54.65	34.98
1999	256.53	280.60	174.91	57.29	62.67	39.07
2000	299.97	329.00	196.88	64.73	71.00	42.48
2001	335.44	367.02	217.63	70.21	76.82	45.55
2002	382.66	418.24	242.12	81.56	89.14	51.61
2003	441.71	482.39	271.00	93.96	102.61	57.65
2004	500.34	544.98	301.58	105.38	114.78	63.52
2005	572.93	622.17	337.62	118.88	129.10	70.05
2006	661.98	717.63	383.70	136.13	147.58	78.91
2007	756.96	821.04	431.02	152.02	164.89	86.56
2008	865.65	937.50	484.35	165.41	179.14	92.55
2009	998.40	1,083.17	545.69	193.76	210.21	105.90

Chapter 8 Human capital for Liaoning

1. Total human capital

Human capital stocks of Liaoning are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table LN-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI(in 1985 Yuan).[45]

Table LN-1.1 Nominal and Real Human Capital, Nominal GDP for Liaoning

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,343		1,343		52	25.90
1986	1,515		1,426		61	25.03
1987	1,708		1,485		72	23.75
1988	1,901		1,398		88	21.58
1989	2,116		1,315		100	21.08
1990	2,342		1,405		106	22.03
1991	2,603		1,482		120	21.69
1992	2,895		1,555		147	19.65
1993	3,300		1,546		201	16.41
1994	3,716		1,402		246	15.09

[45] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	4,188		1,360		279	14.99
1996	4,742		1,427		316	15.02
1997	5,307		1,545		358	14.81
1998	5,911		1,728		388	15.23
1999	6,812		2,011		417	16.33
2000	7,847	7,898	2,310	2,322	467	16.81
2001	8,810	8,898	2,582	2,603	503	17.50
2002	9,680	9,780	2,861	2,886	546	17.73
2003	10,608	10,720	3,066	3,095	600	17.67
2004	11,919	12,052	3,309	3,342	667	17.86
2005	13,076	13,232	3,565	3,604	805	16.25
2006	14,944	15,124	4,018	4,063	930	16.06
2007	16,973	17,207	4,334	4,390	1,116	15.21
2008	19,540	19,848	4,759	4,831	1,367	14.30
2009	21,837	22,234	5,316	5,408	1,521	14.35

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure LN-1.1 graphs real and nominal human capital for Liaoning reported in Table LN-1.1 As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

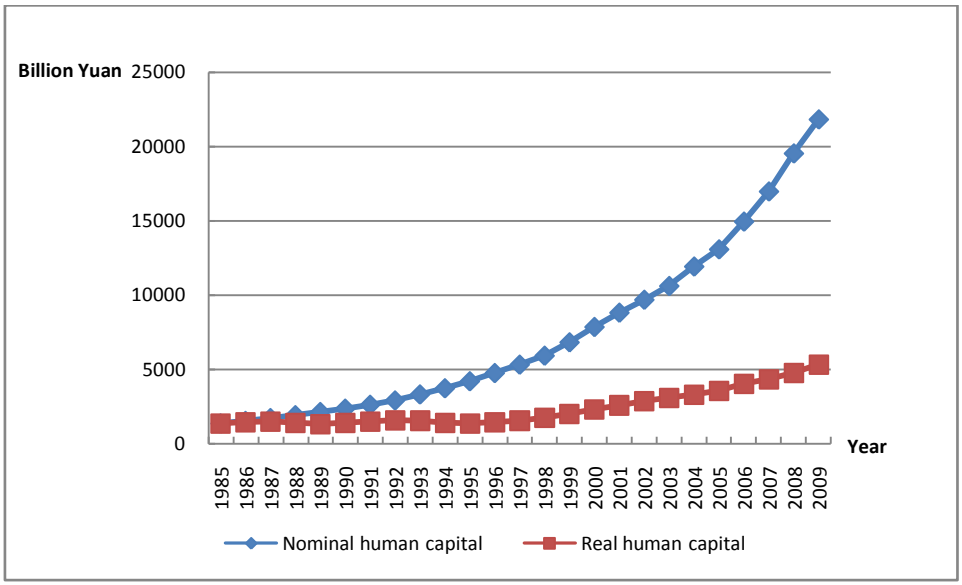


Figure LN-1.1 Nominal and Real Human Capital for Liaoning

In order to get a sense of the magnitude of the human capital in Beijing, we also present the ratio of nominal human capital to nominal GDP in Table LN-1.1.[46] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure LN-1.2, nominal human capital is substantially higher than nominal GDP for Liaoning. There are three stages in this series: Downwards from 1985 through 1997, upwards from 1998 through 2004, and finally downward from 2005 through 2009.

[46] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

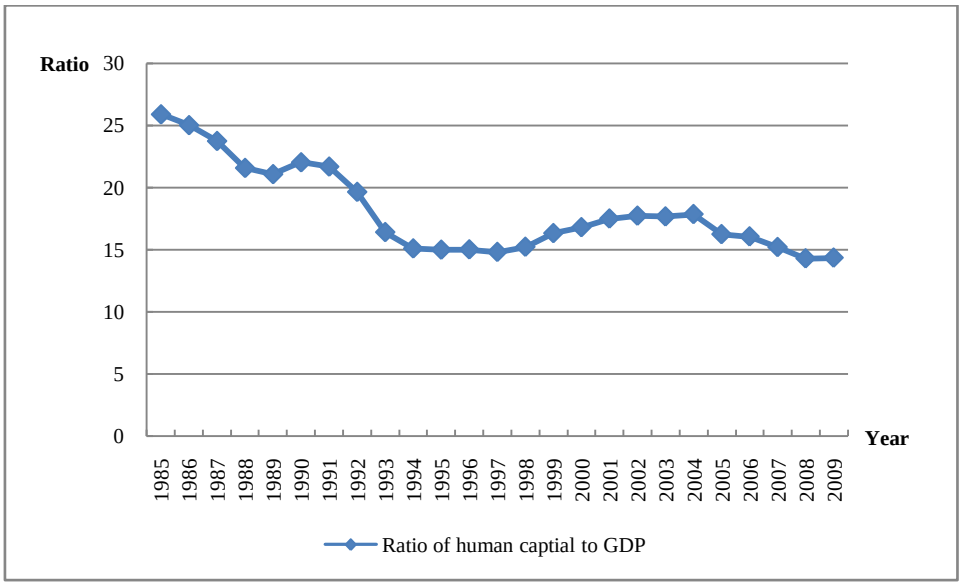


Figure LN-1.2 Ratio of Human Capital to GDP for Liaoning

In order to discuss the trend of human capital, we often need to adjust the nominal value into real value by using adjustment index. We calculate the real values here using CPI. Table LN-1.2 reports the human capital real values for Liaoning classified by gender and region. The results based on five education categories show that the human capital for Liaoning during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Liaoning increases from 1.343 trillion Yuan to 5.316 trillion Yuan (calculated by 1985 comparable price), it has increased by 4 times, the annual growth rate of human capital over this period increases to 5.73%[47].

From 1985 to 2009, male human capital in Liaoning increases from 0.883 trillion Yuan to 3.364 trillion Yuan, the human capital for female in Liaoning increases from 0.460 trillion Yuan to 1.952 trillion Yuan. During the same period, the annual growth rates of human capital are 5.57% and 6.02 % for male and female respectively. The gender gap in the estimated

[47] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

human capital increases from 0.423 trillion Yuan in 1985 to 1.412 trillion Yuan in 2009. In 2009, the male human capital is about 1.72 times the amount of that for female in Liaoning.

From 1985 to 2009, rural human capital for Liaoning increases from 0.538 trillion Yuan to 0.964 trillion Yuan, the urban human capital in Liaoning increases from 0.805 trillion Yuan to 4.352 trillion Yuan. During the same period, the annual growth rates of human capital are 2.43% and 7.03% for rural and urban areas respectively. The region gap in the estimated human capital increases from 0.267 trillion Yuan in 1985 to 3.388 trillion Yuan in 2009. In 2009, the urban human capital is about 4.51 times the amount of that for rural in Liaoning.

Table LN-1.2 Real Human Capital by Gender and Region for Liaoning[48]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	1,343	883	460	805	538
1986	1,426	932	494	872	555
1987	1,485	969	516	916	569
1988	1,398	903	495	872	526
1989	1,315	840	474	847	468
1990	1,405	892	513	929	476
1991	1,482	947	536	971	511
1992	1,555	998	557	996	559
1993	1,546	995	551	979	567
1994	1,402	907	495	876	526
1995	1,360	881	479	854	506
1996	1,427	924	503	909	519
1997	1,545	1,005	540	989	556
1998	1,728	1,119	608	1,117	611

[48] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1999	2,011	1,298	713	1,334	677
2000	2,310	1,493	817	1,564	746
2001	2,582	1,669	913	1,798	784
2002	2,861	1,843	1,017	2,027	834
2003	3,066	1,982	1,084	2,230	836
2004	3,309	2,138	1,171	2,490	819
2005	3,565	2,294	1,270	2,753	812
2006	4,018	2,595	1,423	3,151	867
2007	4,334	2,787	1,546	3,474	860
2008	4,759	3,046	1,713	3,894	865
2009	5,316	3,364	1,952	4,352	964

Figure LN-1.3 shows that the human capital real values for male and female for Liaoning exhibit a rising trend from 1985 to 2009. Before 1996, different human capital all grow quite slowly, starting from 1996, both the growth of human capital for male and female accelerate, the gender gap is fairly stable and appears to be expanding.

The situation that the human capital for male is higher than that for female is consistent with that at the national level. One reason is the older retirement age for male; male has longer time to generate income from market, and thus ends up with a higher lifetime income relative to female.[49] Also the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[49] To ensure the consistent of urban and rural, we define the working age for male and female in rural area as 60 and 55.

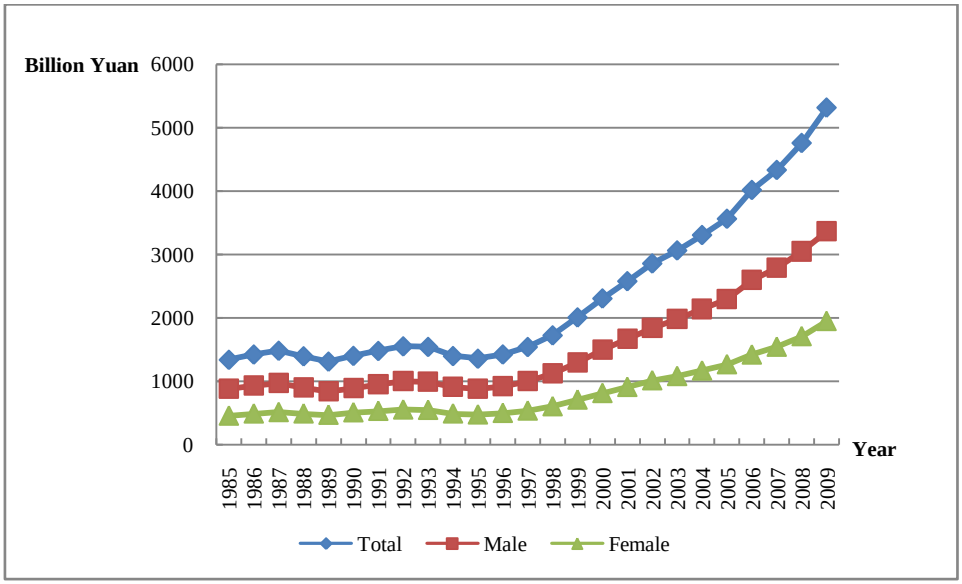


Figure LN-1.3 Real Human Capital by Gender for Liaoning

Figure LN-1.4 shows the human capital real values for urban and rural separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1997, the urban human capital is about 2 times the amount of that for rural. Starting from 1997, however, the urban human capital is rising much more rapidly while rural human capital keeps growing quite slowly, which results in an increasingly larger gap between rural and urban. Thus we can see that human capital changes almost simultaneously with urban human capital. Moreover, the gap shows a trend of further expansion as the human capital for urban increases much faster in later periods.

One reason that results in the gap between rural and urban is the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another one is the education gap between the rural and urban population.

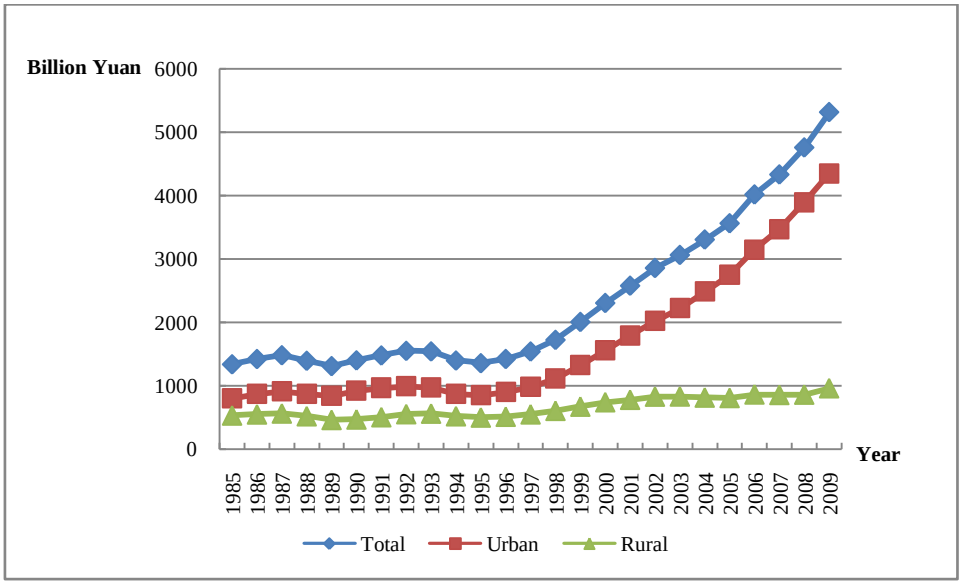


Figure LN-1.4 Real Human Capital by Region for Liaoning

Human capital index can reflect the trend of human capital directly. Table LN-1.3 reports a set of indices of real human capital classified by gender and region for Liaoning from 1985 to 2009. We calculate them using 1985 as the base year and setting its value at 100.

Table LN-1.3 Real Human Capital Index for Liaoning (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.17	105.55	107.39	108.25	103.07
1987	110.59	109.76	112.19	113.80	105.78
1988	104.11	102.33	107.52	108.32	97.81
1989	97.86	95.17	103.04	105.15	86.95
1990	104.58	101.04	111.41	115.35	88.46
1991	110.33	107.22	116.36	120.57	95.02
1992	115.76	113.06	120.99	123.73	103.83
1993	115.10	112.70	119.73	121.55	105.45
1994	104.39	102.79	107.50	108.79	97.81
1995	101.28	99.80	104.11	106.07	94.11

1996	106.25	104.66	109.32	112.83	96.39
1997	115.02	113.82	117.34	122.85	103.29
1998	128.63	126.79	132.13	138.72	113.53
1999	149.69	146.99	154.90	165.67	125.78
2000	171.94	169.10	177.41	194.24	138.57
2001	192.19	189.05	198.31	223.30	145.63
2002	212.96	208.78	220.99	251.74	154.93
2003	228.25	224.50	235.50	276.95	155.37
2004	246.34	242.15	254.38	309.24	152.19
2005	265.40	259.90	275.95	341.90	150.89
2006	299.17	293.97	309.19	391.33	161.23
2007	322.63	315.64	335.89	431.45	159.78
2008	354.30	345.07	372.06	483.61	160.76
2009	395.78	381.09	424.01	540.49	179.20

Figure LN-1.5 shows the index of real human capital. It's obvious that the human capital has been rising much more rapidly since 1996.

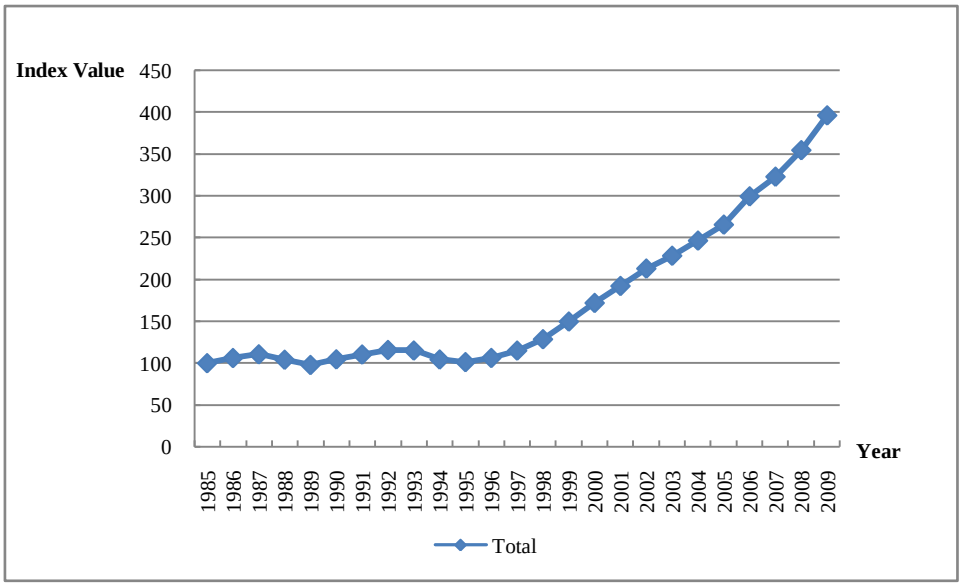


Figure LN-1.5 Human Capital Index for Liaoning

2. Human capital per capita

The increase in the human capital can be caused by population growth, demographic change (like retirement population scale), urbanization (like region migration), higher educational attainment, higher return to education, higher return to on-the-job training, etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital divided by non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it can exclude the influence of population factors to a large extent, thus it can serve as a better indicator of the average human capital.

Table LN-2.1 presents the trends of human capital per capita measured in nominal and real terms for Liaoning classified by gender. Human capital per capita for male remains higher than that for female. Real human capital per capita values for male increases from 48,144 Yuan to 195,536 Yuan, increasing by around 4 times; real human capital per capita for female increases from 30,115 Yuan to 121,299 Yuan, increasing by around 4 times. From 1985 to 2009, the annual growth rate is 5.84% for male, and 5.81% for female.

Table LN-2.1 Nominal and Real Human Capital Per Capita by Gender for Liaoning

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	39.95	48.14	30.11	39.95	48.14	30.11
1986	44.79	54.40	33.59	42.16	51.20	31.64
1987	50.09	61.21	37.30	43.56	53.19	32.52
1988	55.35	68.30	41.11	40.71	50.16	30.30
1989	61.20	76.08	45.45	38.02	47.22	28.27
1990	67.58	84.78	49.93	40.54	50.83	29.98
1991	74.92	93.79	55.26	42.66	53.36	31.50
1992	83.13	103.87	61.20	44.65	55.73	32.93
1993	94.42	117.53	69.61	44.23	55.04	32.66
1994	105.93	131.88	77.81	39.97	49.74	29.39
1995	118.84	147.40	87.58	38.60	47.86	28.47
1996	134.09	166.32	98.91	40.36	50.03	29.78
1997	149.62	186.13	109.57	43.56	54.18	31.92
1998	166.38	206.07	122.87	48.63	60.25	35.88
1999	191.48	235.45	143.06	56.52	69.58	42.12
2000	218.90	268.52	163.81	64.43	79.12	48.09
2001	248.16	306.82	184.06	72.72	90.02	53.81
2002	275.62	341.90	204.22	81.45	101.15	60.19
2003	305.94	382.95	223.83	88.42	110.80	64.58
2004	347.97	436.57	254.08	96.60	121.30	70.41
2005	387.90	486.33	284.19	105.75	132.66	77.38
2006	437.62	548.80	319.69	117.65	147.70	85.82
2007	498.33	621.15	367.43	127.21	158.68	93.66
2008	576.37	714.16	429.26	140.37	174.13	104.38
2009	655.73	802.19	499.13	159.66	195.54	121.30

Figure LN-2.1 shows that the real human capital per capita for male is higher than that for female for Liaoning from 1985 to 2009. Before 1997, different human capital all grow quite slowly, starting from 1997, both the growth of human capital for male and female accelerate, the gender gap, which has been fairly stable, then appears to be expanding.

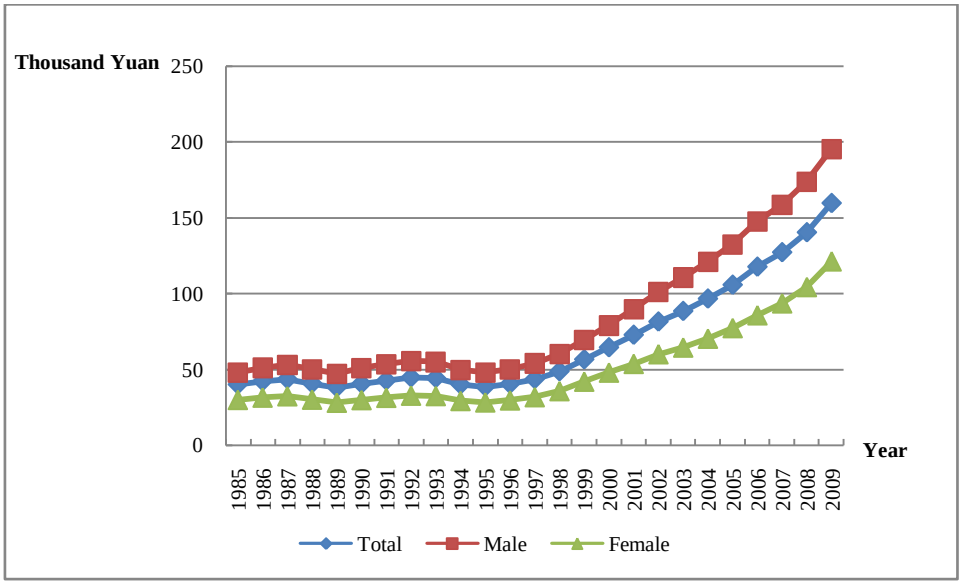


Figure LN-2.1 Human Capital Per Capita by Gender for Liaoning

Table LN-2.2 reports the results of human capital per capita measured in nominal and real terms for Liaoning classified by region. From 1986 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The real urban human capital per capita increases from 52,397 Yuan to 193,042 Yuan, the rural human capital per capita increases from 29,469 Yuan to 89,651 Yuan. The human capital per capita in urban areas grows much faster than the one for rural.

Table LN-2.2 Nominal and Real Human Capital Per Capita by Region for Liaoning

Year	Nominal human capital per capita (Thousands of 1985 Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	39.95	52.40	29.47	39.95	52.40	29.47
1986	44.79	58.53	32.54	42.16	54.70	30.99
1987	50.09	65.12	35.92	43.56	55.43	32.40

1988	55.35	71.59	39.25	40.71	50.95	30.54
1989	61.20	78.76	42.80	38.02	47.83	27.73
1990	67.58	86.69	46.46	40.54	51.06	28.92
1991	74.92	96.02	51.72	42.66	53.35	30.90
1992	83.13	106.60	57.50	44.65	54.79	33.57
1993	94.42	122.07	64.34	44.23	53.77	33.87
1994	105.93	137.58	71.71	39.97	48.06	31.23
1995	118.84	155.38	79.46	38.60	46.75	29.83
1996	134.09	176.22	87.71	40.36	49.00	30.83
1997	149.62	196.25	96.93	43.56	52.57	33.37
1998	166.38	218.09	106.45	48.63	58.54	37.13
1999	191.48	253.50	117.53	56.52	68.94	41.71
2000	218.90	291.18	130.16	64.43	79.18	46.33
2001	248.16	328.41	143.32	72.72	89.40	50.91
2002	275.62	360.14	157.86	81.45	99.12	56.81
2003	305.94	395.10	173.00	88.42	107.46	60.04
2004	347.97	446.16	190.61	96.60	118.04	62.23
2005	387.90	491.27	209.28	105.75	128.94	65.70
2006	437.62	546.60	234.91	117.65	141.90	72.58
2007	498.33	615.91	262.45	127.21	152.87	75.78
2008	576.37	706.97	294.42	140.37	168.07	80.59
2009	655.73	812.01	328.51	159.66	193.04	89.65

Figure LN-2.2 reflects the trend of human capital per capita measured in real terms and classified by region. As is shown in the graph, the size of the difference between urban and rural expanded rapidly after 1997, this is partly due to the long-term stagnant status in the rural area before 2002. Based on five education categories, the ratio of urban to rural increases from 1.78 in 1985 to 2.15 in 2009, which indicates a rising size of region gap of human capital per capita. From 1985 to 2009, the annual growth rate is 5.43% for the urban area, and 4.64% for the rural area.

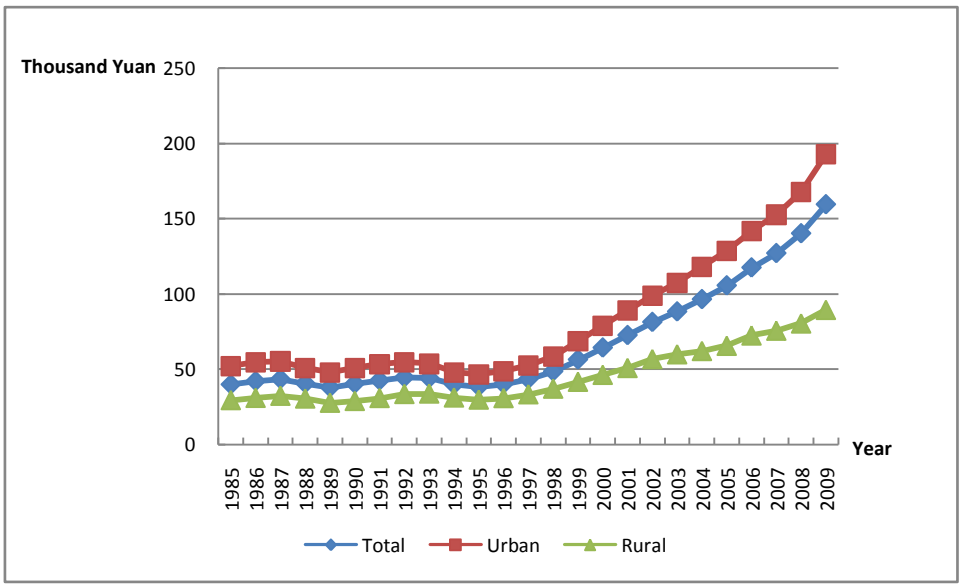


Figure LN-2.2 Real Human Capital Per Capita by Region for Liaoning

Figure LN-2.3 shows the human capital per capita index for Liaoning. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

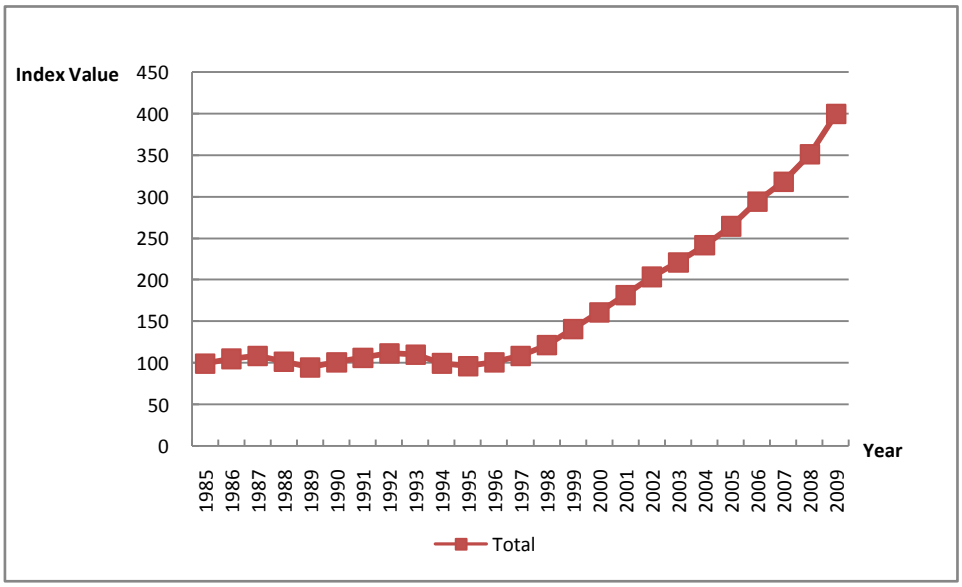


Figure LN-2.3 Real Human Capital Per Capita Index for Liaoning

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimated approach of labor force human capital is the same as that of human capital we illustrated above. Based on the income parameter for Liaoning and the discount rate valued at 4.58%，the labor force human capital for Liaoning is reported in Table LN-3.1. The real values in this table are calculated by using CPI as the deflator with respect to nominal values. We also calculate the ratio of labor force human capital measured in nominal terms to nominal GDP. The results are reported in the last column of Table LN-3.1.

Table LN-3.1 Labor Force Human Capital and Nominal GDP for Liaoning

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	697		697		52	13.43
1986	791		745		61	13.07
1987	901		783		72	12.52
1988	1,008		741		88	11.44
1989	1,123		697		100	11.19
1990	1,251		750		106	11.77
1991	1,402		798		120	11.68
1992	1,561		839		147	10.60
1993	1,739		817		201	8.65

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1994	1,925		729		246	7.82
1995	2,140		699		279	7.66
1996	2,423		734		316	7.67
1997	2,761		809		358	7.71
1998	3,147		926		388	8.11
1999	3,498		1,042		417	8.39
2000	4,091	3,988	1,211	1,183	467	8.76
2001	4,478	4,389	1,320	1,295	503	8.90
2002	4,878	4,810	1,450	1,430	546	8.94
2003	5,389	5,357	1,566	1,556	600	8.98
2004	5,840	5,849	1,630	1,631	667	8.75
2005	6,337	6,353	1,735	1,738	805	7.87
2006	7,260	7,280	1,961	1,965	930	7.80
2007	8,121	8,151	2,083	2,089	1,116	7.27
2008	9,092	9,135	2,225	2,234	1,367	6.65
2009	10,245	10,321	2,504	2,521	1,521	6.73

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends of labor force human capital in both real and nominal terms for Liaoning are presented in Figure LN-3.1. From 1985 to 2009, labor force human capital keeps rising.

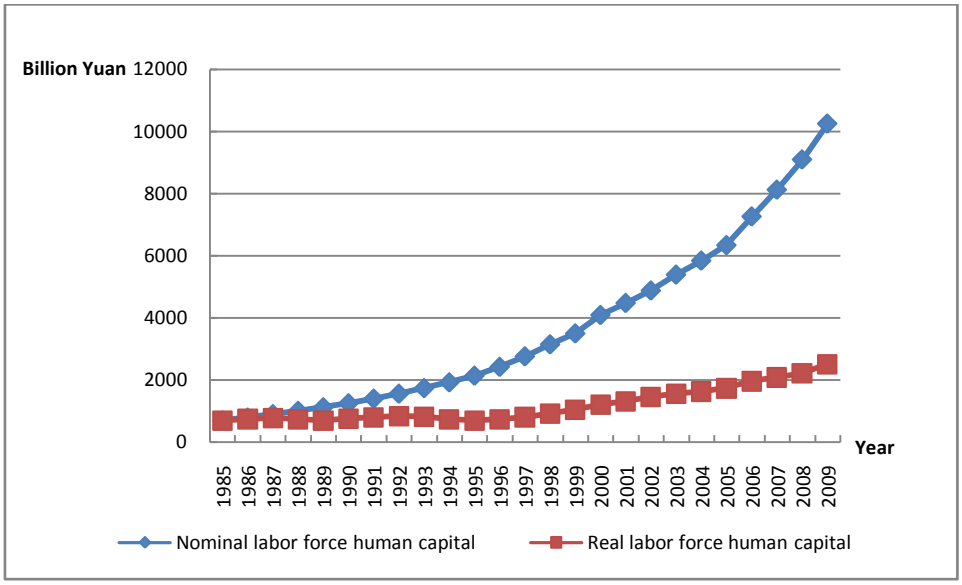


Figure LN-3.1 Nominal and Real Labor Force Human Capital for Liaoning

Similar to the analysis of human capital, in order to get a sense of the magnitude of the labor force human capital, we construct the ratio of labor force human capital measured in nominal terms to nominal GDP. It's shown in Figure LN-3.2. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of annual labor force human capital is much higher than that of GDP. The ratio of labor force human capital to GDP in Liaoning from 1985 to 2009 decreases as a whole, especially decreases at a considerable rate during 1990 to 1994. But from 1997 to 2003, the ratio increases slightly, and then decreases after that.

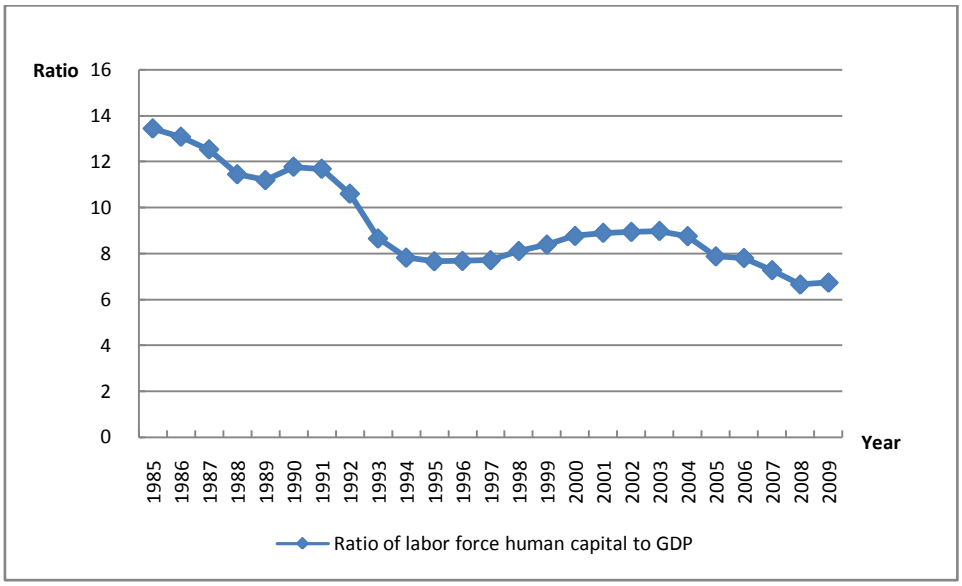


Figure LN-3.2 Ratio of Labor Force Human Capital to GDP for Liaoning

Table LN-3.2 shows the labor force human capital real values for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table LN-3.2 Nominal and Real Labor Force Human Capital by Region for Liaoning

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	697	400	297	697	400	297
1986	791	481	310	745	450	295
1987	901	580	320	783	494	289
1988	1,008	659	350	741	469	272
1989	1,123	747	376	697	454	244
1990	1,251	849	402	750	500	250
1991	1,402	946	456	798	526	272

1992	1,561	1,047	514	839	538	300
1993	1,739	1,155	584	817	509	308
1994	1,925	1,268	657	729	443	286
1995	2,140	1,397	743	699	420	279
1996	2,423	1,603	820	734	446	288
1997	2,761	1,850	911	809	496	314
1998	3,147	2,136	1,011	926	573	353
1999	3,498	2,409	1,089	1,042	655	387
2000	4,091	2,916	1,175	1,211	793	418
2001	4,478	3,263	1,215	1,320	888	432
2002	4,878	3,613	1,265	1,450	995	455
2003	5,389	4,046	1,343	1,566	1,100	466
2004	5,840	4,467	1,373	1,630	1,182	448
2005	6,337	4,938	1,399	1,735	1,296	439
2006	7,260	5,724	1,536	1,961	1,486	475
2007	8,121	6,473	1,648	2,083	1,607	476
2008	9,092	7,351	1,741	2,225	1,748	477
2009	10,245	8,310	1,935	2,504	1,976	528

Figure LN-3.3 shows the labor force human capital real values for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The rural labor force human capital grows quite slowly and much less than the one for urban.

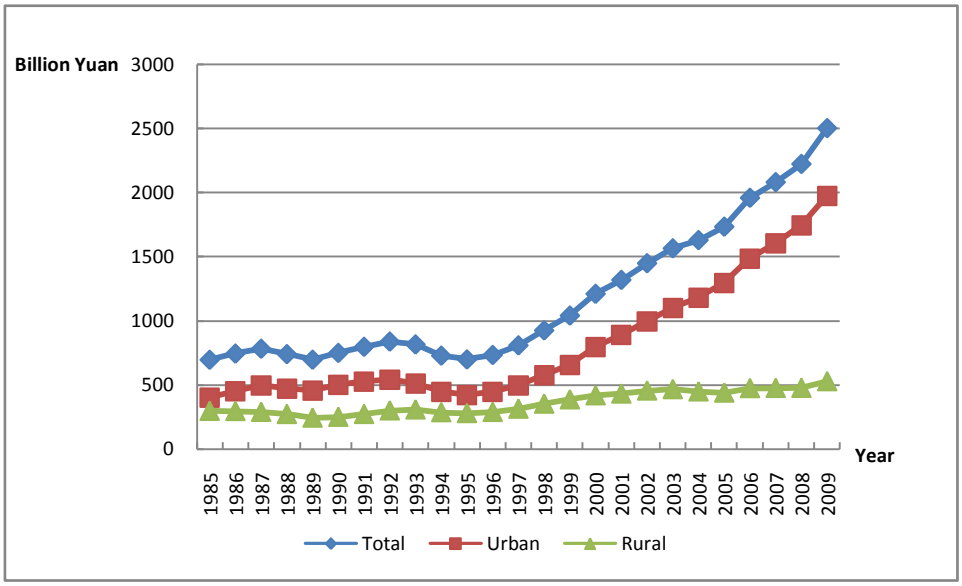


Figure LN-3.3 Real Labor force human capital by region for Liaoning

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table LN-3.3 reports the real average labor force human capital classified by gender. And the average labor force human capital for female is smaller than that for male. More specifically, the number for male is about 1.66 times that for female in 2009.

Table LN-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Liaoning

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	31.58	38.25	23.44	31.58	38.25	23.44
1986	35.63	43.65	26.07	33.55	41.08	24.57
1987	40.21	49.84	28.99	34.95	43.26	25.27
1988	43.68	54.57	31.77	32.09	40.01	23.43
1989	47.44	59.67	34.80	29.46	37.00	21.65
1990	51.68	65.60	38.02	31.00	39.30	22.84
1991	57.48	72.68	42.22	32.72	41.33	24.07
1992	63.67	80.21	46.75	34.20	43.01	25.17
1993	70.78	88.97	51.78	33.23	41.70	24.36
1994	78.30	98.02	57.33	29.65	37.09	21.74
1995	86.80	108.12	63.82	28.36	35.32	20.86
1996	96.98	121.40	70.61	29.38	36.75	21.39
1997	108.65	136.50	78.37	31.84	40.00	22.98
1998	121.64	153.33	87.23	35.79	45.12	25.66
1999	134.50	169.59	96.42	40.05	50.53	28.68
2000	155.01	195.29	110.70	45.89	57.84	32.75
2001	170.34	216.18	120.72	50.21	63.74	35.55
2002	186.78	238.97	131.15	55.52	71.04	38.97
2003	206.49	266.22	143.48	60.01	77.37	41.71
2004	227.80	295.00	157.41	63.60	82.34	43.96
2005	251.32	325.54	174.03	68.82	89.15	47.65
2006	282.33	365.04	195.21	76.24	98.59	52.71
2007	316.41	405.37	222.01	81.15	103.99	56.90
2008	356.21	450.94	255.19	87.16	110.42	62.36
2009	406.75	502.27	304.37	99.42	122.90	74.21

Table LN-3.4 reports the real average Labor force human capital classified by region separately. The average labor force human capital is much smaller in rural area than in urban area. The number for urban is about 1.74

times that for rural in 2009.

Table LN-3.4 Nominal and Real Average Labor Force Human Capital by Region for Liaoning

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	31.58	38.94	25.17	31.58	38.94	25.17
1986	35.63	44.27	27.34	33.55	41.38	26.04
1987	40.21	50.09	29.63	34.95	42.63	26.72
1988	43.68	54.06	32.07	32.09	38.48	24.96
1989	47.44	58.45	34.53	29.46	35.49	22.37
1990	51.68	63.49	37.11	31.00	37.39	23.10
1991	57.48	70.60	41.47	32.72	39.23	24.77
1992	63.67	78.20	46.21	34.20	40.20	26.98
1993	70.78	87.07	51.69	33.23	38.35	27.21
1994	78.30	96.34	57.50	29.65	33.65	25.04
1995	86.80	106.89	64.15	28.36	32.16	24.08
1996	96.98	119.94	70.59	29.38	33.35	24.81
1997	108.65	134.97	77.82	31.84	36.15	26.79
1998	121.64	151.65	85.80	35.79	40.70	29.93
1999	134.50	167.89	93.42	40.05	45.66	33.15
2000	155.01	196.28	101.85	45.89	53.38	36.25
2001	170.34	213.76	110.24	50.21	58.19	39.16
2002	186.78	232.06	119.96	55.52	63.87	43.17
2003	206.49	254.52	131.65	60.01	69.22	45.69
2004	227.80	279.21	142.47	63.60	73.87	46.51
2005	251.32	305.96	154.18	68.82	80.30	48.40
2006	282.33	339.25	173.67	76.24	88.07	53.66
2007	316.41	376.09	194.85	81.15	93.34	56.27
2008	356.21	419.17	217.97	87.16	99.65	59.66
2009	406.75	483.44	242.00	99.42	114.93	66.04

Chapter 9 Human capital for Shanghai

1. Total human capital

Human capital stocks of Shanghai are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table SH-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[50]

Table SH-1.1 Nominal and Real Human Capital, Nominal GDP for Shanghai

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	752		752		47	16.12
1986	864		813		49	17.61
1987	998		869		55	18.29
1988	1,142		828		65	17.62
1989	1,303		815		70	18.71
1990	1,487		874		78	19.02
1991	1,683		896		89	18.83
1992	1,903		921		111	17.08
1993	2,173		875		152	14.30
1994	2,440		793		199	12.26

[50] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	2,813		770		250	11.25
1996	3,199		802		296	10.82
1997	3,715		906		344	10.80
1998	4,288		1,046		380	11.28
1999	5,039		1,210		419	12.03
2000	6,076	6,297	1,424	1,476	477	12.73
2001	7,092	7,263	1,662	1,702	521	13.61
2002	8,039	8,243	1,875	1,922	574	14.00
2003	9,350	9,623	2,178	2,242	669	13.97
2004	11,055	11,437	2,521	2,608	807	13.70
2005	12,864	13,602	2,906	3,073	925	13.91
2006	14,739	16,278	3,290	3,633	1,057	13.94
2007	16,982	18,836	3,675	4,076	1,249	13.59
2008	19,807	22,088	4,051	4,518	1,407	14.08
2009	23,417	26,293	4,809	5,400	1,505	15.57

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure SH-1.1 graphs real and nominal human capital for Shanghai reported in Table SH-1.1. As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

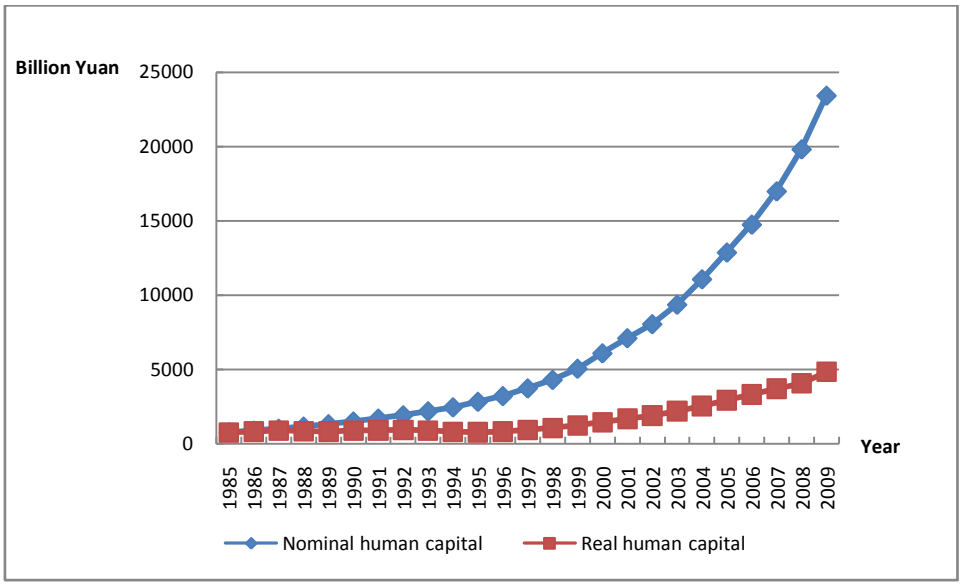


Figure SH-1.1 Nominal and Real Human Capital for Shanghai

In order to get a sense of the magnitude of the human capital in Shanghai, we also present the ratio of nominal human capital to nominal GDP in Table SH-1.1.[51] Similar to physical capital, human capital plays an important role in GDP growth, so that the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure SH-1.2, nominal human capital is substantially higher than nominal GDP for Shanghai. There are three stages in this series: Upwards from 1985 through 1991, downwards from 1992 through 1997, and finally an upward from 1998 through 2009.

[51] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

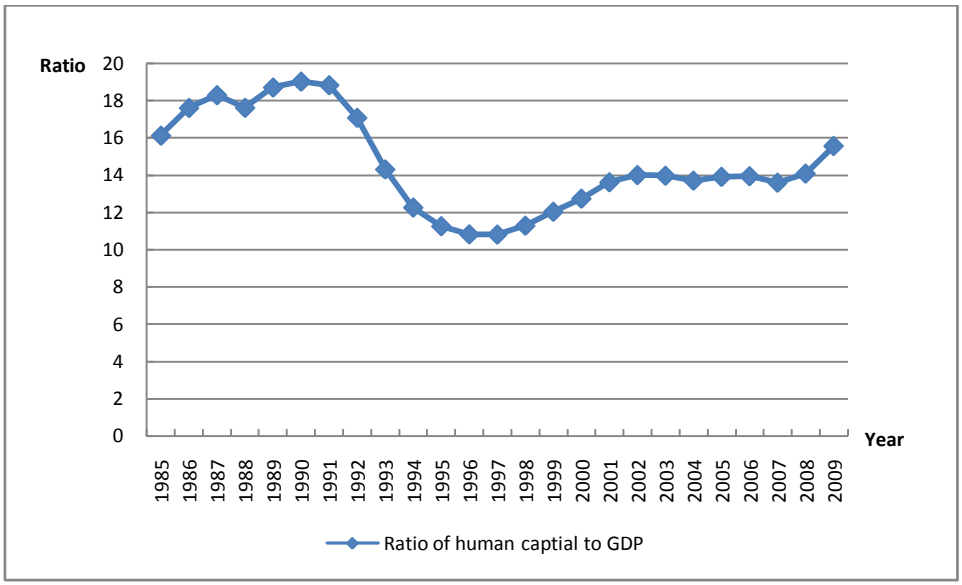


Figure SH-1.2 Ratio of Human Capital to GDP for Shanghai

In order to discuss the trend of human capital, we often need to adjust the nominal values into real values by using adjustment index. We calculate the real values here using CPI. Table SH-1.2 reports the human capital real values for Shanghai classified by gender. The results based on five education categories show that the human capital for Shanghai during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Shanghai increases from 0.752 trillion Yuan to 4.81 trillion Yuan (calculated by 1985 comparable price), it has increased by around 6 times, the annual growth rate of human capital over this period increases to 7.73%.[52]

From 1985 to 2009, human capital for male in Shanghai increases from 0.466 trillion Yuan to 3.183 trillion Yuan, the human capital for female in Shanghai increases from 0.286 trillion Yuan to 1.626 trillion Yuan. During the same period, the annual growth rates of human capital are 8.01% and 7.24% for male and female respectively. The gender gap in the estimated human capital increases from 0.18 trillion Yuan in 1985 to 1.557 trillion

[52] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

Yuan in 2009. In 2009, the male human capital is about 2 times the amount of that for female in Shanghai.

Table SH-1.2 Real Human Capital by Gender for Shanghai[53]

Billions of 1985 Yuan

Year	Total	Male	Female
1985	752	466	286
1986	813	502	311
1987	869	535	333
1988	828	517	310
1989	815	512	303
1990	874	552	322
1991	896	566	330
1992	921	582	339
1993	875	554	321
1994	793	504	289
1995	770	487	284
1996	802	512	290
1997	906	582	324
1998	1,046	673	373
1999	1,210	775	436
2000	1,424	913	511
2001	1,662	1,067	596
2002	1,875	1,203	672
2003	2,178	1,397	782
2004	2,521	1,617	904
2005	2,906	1,873	1,033
2006	3,290	2,131	1,158
2007	3,675	2,407	1,268
2008	4,051	2,669	1,383
2009	4,809	3,183	1,626

Figure SH-1.3 shows that the human capital real values for male and female for Shanghai exhibited a rising trend from 1985 to 2009. Before

[53] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

1997, different human capital all grow quite slowly, starting from 1997, both the growth of human capital for male and female accelerate, the gender gap, which has been fairly stable, then appears to be expanding.

The situation that the human capital for male is higher than that for female is consistent with that at the national level. One reason is that older retirement age for male, male has longer time to generate income from market, and thus ends up with a higher lifetime income relative to female.[54] Also the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

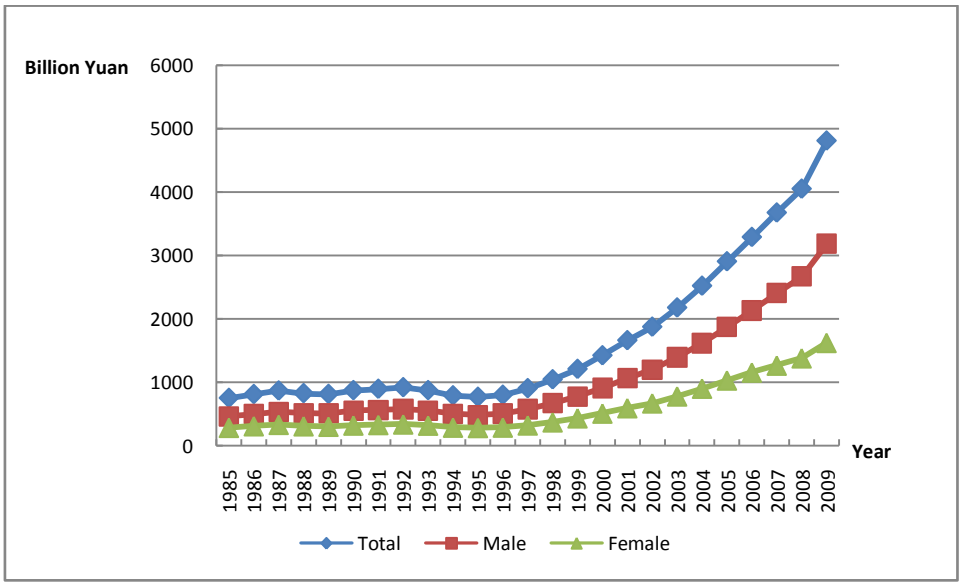


Figure SH-1.3 Real Human Capital by Gender for Shanghai

Human capital index can reflect the trend of human capital directly. Table SH-1.3 reports a set of indices of real human capital classified by gender for Shanghai from 1985 to 2009. We calculate them using 1985 as the base year and set its value at 100.

[54] To ensure the consistent of urban and rural, we define the working age for male and female in rural area as 60 and 55.

Table SH-1.3 Real Human Capital Index for Shanghai (1985=100)

Year	Total	Male	Female
1985	100	100	100
1986	108.06	107.57	108.84
1987	115.45	114.82	116.43
1988	110.01	110.94	108.49
1989	108.31	109.74	105.98
1990	116.23	118.43	112.65
1991	119.10	121.34	115.45
1992	122.40	124.75	118.56
1993	116.28	118.83	112.13
1994	105.37	108.02	101.08
1995	102.35	104.35	99.09
1996	106.58	109.72	101.47
1997	120.39	124.75	113.28
1998	139.04	144.38	130.20
1999	160.84	166.13	152.39
2000	189.29	195.90	178.50
2001	220.92	228.87	208.21
2002	249.24	258.04	234.85
2003	289.51	299.66	273.23
2004	335.11	346.85	316.04
2005	386.28	401.76	361.06
2006	437.33	457.10	404.75
2007	488.50	516.30	443.20
2008	538.48	572.50	483.40
2009	639.24	682.75	568.33

Figure SH-1.4 shows the index of real human capital. It's obvious that the human capital has been rising much more rapidly since 1996.

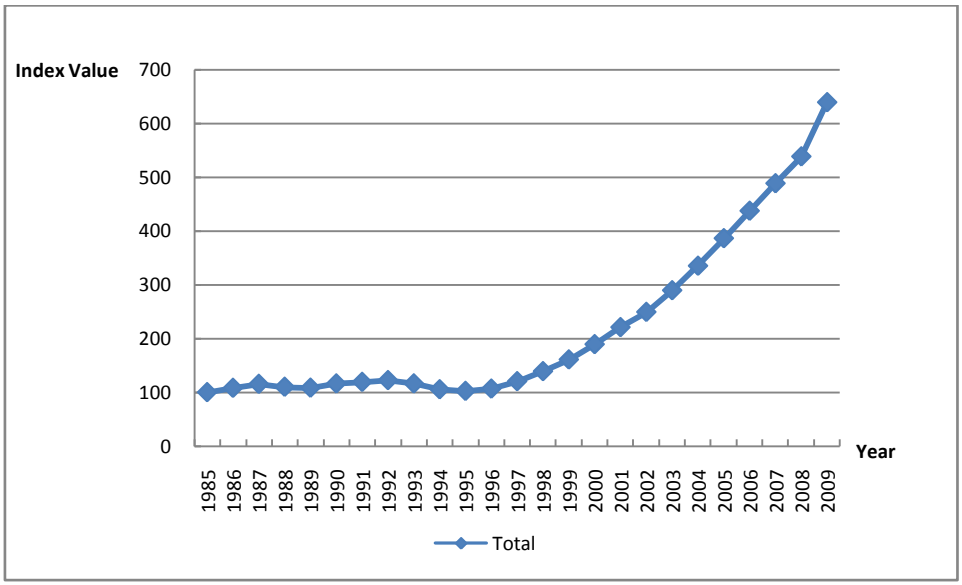


Figure SH-1.4 Real Human Capital Index for Shanghai

2. Human capital per capita

The increase in the human capital can be caused by population growth, demographic change (like retirement age), urbanization (like region migration), higher educational attainment, higher return to education, higher return to on-the-job training, etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital divided by non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it can exclude the population factor influence to a large extent, thus it can serve as a better indicator of the average human capital.

Table SH-2.1 presents the trends of human capital per capita measured in nominal and real terms for Shanghai classified by gender. Human capital per capita for male remains higher than that for female. Real human capital per capita for male increases from 86,286 Yuan to 533,811 Yuan, increasing by around 6 times; human capital per capita real values for female increases

from 58,116 Yuan to 314,275 Yuan, increasing by around 5 times. From 1985 to 2009, the annual growth rate is 7.59% for male, and 7.03% for female.

Table SH-2.1 Nominal and Real Human Capital Per Capita by Gender for Shanghai

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	72.86	86.29	58.12	72.86	86.29	58.12
1986	83.00	97.97	66.59	78.07	92.17	62.64
1987	95.03	112.04	76.41	82.71	97.49	66.49
1988	107.95	127.68	85.86	78.23	92.51	62.23
1989	122.24	143.80	97.62	76.44	89.90	61.03
1990	139.60	163.48	111.62	82.09	96.15	65.64
1991	157.76	185.89	125.38	83.99	98.93	66.73
1992	178.76	211.88	140.98	86.50	102.52	68.22
1993	204.48	244.22	159.64	82.32	98.33	64.26
1994	230.37	277.75	177.63	74.84	90.24	57.71
1995	266.35	321.66	205.80	72.91	88.01	56.32
1996	300.28	365.06	228.74	75.26	91.49	57.34
1997	347.91	423.14	263.60	84.82	103.19	64.28
1998	401.13	487.09	304.16	97.85	118.79	74.15
1999	468.32	563.27	360.41	112.46	135.31	86.58
2000	553.32	661.07	428.44	129.68	154.93	100.41
2001	643.61	770.78	497.00	150.83	180.71	116.47
2002	727.19	873.35	559.42	169.61	203.73	130.47
2003	845.09	1,017.68	648.74	196.86	237.15	151.11
2004	997.52	1,204.17	762.56	227.37	274.63	173.90
2005	1,157.83	1,404.71	878.90	261.64	317.37	198.45
2006	1,327.77	1,618.02	998.07	296.36	361.05	222.73
2007	1,526.99	1,881.16	1,124.86	330.49	407.19	243.44
2008	1,776.48	2,192.36	1,300.50	363.28	448.38	266.03
2009	2,102.98	2,599.46	1,530.21	431.82	533.81	314.27

Figure SH-2.1 shows that the real human capital per capita for male is higher than that for female of Shanghai from 1985 to 2009. Before 1997, different human capital all grow quite slowly, starting from 1997, both the growth of human capital for male and female accelerate, the gender gap which has been fairly stable, then appears to be expanding.

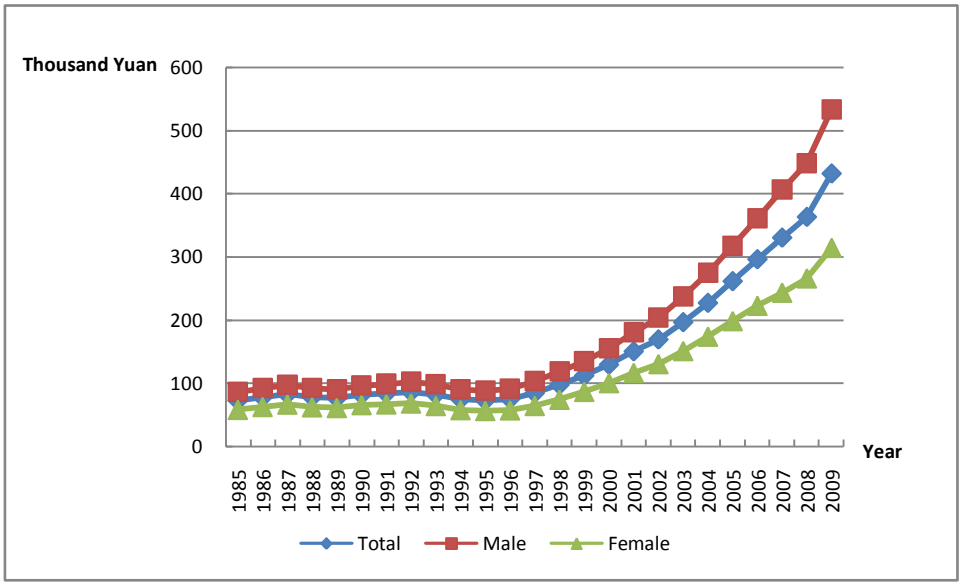


Figure SH-2.1 Real Human Capital Per Capita by Gender for Shanghai

Figure SH-2.2 shows the human capital per capita index for Shanghai. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

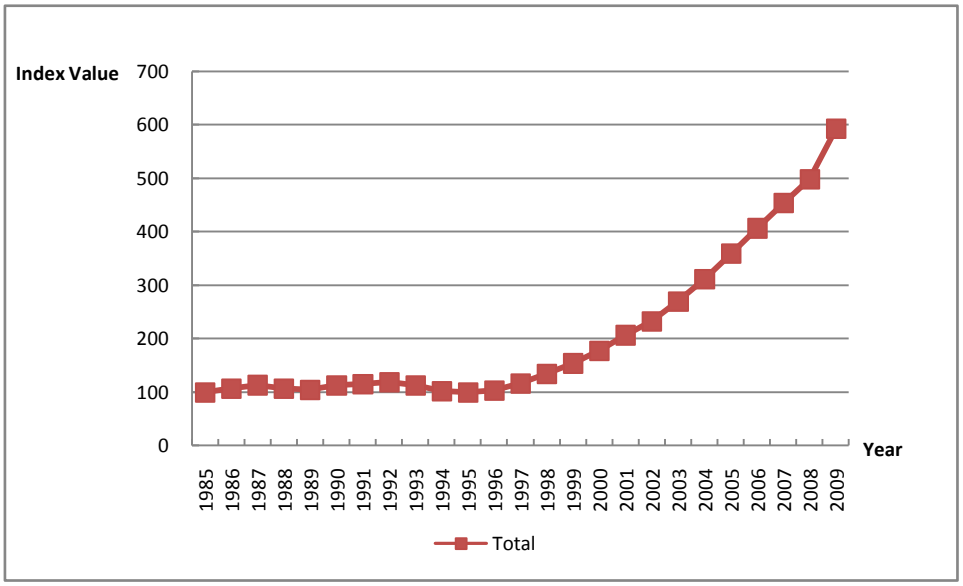


Figure SH-2.2 Human Capital Per Capita Index for Shanghai

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimated approach of labor force human capital is the same as that of human capital we illustrated above. Based on the income parameter for Shanghai and the discount rate valued at 4.58%，the labor force human capital for Shanghai is reported in Table SH-3.1. The real values in this table are calculated by using CPI as the deflator with respect to nominal values. We also calculate the ratio of labor force human capital measured in nominal terms to nominal GDP. The results are reported in the last column of Table SH-3.1.

Table SH-3.1 Labor Force Human Capital and Nominal GDP for Shanghai

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	396		396		47	8.48
1986	446		419		49	9.08
1987	502		437		55	9.21
1988	576		418		65	8.89
1989	653		408		70	9.37
1990	733		431		78	9.38
1991	810		431		89	9.06
1992	904		438		111	8.11
1993	1,019		410		152	6.71
1994	1,128		367		199	5.67
1995	1,251		342		250	5.01
1996	1,430		358		296	4.84
1997	1,684		411		344	4.90
1998	2,006		489		380	5.28
1999	2,358		566		419	5.63
2000	2,788	2,752	653	645	477	5.84
2001	3,252	3,134	762	735	521	6.24
2002	3,719	3,637	867	848	574	6.48
2003	4,345	4,327	1,012	1,008	669	6.49
2004	5,003	5,089	1,141	1,161	807	6.20
2005	5,909	6,025	1,335	1,361	925	6.39
2006	6,721	6,869	1,500	1,533	1,057	6.36
2007	7,727	7,914	1,672	1,712	1,249	6.18
2008	8,911	9,145	1,823	1,871	1,407	6.33
2009	10,247	10,547	2,105	2,166	1,505	6.81

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends of labor force human capital in both real and nominal terms for Shanghai are presented in Figure SH-3.1. From 1985 to 2009, nominal labor force human capital keeps rising.

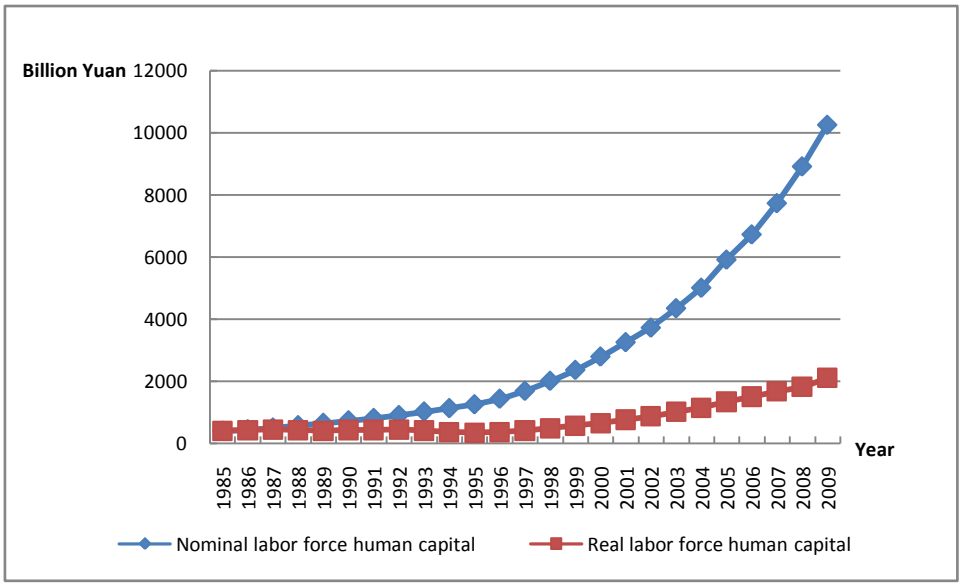


Figure SH-3.1 Nominal and Real Labor Force Human Capital for Shanghai

Similar to the analysis of human capital, in order to get a sense of the magnitude of the labor force human capital, we construct the ratio of labor force human capital measured in nominal terms to nominal GDP. It's shown in Figure SH-3.2. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of annual labor force human capital is much higher than that of GDP. There is an increase from 1985 to 1987, the ratio of labor force human capital to GDP in Shanghai from 1990 to 1996 decreases at a considerable rate, after 1996, the ratio increases slightly.

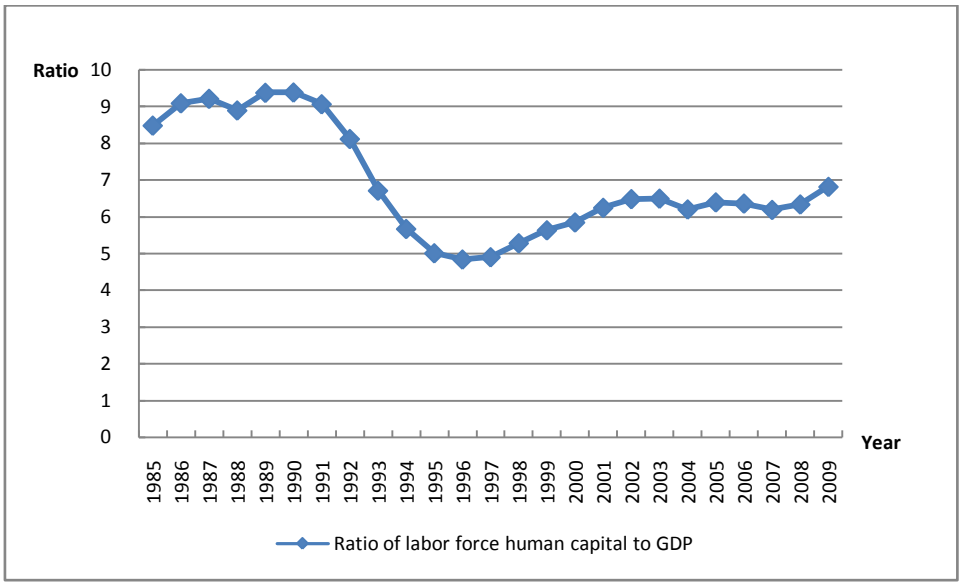


Figure SH-3.2 Ratio of Labor Force Human Capital to GDP for Shanghai

3.2 Average Labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table SH-3.2 reports the real average labor force human capital classified by gender. And the average labor force human capital for female is smaller than that for male. More specifically, the real value for male is about 1.71 times that for female in 2009.

Table SH-3.2 Nominal and Real Average Labor Force Human Capital by Gender for Shanghai

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	53.20	63.00	42.57	53.20	63.00	42.57
1986	59.52	70.87	47.17	55.98	66.69	44.39
1987	66.66	79.67	52.49	58.01	69.33	45.67
1988	75.81	90.69	59.14	54.93	65.69	42.85
1989	85.23	101.91	65.97	53.28	63.71	41.25
1990	95.88	114.67	73.53	56.38	67.43	43.24
1991	106.34	127.86	81.17	56.60	68.05	43.22
1992	118.96	143.96	90.15	57.56	69.66	43.63
1993	134.25	163.95	100.48	54.03	66.01	40.47
1994	149.72	184.47	110.97	48.66	59.94	36.05
1995	166.53	206.26	122.93	45.58	56.45	33.65
1996	189.68	235.69	138.64	47.54	59.07	34.75
1997	219.36	273.81	158.03	53.49	66.77	38.54
1998	254.93	318.27	182.61	62.14	77.62	44.53
1999	292.72	364.68	209.30	70.30	87.61	50.27
2000	333.73	414.59	239.11	78.21	97.15	56.05
2001	387.46	482.63	276.45	90.79	113.10	64.76
2002	441.95	550.99	315.69	103.07	128.49	73.63
2003	512.11	638.96	366.21	119.28	148.83	85.33
2004	588.47	735.41	420.06	134.21	167.70	95.80
2005	685.59	854.60	492.79	154.89	193.06	111.33
2006	779.07	973.21	557.25	173.87	217.24	124.38
2007	894.83	1,116.08	640.81	193.63	241.37	138.63
2008	1,034.42	1,285.23	744.94	211.62	262.81	152.36
2009	1,205.81	1,493.07	871.19	247.63	306.62	178.94

Chapter 10 Human capital for Jiangsu

1. Total human capital

Human capital stocks of Jiangsu are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table JS-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[55]

Table JS-1.1 Nominal and Real Human Capital, Nominal GDP for Jiangsu

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	2,862		2,862		65	43.91
1986	3,211		2,994		74	43.10
1987	3,604		3,093		92	39.07
1988	4,116		2,900		121	34.05
1989	4,723		2,828		132	35.73
1990	5,587		3,243		142	39.44
1991	6,343		3,534		160	39.61
1992	7,174		3,762		214	33.59
1993	8,181		3,634		300	27.29
1994	9,249		3,331		406	22.80
1995	10,453		3,240		516	20.28
1996	12,023		3,416		600	20.02
1997	14,237		3,944		668	21.31
1998	16,824		4,652		720	23.37

[55] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

1999	19,737		5,487		770	25.64
2000	22,630	22,834	6,240	6,288	855	26.46
2001	25,616	25,860	7,001	7,058	946	27.09
2002	29,148	29,412	8,020	8,086	1,061	27.48
2003	33,818	34,195	9,183	9,278	1,244	27.18
2004	38,500	38,990	10,040	10,160	1,500	25.66
2005	43,200	43,790	11,016	11,155	1,860	23.23
2006	48,970	49,700	12,267	12,439	2,174	22.52
2007	55,810	56,730	13,384	13,591	2,602	21.45
2008	63,440	64,560	14,430	14,667	3,098	20.48
2009	71,800	73,170	16,397	16,700	3,446	20.84

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure JS-1.1 graphs real and nominal human capital for Jiangsu reported in Table JS-1.1. As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

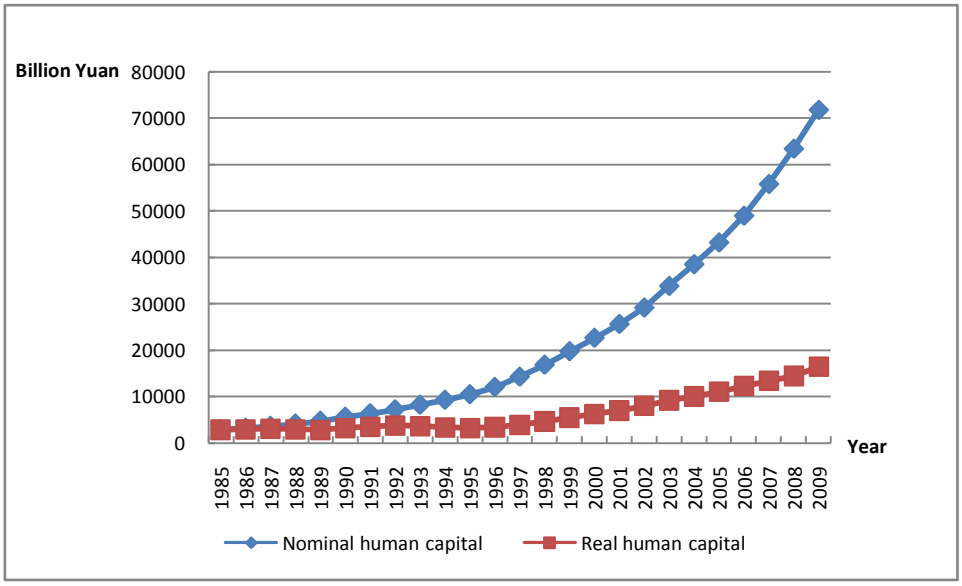


Figure JS-1.1 Nominal and Real Human Capital for Jiangsu

In order to get a sense of the magnitude of the human capital in Jiangsu, we also present the ratio of nominal human capital to nominal GDP in Table JS-1.1.[56] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure JS-1.2, nominal human capital is substantially higher than nominal GDP for Jiangsu. At the same time, the ratio of human capital to GDP in Jiangsu from 1991 to 1996 decreases at a considerable rate, after 1996, the ratio increases slowly and decreases again after 2001.

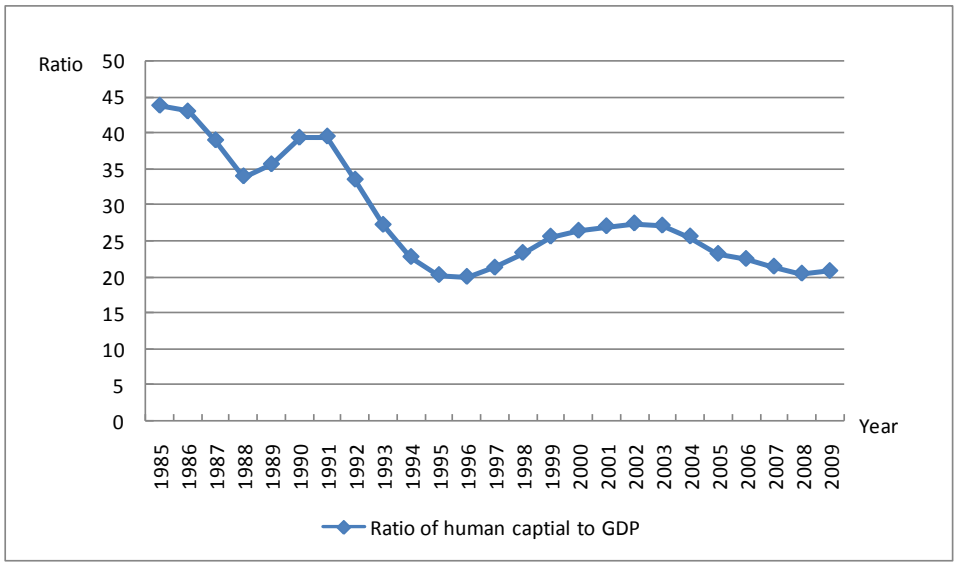


Figure JS-1.2 Ratio of Human Capital to GDP for Jiangsu

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table JS-1.2 shows real human capital for Jiangsu by gender and region. The results based on five education categories show that

[56] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

the human capital for Jiangsu during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Jiangsu increases from 2.9 trillion Yuan to 16.4 trillion Yuan (based on 1985), which has increased by 5 times, The annual growth rate of human capital over this period increased by 7.2%.[57]

From 1985 to 2009, male human capital in Jiangsu increases from 1.747 trillion Yuan to 10.954 trillion Yuan, the human capital for female in Jiangsu increases from 1.115 trillion Yuan to 5.448 trillion Yuan. During the same period, the annual growth rates of human capital are 7.6% and 6.6 % for male and female respectively. The gender gap in the estimated human capital increases from 0.632 trillion Yuan in 1985 to 5.506 trillion Yuan in 2009. In 2009, the male human capital is about 2 times the amount of that for female in Jiangsu.

From 1985 to 2009, rural human capital in Jiangsu increases from 2.015 trillion Yuan to 4.127 trillion Yuan, the urban human capital in Jiangsu increases from 0.847 trillion Yuan to 12.27 trillion Yuan. During the same period, the annual growth rates of human capital are 0.3% and 11.1 % for rural and urban areas respectively. The region gap in the estimated human capital increases from -1.168 trillion Yuan in 1985 to 8.143 trillion Yuan in 2009. In 2009, the urban human capital is about 3 times the amount of rural human capital in Jiangsu.

[57] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

Table JS-1.2 Real Human Capital by Gender and Region for Jiangsu[58]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	2,862	1,747	1,115	847	2,015
1986	2,994	1,856	1,138	974	2,020
1987	3,093	1,928	1,165	991	2,102
1988	2,900	1,818	1,082	982	1,918
1989	2,828	1,772	1,057	1022	1,806
1990	3,243	2,041	1,202	1,214	2,029
1991	3,534	2,228	1,307	1,377	2,157
1992	3,762	2,379	1,383	1,493	2,269
1993	3,634	2,315	1,319	1,485	2,149
1994	3,331	2,124	1,206	1,382	1,949
1995	3,240	2,061	1,179	1,428	1,812
1996	3,416	2,170	1,246	1,547	1,869
1997	3,944	2,538	1,406	1,979	1,965
1998	4,652	2,983	1,669	2,495	2,157
1999	5,487	3,521	1,966	3,177	2,310
2000	6,240	4,058	2,182	3,885	2,355
2001	7,001	4,552	2,447	4,486	2,515
2002	8,020	5,241	2,780	5,330	2,690
2003	9,183	6,007	3,176	6,307	2,876
2004	10,040	6,583	3,457	7,022	3,018
2005	11,016	7,225	3,791	7,834	3,182
2006	12,267	8,098	4,169	8,885	3,382
2007	13,384	8,866	4,518	9,872	3,512
2008	14,430	9,582	4,847	10,800	3,630
2009	16,397	10,954	5,448	12,270	4,127

Figure JS-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason why real human capital for male is higher than that for female is the earlier

[58] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

retirement age for women (age 55 for women vs. age 60 for men based on China Labor Law). Accordingly, men have a longer time to generate income in the market. Another reason is higher educational attainment for men. Moreover, the male-female income gap has been enlarging. The results based on six education categories show similar trends.

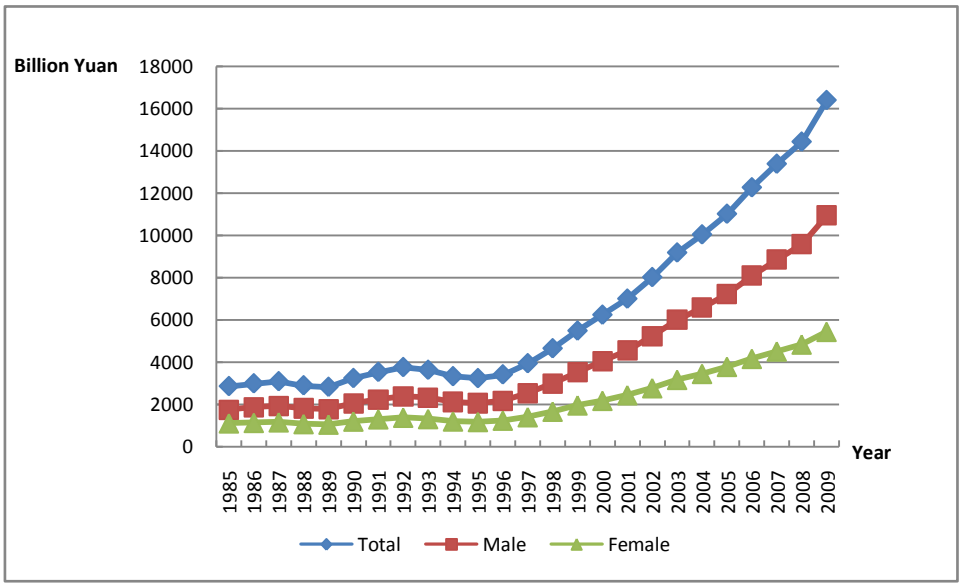


Figure JS-1.3 Real Human Capital by Gender for Jiangsu

Figure JS-1.4 shows the real human capital for urban and rural separately. Before 1997, the rural human capital is larger than the urban human capital. Since 1996, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly, the urban human capital surpasses the rural human capital in 1997, and the region gap has the trend of expanding.

There are several reasons for such a trend. First, in the early years, the rural population is significantly larger than the urban population, and thus has larger amount of human capital. This change in the later years is, to a large extent, a result of the rapid urbanization during the course of economic

transition as well as a large scale rural-urban migration. Another reason is the increased education gap between the urban and rural population in the last two decades. Urban areas usually have a larger proportion of educated population than rural areas.

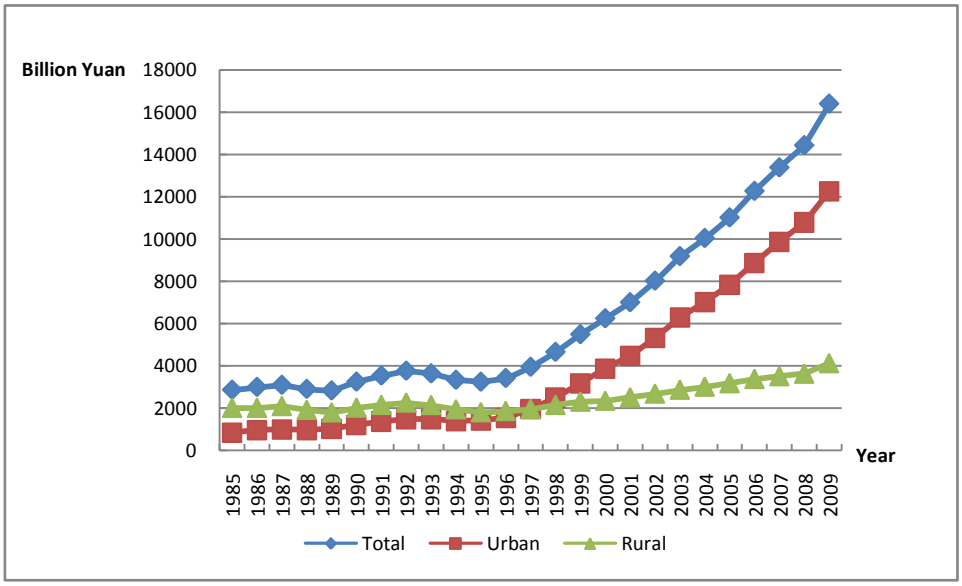


Figure JS-1.4 Real Human Capital by Region for Jiangsu

Finally we calculate real human capital indices using 1985 as the base-line year. The results for each group are reported in Table JS-1.3.

Table JS-1.3 Real Human Capital Index for Jiangsu (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	104.61	106.22	102.10	114.97	100.25
1987	108.05	110.38	104.49	116.94	104.32
1988	101.33	104.06	97.03	115.96	95.19
1989	98.81	101.43	94.83	120.66	89.63
1990	113.31	116.85	107.80	143.33	100.69
1991	123.48	127.55	117.22	162.57	107.05
1992	131.45	136.18	124.09	176.27	112.61

1993	126.97	132.51	118.34	175.32	106.65
1994	116.39	121.57	108.20	163.16	96.72
1995	113.21	117.96	105.78	168.60	89.93
1996	119.36	124.19	111.74	182.64	92.75
1997	137.81	145.28	126.17	233.65	97.52
1998	162.54	170.75	149.72	294.57	107.05
1999	191.72	201.55	176.33	375.09	114.64
2000	218.03	232.28	195.74	458.68	116.87
2001	244.62	260.56	219.53	529.63	124.81
2002	280.22	300.00	249.43	629.28	133.50
2003	320.86	343.85	284.89	744.63	142.73
2004	350.80	376.82	310.13	829.04	149.78
2005	384.91	413.57	340.09	924.91	157.92
2006	428.62	463.54	374.00	1,049.00	167.84
2007	467.65	507.50	405.31	1,165.53	174.29
2008	504.19	548.48	434.83	1,275.09	180.15
2009	572.92	627.02	488.74	1,448.64	204.81

Figure JS-1.5 shows the index of real total human capital for Jiangsu. Before 1997 the index grows quite steadily, but it accelerates after that year.

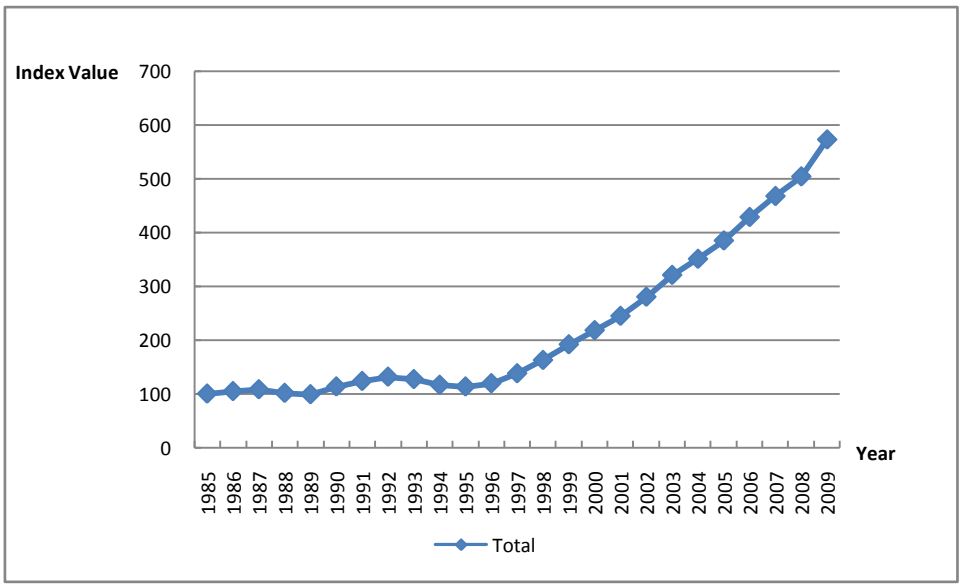


Figure JS-1.5 Real Human Capital Index for Jiangsu

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table JS-2.1 shows the human capital per capita by gender for Jiangsu. Based on the five education categories, real human capital per capita for male increases from 59,670 Yuan to 333,949 Yuan, increasing by around 5 times; real human capital per capita for female increases from 42,606 Yuan to 184,067 Yuan, increases by around 3 times. From 1985 to 2009, the annual growth rate is 7.1% for male, and 6.0% for female.

Table JS-2.1 Nominal and Real Human Capital Per Capita by Gender for Jiangsu

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	**Male**	**Female**	**Total**	**Male**	**Female**
1985	51.62	59.67	42.61	51.62	59.67	42.61
1986	57.70	67.55	46.64	53.80	62.99	43.46
1987	64.35	75.65	51.56	55.22	64.92	44.28
1988	72.46	85.71	57.49	51.06	60.34	40.54
1989	81.97	97.07	65.04	49.08	58.15	38.95
1990	93.52	111.36	73.48	54.28	64.64	42.67
1991	105.10	125.95	81.91	58.56	70.13	45.72
1992	118.03	142.31	91.22	61.89	74.51	47.94

1993	134.20	163.44	102.02	59.61	72.48	45.45
1994	151.42	185.52	114.29	54.53	66.68	41.26
1995	170.66	209.89	128.57	52.90	64.98	39.92
1996	195.46	240.06	147.59	55.53	68.14	41.98
1997	230.71	285.20	171.44	63.91	78.94	47.58
1998	271.86	335.19	203.25	75.17	92.68	56.20
1999	318.58	391.60	238.91	88.57	108.92	66.34
2000	359.78	446.05	264.73	99.21	123.01	72.95
2001	407.42	507.00	298.39	111.35	138.62	81.48
2002	463.53	580.19	336.35	127.54	159.69	92.48
2003	537.00	673.65	388.09	145.82	183.10	105.27
2004	611.74	770.02	439.99	159.53	200.92	114.58
2005	687.37	869.15	491.75	175.28	221.75	125.25
2006	776.60	985.79	550.33	194.54	247.07	137.68
2007	884.96	1,124.27	624.69	212.22	269.78	149.59
2008	1,007.66	1,277.69	711.21	229.20	290.83	161.51
2009	1,150.66	1,460.92	807.02	262.78	333.95	184.07

Figure JS-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for male and female. Real human capital per capita for male and female both exhibit an accelerated growth after 1996. The male-female gap has been widening.

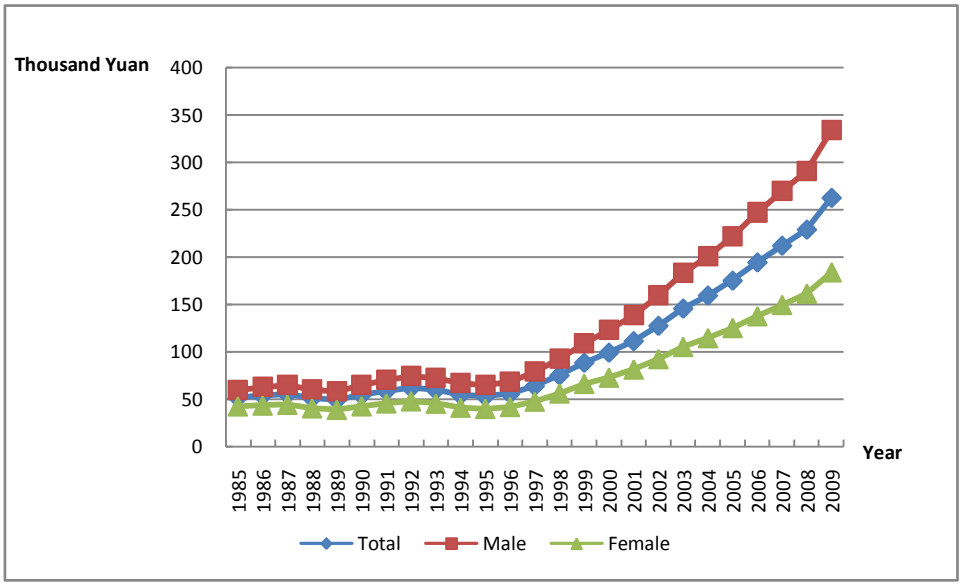


Figure JS-2.1 Real Human Capital Per Capita by Gender for Jiangsu

Table JS-2.2 reports the results of human capital per capita measured in nominal and real terms for Jiangsu by region. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The urban human capital per capita increases from 93,075 Yuan to 368,957 Yuan, the rural human capital per capita increases from 43,448 Yuan to 141,234 Yuan. The human capital per capita in urban areas grows much faster than the one for rural.

Table JS-2.2 Nominal and Real Human Capital Per Capita by Region for Jiangsu

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	51.62	93.07	43.45	51.62	93.07	43.45
1986	57.70	101.85	47.86	53.80	95.72	44.44
1987	64.35	112.63	53.42	55.22	95.80	46.05
1988	72.46	125.24	59.37	51.06	86.89	42.16
1989	81.97	140.72	66.21	49.08	84.16	39.68
1990	93.52	163.42	74.41	54.28	94.52	43.29
1991	105.10	182.69	81.67	58.56	98.11	46.63
1992	118.03	208.54	89.80	61.89	102.93	49.11
1993	134.20	242.25	99.70	59.61	100.74	46.49
1994	151.42	274.11	110.69	54.53	90.97	42.41
1995	170.66	297.91	122.67	52.90	85.09	40.76
1996	195.46	353.83	135.27	55.53	91.21	41.97
1997	230.71	416.01	150.14	63.91	105.86	45.67
1998	271.86	494.33	166.87	75.17	125.79	51.27
1999	318.58	558.31	186.16	88.57	144.09	57.89
2000	359.78	567.79	208.61	99.21	146.53	64.81
2001	407.42	640.91	229.95	111.35	165.24	70.38
2002	463.53	715.63	255.46	127.54	187.50	78.03

2003	537.00	818.72	286.37	145.82	212.60	86.44
2004	611.74	923.30	321.83	159.53	231.20	92.87
2005	687.37	1,010.60	361.05	175.28	248.10	101.74
2006	776.60	1,130.06	400.46	194.54	273.06	110.96
2007	884.96	1,274.02	447.08	212.22	295.72	118.21
2008	1,007.66	1,438.49	500.52	229.20	317.39	125.32
2009	1,150.66	1,665.34	561.40	262.78	368.96	141.23

Figure JS-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, real human capital per capita for urban and rural both exhibit an accelerated growth after 1996. Based on the five education categories, the ratio of urban to rural increases from 2.14 in 1985 to 2.6 in 2009, the absolute size of the region gap has been on the rise. From 1985 to 2009, the annual growth rate is 5.7% for the urban area, and 4.9% for the rural area.

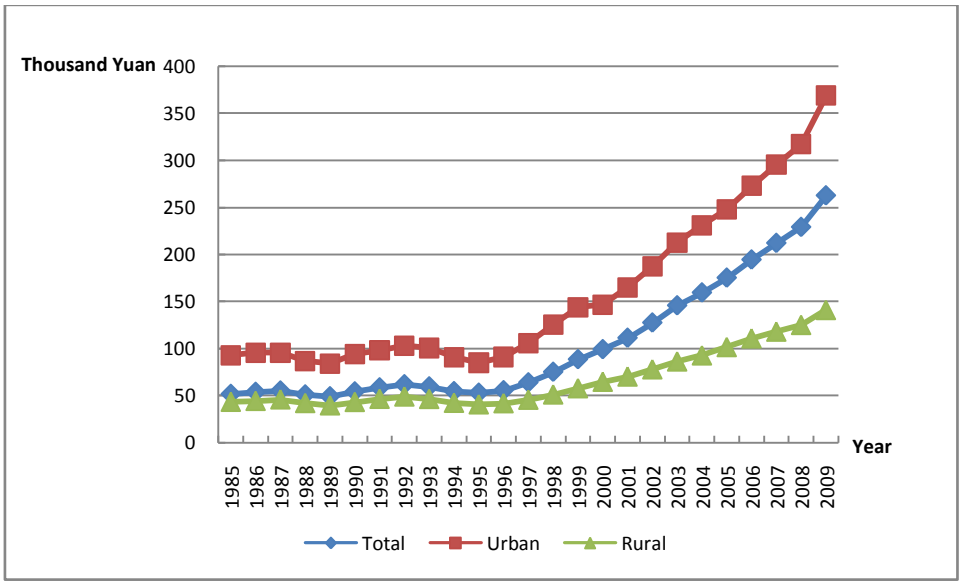


Figure JS-2.2 Real Human Capital Per Capita by Region for Jiangsu

Figure JS-2.3 shows the real human capital per capita index for Jiangsu. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

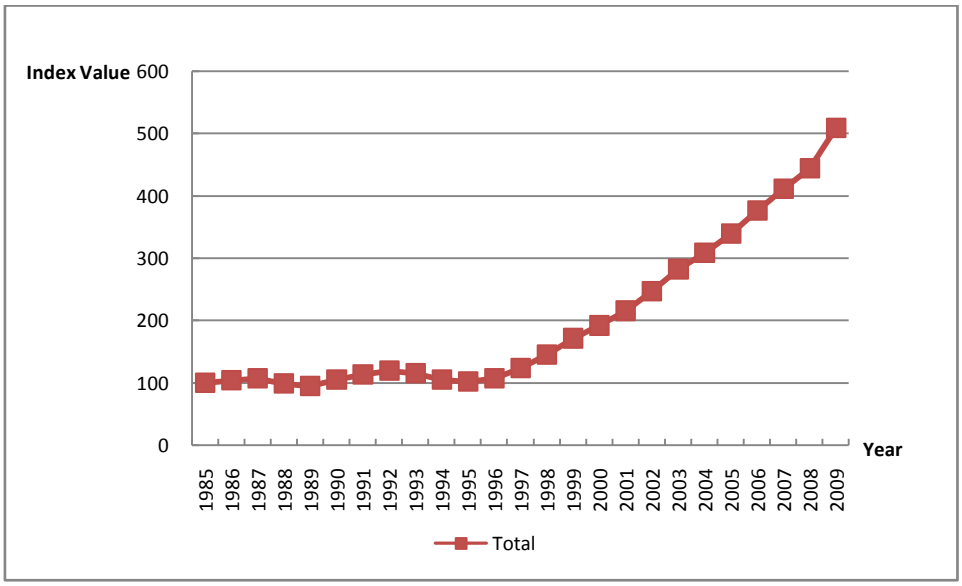


Figure JS-2.3 Real Human Capital Per Capita Index for Jiangsu

3. Labor force human capital

3.1 Total Labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table JS-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table JS-3.1 Labor Force Human Capital and Nominal GDP for Jiangsu

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,305		1,305		65	20.02
1986	1,508		1,404		74	20.24
1987	1,731		1,488		92	18.77
1988	2,019		1,425		121	16.70
1989	2,316		1,387		132	17.52
1990	2,619		1,520		142	18.49
1991	2,969		1,660		160	18.54
1992	3,328		1,757		214	15.58
1993	3,709		1,663		300	12.37
1994	4,111		1,497		406	10.13
1995	4,643		1,452		516	9.01
1996	5,028		1,452		600	8.37
1997	5,730		1,617		668	8.58
1998	6,550		1,852		720	9.10
1999	7,548		2,143		770	9.81
2000	9,477	9,361	2,640	2,608	855	11.08
2001	10,219	10,125	2,828	2,801	946	10.81
2002	11,255	11,194	3,133	3,115	1,061	10.61
2003	12,454	12,482	3,427	3,432	1,244	10.01
2004	13,818	13,797	3,647	3,639	1,500	9.21
2005	15,547	15,512	4,003	3,994	1,860	8.36
2006	17,792	17,770	4,506	4,498	2,174	8.18
2007	20,208	20,182	4,902	4,893	2,602	7.77
2008	23,005	22,979	5,295	5,287	3,098	7.43
2009	25,589	25,564	5,928	5,920	3,446	7.43

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure JS-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keep on increasing.

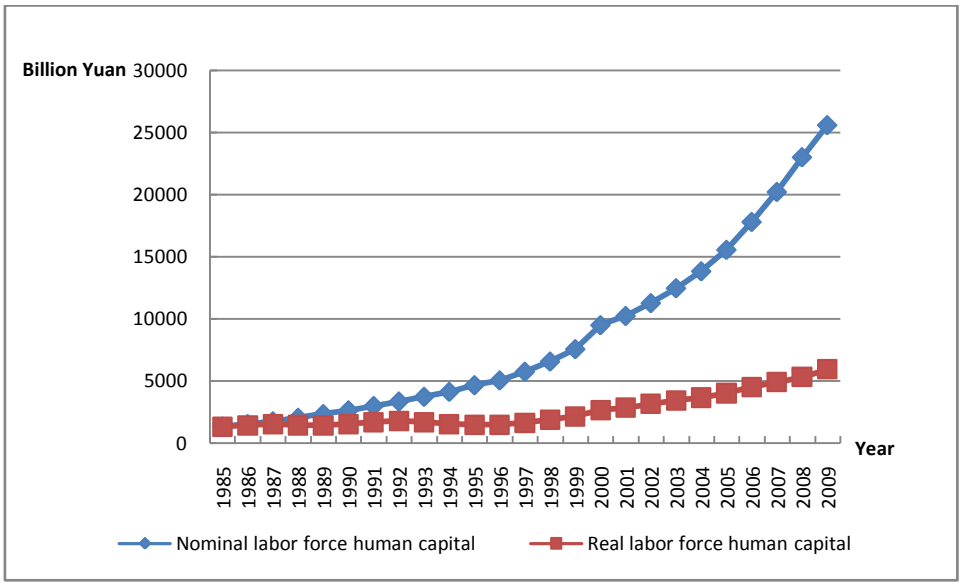


Figure JS-3.1 Nominal and Real Labor Force Human Capital for Jiangsu

We also calculate the ratio of labor force human capital to GDP. The results are reported in the last column of Table JS-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure JS-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio remains between 5 and 20 and generally shows a decreasing trend.

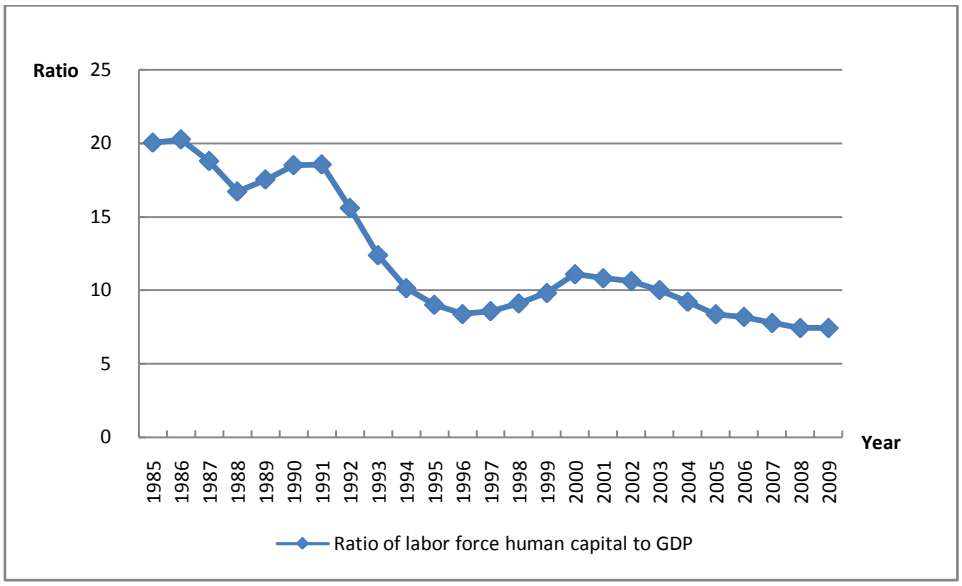


Figure JS-3.2 Ratio of Labor Force Human Capital to GDP for Jiangsu

Table JS-3.2 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real human capital. Urban real labor force human capital surpasses its rural counterpart for the first time in 2000. The region gap has increased from -0.741 trillion Yuan in 1985 to around 1.6 trillion Yuan in 2009.

Table JS-3.2 Nominal and Real Labor Force Human Capital by Region for Jiangsu

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	1,305	282	1,023	1,305	282	1,023
1986	1,508	367	1,141	1,404	345	1,059
1987	1,731	432	1,299	1,488	368	1,120
1988	2,019	559	1,460	1,425	388	1,037

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1989	2,316	705	1,611	1,387	421	965
1990	2,619	827	1,792	1,520	478	1,042
1991	2,969	1,019	1,950	1,660	547	1,113
1992	3,328	1,173	2,155	1,757	579	1,178
1993	3,709	1,316	2,393	1,663	547	1,116
1994	4,111	1,516	2,595	1,497	503	994
1995	4,643	1,943	2,700	1,452	555	897
1996	5,028	2,060	2,968	1,452	531	921
1997	5,730	2,540	3,190	1,617	646	970
1998	6,550	3,059	3,491	1,852	779	1,073
1999	7,548	3,877	3,671	2,143	1,001	1,142
2000	9,477	5,779	3,698	2,640	1,491	1,149
2001	10,219	6,228	3,991	2,828	1,606	1,222
2002	11,255	7,023	4,232	3,133	1,840	1,293
2003	12,454	7,880	4,574	3,427	2,046	1,381
2004	13,818	8,926	4,892	3,647	2,235	1,412
2005	15,547	10,400	5,147	4,003	2,552	1,451
2006	17,792	11,960	5,832	4,506	2,890	1,616
2007	20,208	13,660	6,548	4,902	3,171	1,731
2008	23,005	15,640	7,365	5,295	3,451	1,844
2009	25,589	16,980	8,609	5,928	3,762	2,166

Figure JS-3.3 shows real labor force human capital for urban and rural respectively. The pattern of labor force human capital is almost the same as that of real human capital. The urban labor force human capital surpasses the rural one in 2000 and has grown much faster ever since.

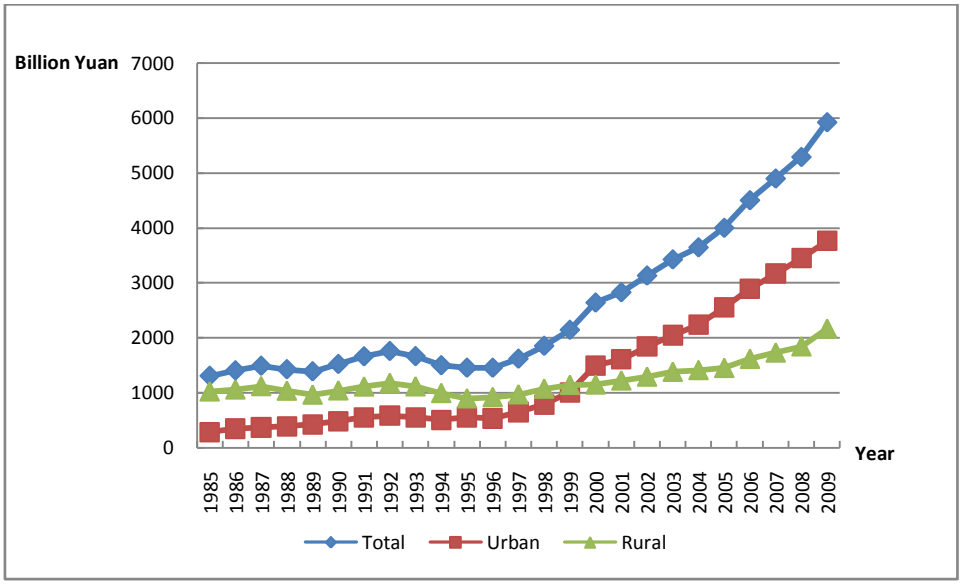


Figure JS-3.3 Real Labor Force Human Capital by Region for Jiangsu

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table JS-3.3 reports the real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female is smaller than that for male.

Table JS-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Jiangsu

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	36.43	42.09	30.19	36.43	42.09	30.19
1986	40.90	47.65	33.42	38.07	44.38	31.11
1987	45.63	53.44	36.96	39.21	45.91	31.77
1988	51.72	61.08	41.31	36.50	43.09	29.17
1989	58.41	69.45	46.06	34.98	41.60	27.58
1990	64.73	77.35	50.58	37.57	44.93	29.37
1991	72.13	86.96	55.75	40.33	48.59	31.24
1992	79.80	96.71	61.32	42.13	50.99	32.47
1993	88.67	108.22	67.62	39.76	48.45	30.40
1994	98.12	120.36	74.59	35.74	43.77	27.24
1995	110.60	136.26	83.95	34.59	42.57	26.30
1996	120.82	149.64	90.63	34.89	43.17	26.21
1997	137.16	171.89	100.23	38.70	48.41	28.37
1998	154.81	195.04	112.30	43.76	55.05	31.80
1999	176.08	222.69	126.34	49.99	63.13	35.93
2000	212.40	269.78	150.24	59.17	75.07	41.95
2001	231.10	295.70	161.95	63.95	81.76	44.88
2002	256.05	329.69	177.40	71.28	91.70	49.43
2003	283.69	366.28	196.10	78.06	100.76	53.97
2004	316.93	410.00	218.58	83.65	108.21	57.67
2005	357.40	465.27	244.74	92.02	119.85	62.98
2006	401.63	524.36	272.64	101.72	132.86	68.98
2007	451.75	590.35	305.07	109.58	143.26	73.91
2008	510.35	666.01	343.98	117.47	153.35	79.08
2009	572.82	747.67	383.81	132.70	173.32	88.81

Table JS-3.4 reports the real average labor force human capital by area. The real average labor force human capital is much smaller in rural area than in urban area.

Table JS-3.4 Nominal and Real Average Labor Force Human Capital by Region for Jiangsu

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	36.43	52.04	33.61	36.43	52.04	33.61
1986	40.90	58.48	37.32	38.07	54.97	34.65
1987	45.63	65.07	41.53	39.21	55.35	35.80
1988	51.72	74.18	46.39	36.50	51.47	32.94
1989	58.41	84.46	51.38	34.98	50.52	30.79
1990	64.73	94.38	56.56	37.57	54.59	32.91
1991	72.13	105.46	62.01	40.33	56.64	35.41
1992	79.80	118.43	67.92	42.13	58.46	37.14
1993	88.67	133.84	74.75	39.76	55.66	34.85
1994	98.12	150.10	81.47	35.74	49.82	31.21
1995	110.60	169.22	88.54	34.59	48.33	29.42
1996	120.82	185.32	97.41	34.89	47.77	30.22
1997	137.16	208.62	107.72	38.70	53.09	32.77
1998	154.81	233.35	119.49	43.76	59.38	36.71
1999	176.08	259.01	131.62	49.99	66.84	40.93
2000	212.40	302.11	145.36	59.17	77.97	45.16
2001	231.10	324.05	159.63	63.95	83.55	48.86
2002	256.05	352.96	175.72	71.28	92.48	53.68
2003	283.69	383.27	196.33	78.06	99.52	59.26
2004	316.93	424.37	217.40	83.65	106.27	62.73
2005	357.40	466.17	242.76	92.02	114.45	68.41
2006	401.63	516.09	276.57	101.72	124.70	76.63
2007	451.75	571.56	313.82	109.58	132.67	82.97
2008	510.35	638.70	357.24	117.47	140.92	89.44
2009	572.82	717.09	408.36	132.70	158.87	102.73

Chapter 11 Human capital for Anhui

1. Total human capital

Human capital stocks of Anhui are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table AH-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[59]

Table AH-1.1 Nominal and Real Human Capital, Nominal GDP for Anhui

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,019		1,019		33	30.78
1986	1,151		1,083		38	30.08
1987	1,312		1,135		44	29.66
1988	1,506		1,086		55	27.54
1989	1,720		1,054		62	27.91
1990	2,011		1,199		66	30.55
1991	2,283		1,294		66	34.40
1992	2,588		1,354		80	32.30
1993	2,949		1,341		104	28.43
1994	3,335		1,196		132	25.26
1995	3,767		1,180		181	20.80
1996	4,436		1,261		209	21.19

[59] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

1997	5,077		1,426		235	21.63
1998	5,746		1,611		254	22.60
1999	6,730		1,922		271	24.81
2000	7,961	7,951	2,255	2,251	290	27.43
2001	9,112	9,111	2,560	2,559	325	28.07
2002	10,363	10,371	2,939	2,941	352	29.44
2003	11,756	11,775	3,273	3,276	392	29.97
2004	13,373	13,400	3,558	3,564	476	28.10
2005	15,159	15,190	3,974	3,981	535	28.33
2006	17,526	17,572	4,535	4,546	611	28.67
2007	20,273	20,331	4,981	4,993	736	27.54
2008	23,386	23,459	5,405	5,422	885	26.42
2009	27,111	27,213	6,322	6,344	1,006	26.94

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure Anhui-1.1 shows the real and nominal human capital for Anhui reported in Table AH-1.1 As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

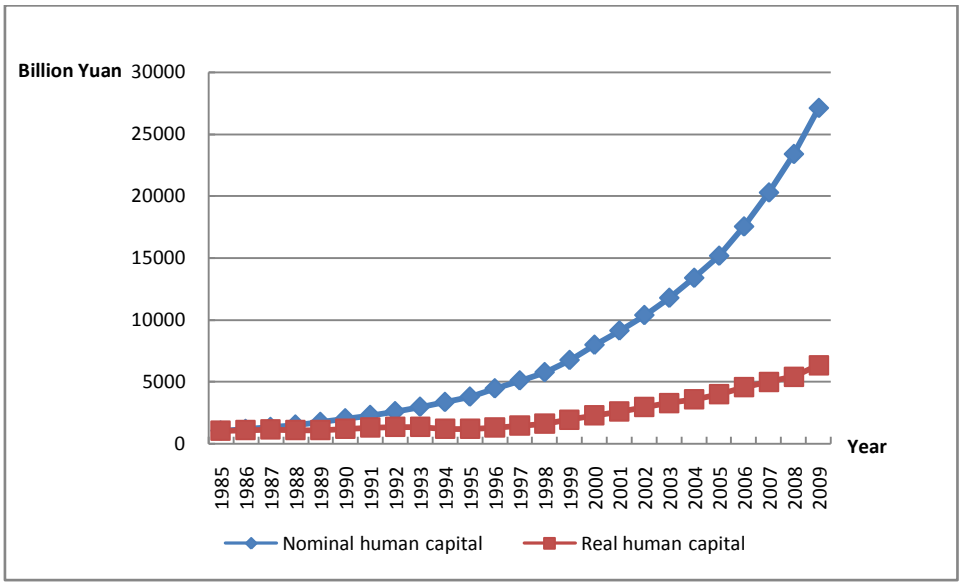


Figure AH-1.1 Nominal and Real Human Capital for Anhui

In order to get a sense of the magnitude of the human capital in Anhui Province, we also present the ratio of nominal human capital to nominal GDP in Table AH-1.1.[60] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure AH-1.2, nominal human capital is substantially higher than nominal GDP for Anhui. There is a decreasing trend during 1985 to 1995, although during 1989-1991 there is a short period rise. After 1995, the ratio increases slowly in a small scale.

[60] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

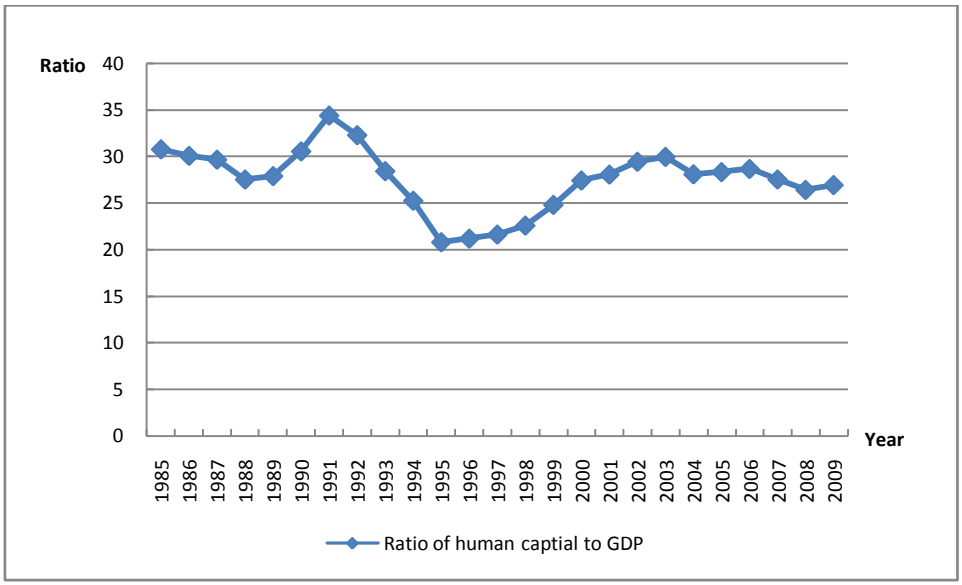


Figure AH-1.2 Ratio of Human Capital to GDP for Anhui

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table AH-1.2 shows real human capital for Anhui by gender and region. The results based on five education categories show that the human capital for Anhui Province during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Anhui Province increases from 1.019 trillion Yuan to 3.94 trillion Yuan (calculated by 1985 comparable price), the annual growth rate of human capital over this period increases to 7.6%.[61]

From 1985 to 2009, human capital for male in Anhui Province increases from 0.611 trillion Yuan to 4.07 trillion Yuan, the human capital for female in Anhui Province increases from 0.409 trillion Yuan to 2.252 trillion Yuan. During the same period, the annual growth rates of human capital are 7.9% and 7.1 % for male and female respectively. The gender gap in the estimated human capital increases from 0.202 trillion Yuan in 1985 to

[61] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

1.818 trillion Yuan in 2009. In 2009, the human capital for male is about 1.8 times the amount of that for female in Anhui Province.

From 1985 to 2009, rural human capital in Anhui Province increases from 0.659 trillion Yuan to 2.057 trillion Yuan, the urban human capital in Anhui Province increases from 0.324 trillion Yuan to 4.265 trillion Yuan. During the same period, the annual growth rates of human capital are 4.52% and 10.7 % for rural and urban areas respectively. The region gap in the estimated human capital increases from -0.371 trillion Yuan in 1985 to 0.22 trillion Yuan in 2009. In 2009, the urban human capital is about 2 times the amount of that for rural in Anhui Province.

Table AH-1.2 Real Human Capital by Gender and Region for Anhui[62]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	1,019	611	409	324	695
1986	1,083	650	433	352	732
1987	1,135	688	447	375	760
1988	1,086	663	424	362	724
1989	1,054	646	408	364	689
1990	1,199	737	462	424	775
1991	1,294	797	496	452	841
1992	1,354	838	516	477	877
1993	1,341	833	507	484	857
1994	1,196	746	450	436	761
1995	1,180	736	444	429	751
1996	1,261	789	473	519	743
1997	1,426	895	530	598	828
1998	1,611	1,017	594	689	922
1999	1,922	1,222	701	916	1,006
2000	2,255	1,439	815	1,124	1,131

[62] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

2001	2,560	1,631	929	1,348	1,212
2002	2,939	1,872	1,067	1,611	1,328
2003	3,273	2,088	1,184	1,858	1,415
2004	3,558	2,270	1,287	2,094	1,464
2005	3,974	2,532	1,442	2,415	1,559
2006	4,535	2,908	1,628	2,825	1,710
2007	4,981	3,197	1,784	3,177	1,804
2008	5,405	3,464	1,941	3,551	1,854
2009	6,322	4,070	2,252	4,265	2,057

Figure AH-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason why male real human capital is higher than female real human capital is the earlier retirement age for women (age 55 vs. age 60 for men based on China Labor Law). Accordingly, men have a longer time to generate income in the labor market. Another reason is higher educational attainment for men. Moreover, the male-female income gap has been on expanding. The results based on six education categories show the similar trends.

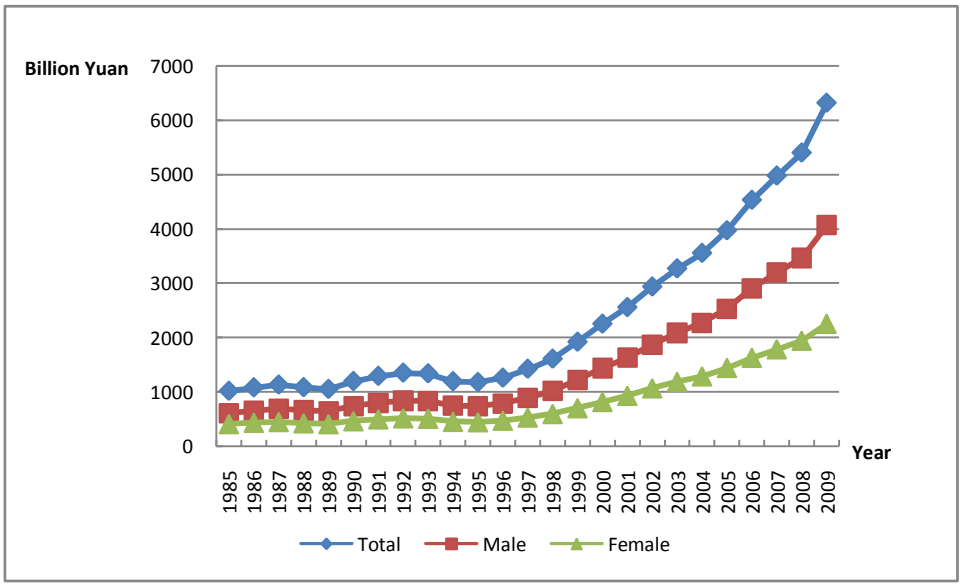


Figure AH-1.3 Real Human Capital by Gender for Anhui

Figure AH-1.4 shows the real human capital for urban and rural separately. As previously noted, before 2001, rural real human capital is larger than that in the urban area. Since 1997, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly, the urban human capital surpasses the rural human capital in 2001, and the region gap has the trend of expanding.

There are several reasons for such a trend. First, in the early years, the rural population is significantly larger than the urban population, and thus has larger amount of human capital. This change in the later years is, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the increased education gap between the urban and rural population. Urban areas usually have a larger proportion of educated population than rural areas.

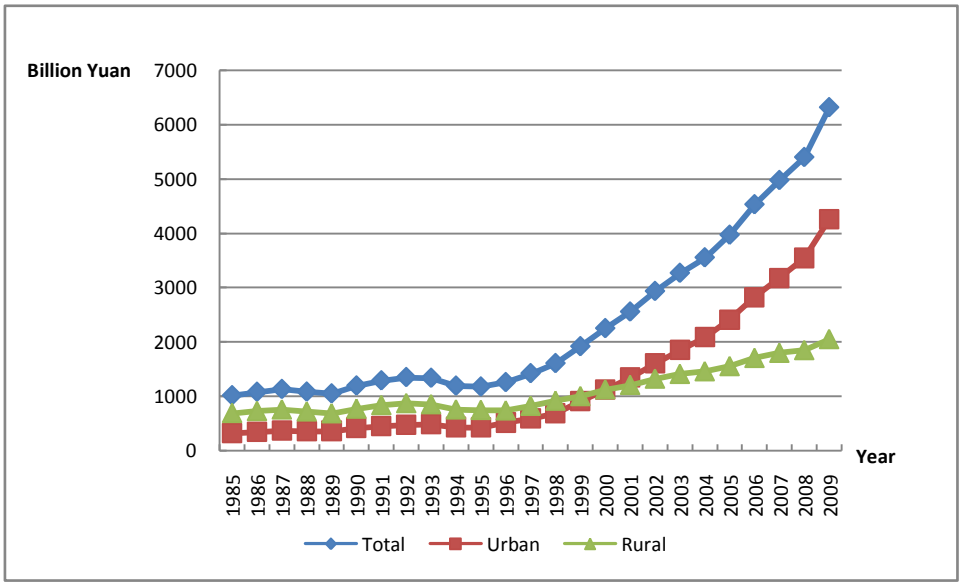


Figure AH-1.4 Real Human Capital by Region for Anhui

Finally we calculate real human capital indices using 1985 as the base-line year. The results for each group are reported in Table AH-1.3.

Table AH-1.3 Real Human Capital Index for Anhui (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.27	106.50	105.94	108.51	105.22
1987	111.31	112.59	109.37	115.55	109.34
1988	106.55	108.52	103.67	111.75	104.13
1989	103.35	105.75	99.78	112.34	99.17
1990	117.60	120.70	112.96	130.78	111.45
1991	126.90	130.59	121.40	139.51	121.02
1992	132.82	137.27	126.17	147.13	126.15
1993	131.51	136.46	124.12	149.23	123.25
1994	117.36	122.22	110.10	134.42	109.41
1995	115.74	120.49	108.66	132.29	108.03
1996	123.73	129.17	115.61	159.96	106.83
1997	139.86	146.61	129.75	184.45	119.06
1998	158.05	166.57	145.30	212.65	132.59
1999	188.57	200.05	171.50	282.63	144.71
2000	221.21	235.72	199.46	346.70	162.69
2001	251.13	267.13	227.23	415.79	174.34
2002	288.31	306.63	260.91	496.92	191.02
2003	321.07	341.93	289.73	573.10	203.54
2004	349.03	371.77	314.77	645.90	210.59
2005	389.84	414.69	352.67	744.91	224.25
2006	444.87	476.25	398.21	871.38	245.97
2007	488.62	523.58	436.42	979.95	259.49
2008	530.21	567.31	474.90	1,095.31	266.69
2009	620.17	666.56	550.95	1,315.55	295.89

Figure AH-1.5 shows the index of real total human capital for Anhui. Before 1997 the index grows quite steadily, but it accelerates after that year.

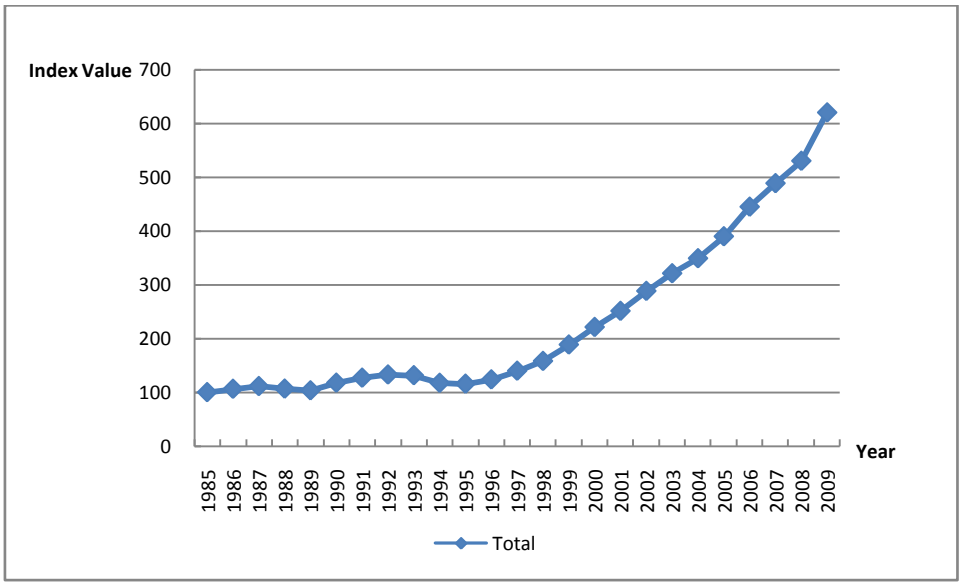


Figure AH-1.5 Real Human Capital Index for Anhui

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table AH-2.1 shows the human capital per capita by gender for Anhui. Based on the five education categories, real human capital per capita for male increases from 24,550 Yuan to 139,060 Yuan, by around 5 times; real human capital per capita for female increases from 18,400 Yuan to 84,850 Yuan, by around 4 times. From 1985 to 2009, the annual growth rate is 7.23% for male, and 6.35% for female.

Table AH-2.1 Nominal and Real Human Capital Per Capita by Gender for Anhui

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	21.69	24.55	18.48	21.69	24.55	18.48
1986	24.30	27.54	20.64	22.86	25.92	19.43
1987	27.36	31.28	22.93	23.65	27.04	19.83
1988	30.90	35.53	25.65	22.29	25.62	18.52
1989	34.84	40.13	28.83	21.35	24.58	17.66
1990	39.31	45.32	32.45	23.44	27.03	19.35
1991	44.16	51.18	36.19	25.02	28.98	20.52
1992	49.44	57.59	40.18	25.86	30.11	21.04
1993	56.14	65.65	45.34	25.52	29.83	20.63
1994	63.07	74.10	50.54	22.63	26.58	18.15
1995	70.77	83.54	56.43	22.17	26.15	17.70
1996	82.73	97.93	65.64	23.52	27.84	18.68
1997	93.88	111.66	73.96	26.36	31.33	20.79
1998	106.42	126.88	83.34	29.84	35.56	23.40
1999	124.42	149.30	96.44	35.54	42.63	27.56
2000	144.50	173.94	111.23	40.93	49.24	31.53
2001	165.38	199.84	126.92	46.46	56.13	35.67
2002	188.48	228.64	144.03	53.45	64.82	40.87
2003	214.83	261.68	163.27	59.81	72.81	45.47
2004	245.77	300.75	185.82	65.39	79.97	49.44
2005	279.02	343.44	209.84	73.15	90.00	55.03
2006	319.73	394.15	239.05	82.73	101.98	61.90
2007	367.07	451.76	274.84	90.19	110.98	67.52
2008	420.90	516.19	316.38	97.28	119.37	73.14
2009	485.75	596.38	363.88	113.27	139.06	84.85

Figure AH-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for male and female. Real human capital per capita for male and female both exhibit an accelerating growth after 1996. The male-female gap has been widening.

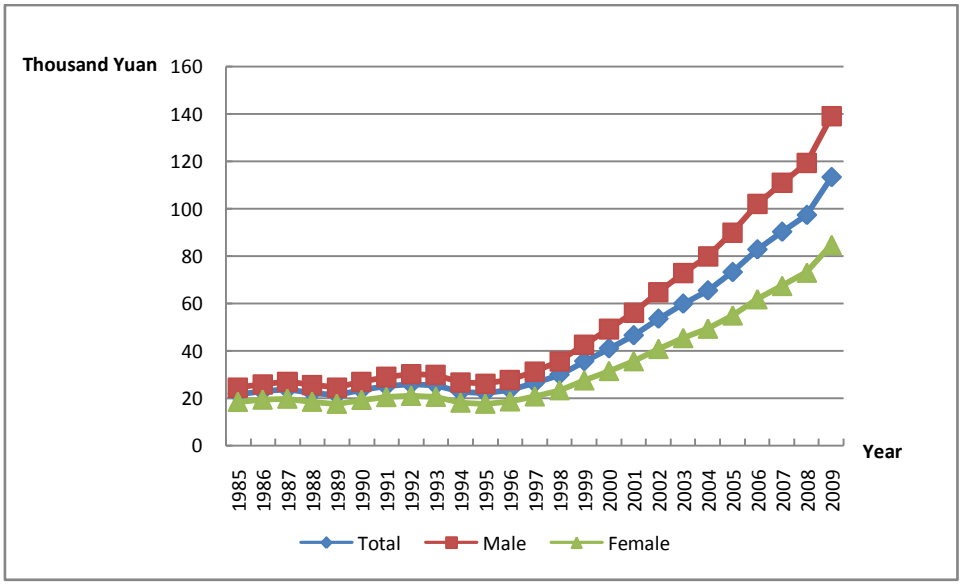


Figure AH-2.1 Real Human Capital Per Capita by Gender for Anhui

Table AH-2.2 reports the results of human capital per capita measured in nominal and real terms for Anhui Province by urban and rural separately. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The urban human capital per capita increases from 43,460 Yuan to 176,480 Yuan, the rural human capital per capita increases from 17,580 Yuan to 64,990 Yuan. The human capital per capita in urban areas grows much faster than the one for rural.

Table AH-2.2 Nominal and Real Human Capital Per Capita by Region for Anhui

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	21.69	43.46	17.58	21.69	43.46	17.58
1986	24.30	47.66	19.67	22.86	45.04	18.47
1987	27.36	53.25	22.04	23.65	45.80	19.11
1988	30.90	60.33	24.71	22.29	42.74	17.99
1989	34.84	67.80	27.66	21.35	41.51	16.95
1990	39.31	77.50	30.97	23.44	46.25	18.46
1991	44.16	87.58	34.59	25.02	48.66	19.80
1992	49.44	98.27	38.64	25.86	50.19	20.49
1993	56.14	112.12	43.42	25.52	50.06	19.95
1994	63.07	126.41	48.48	22.63	44.30	17.64
1995	70.77	141.45	54.33	22.17	42.77	17.38
1996	82.73	162.54	60.67	23.52	44.64	17.69
1997	93.88	186.11	67.90	26.36	50.15	19.67
1998	106.42	211.11	76.01	29.84	56.72	22.04
1999	124.42	233.58	85.20	35.54	64.30	25.20
2000	144.50	265.38	97.09	40.93	72.40	28.58
2001	165.38	302.27	107.57	46.46	82.47	31.26
2002	188.48	340.72	119.23	53.45	93.81	35.10
2003	214.83	384.84	132.41	59.81	104.08	38.33
2004	245.77	433.61	147.70	65.39	112.43	40.80
2005	279.02	478.84	165.79	73.15	122.93	44.94
2006	319.73	537.39	187.11	82.73	136.06	50.27
2007	367.07	603.35	211.77	90.19	145.07	54.08
2008	420.90	677.19	237.88	97.28	153.61	57.09
2009	485.75	769.33	269.21	113.27	176.48	64.99

Figure AH-2.2 shows trends in real human capital per capita in urban and rural areas. Real human capital per capita for urban and rural areas both exhibits an accelerating growth after 1996. Based on the five education categories, the ratio of urban to rural increases from 2.47 in 1985 to 2.72 in 2009 and the absolute size of the region gap has been on the rise. From 1985 to 2009, the annual growth rate is 5.8% for the urban area, and 5.4% for the rural area.

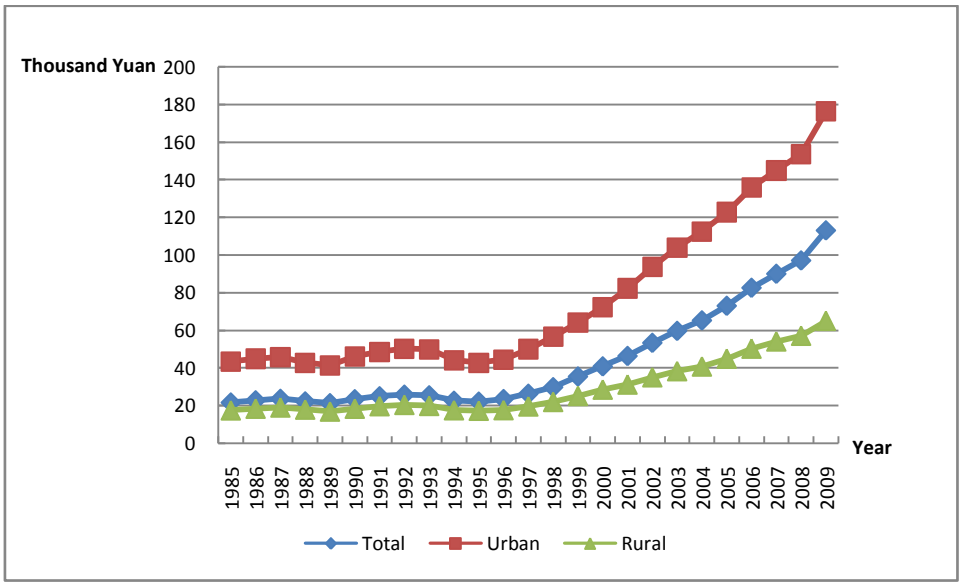


Figure AH-2.2 Real Human Capital Per Capita by Region for Anhui

Figure AH-2.3 shows the real human capital per capita index for Anhui Province. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

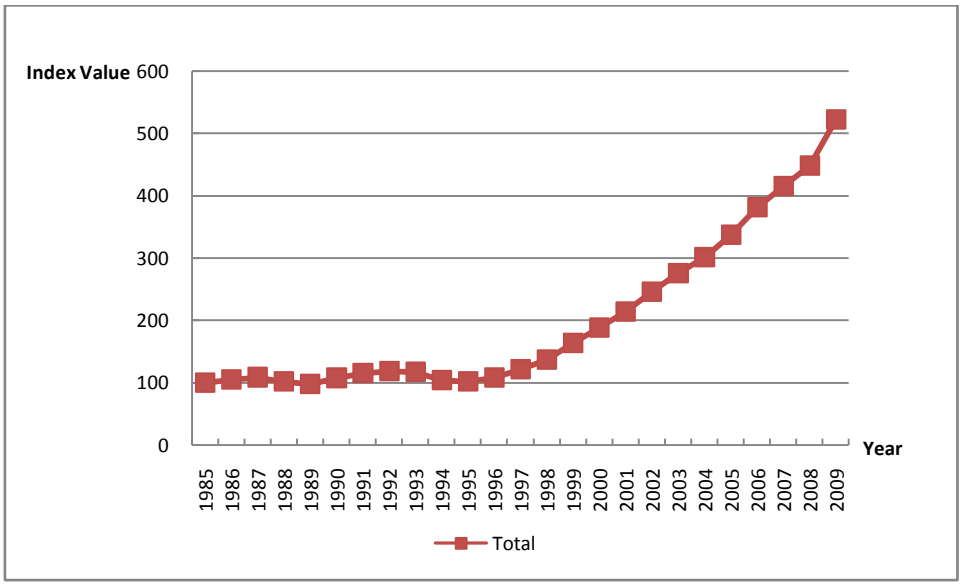


Figure AH-2.3 Real Human Capital Per Capita Index for Anhui

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table AH-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table AH-3.1 Labor Force Human Capital and Nominal GDP for Anhui

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	462		462		33	13.94
1986	543		511		38	14.19
1987	638		552		44	14.42
1988	753		544		55	13.76
1989	879		539		62	14.27
1990	1,030		614		66	15.66
1991	1,164		660		66	17.54
1992	1,308		685		80	16.32
1993	1,473		671		104	14.20
1994	1,657		596		132	12.55
1995	1,846		581		181	10.20
1996	2,108		603		209	10.07
1997	2,366		669		235	10.08
1998	2,656		751		254	10.44
1999	3,107		893		271	11.46
2000	3,664	3,606	1,043	1,027	290	12.63
2001	4,004	3,948	1,131	1,115	325	12.33
2002	4,396	4,348	1,255	1,241	352	12.49
2003	4,847	4,813	1,358	1,349	392	12.36
2004	5,340	5,321	1,429	1,424	476	11.22
2005	6,038	6,017	1,590	1,584	535	11.29
2006	6,932	6,910	1,805	1,799	611	11.34
2007	8,160	8,131	2,019	2,010	736	11.09
2008	9,549	9,514	2,223	2,214	885	10.79
2009	11,360	11,322	2,664	2,654	1,006	11.29

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented

in Figure AH-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keep increasing.

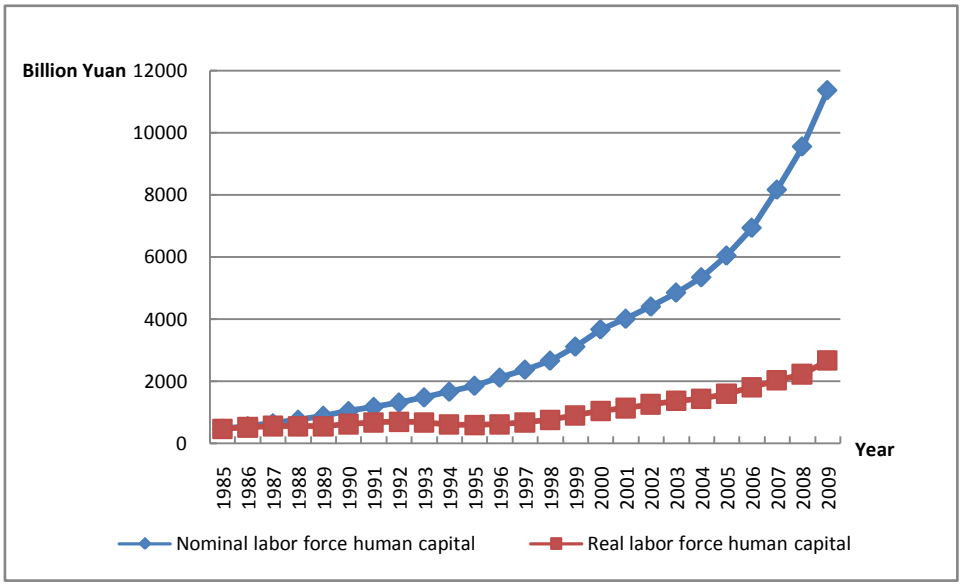


Figure AH-3.1 Nominal and Real Labor Force Human Capital for Anhui

We also calculate the ratio of labor force human capital to GDP. The results are reported in the last column of Table AH-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure AH-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio of labor force human capital to GDP increases during 1985 to 1991, decreases dramatically from 1991 to 1996, and increases slowly after 1996.

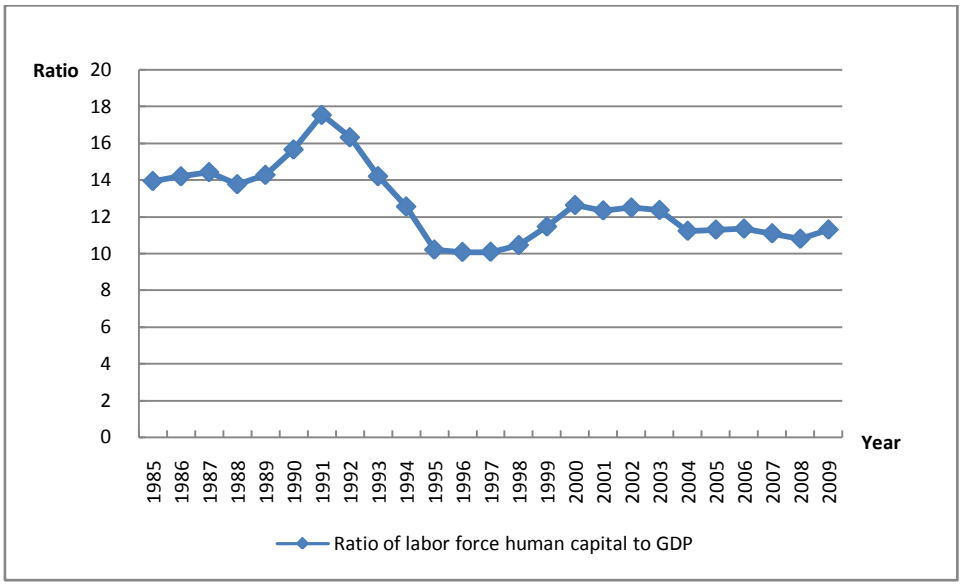


Figure AH-3.2 Ratio of Labor Force Human Capital to GDP for Anhui

Table AH-3.2 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real human capital. Urban real labor force human capital surpasses its rural counterpart for the first time in 2005. The region gap has increased from -0.217 trillion Yuan in 1985 to 0.343 trillion Yuan in 2009.

Table AH-3.2 Nominal and Real Labor Force Human Capital by Region for Anhui

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	462	122	339	462	122	339
1986	543	150	393	511	142	369
1987	638	184	454	552	159	393
1988	753	224	529	544	159	385
1989	879	270	610	539	165	374

1990	1,030	324	706	614	194	421
1991	1,164	360	804	660	200	461
1992	1,308	400	908	685	204	481
1993	1,473	451	1,022	671	201	470
1994	1,657	509	1,148	596	178	418
1995	1,846	563	1,283	581	170	410
1996	2,108	704	1,404	603	193	409
1997	2,366	792	1,574	669	213	456
1998	2,656	909	1,747	751	244	507
1999	3,107	1,261	1,846	893	347	546
2000	3,664	1,634	2,030	1,043	446	598
2001	4,004	1,824	2,180	1,131	498	634
2002	4,396	2,065	2,331	1,255	569	686
2003	4,847	2,346	2,501	1,358	635	724
2004	5,340	2,705	2,635	1,429	702	728
2005	6,038	3,259	2,779	1,590	837	753
2006	6,932	3,710	3,222	1,805	939	866
2007	8,160	4,399	3,761	2,019	1,058	961
2008	9,549	5,267	4,282	2,223	1,195	1,028
2009	11,360	6,534	4,826	2,664	1,499	1,165

Figure AH-3.3 shows real labor force human capital for urban and rural respectively. The pattern of labor force human capital is almost the same as that of real human capital. The urban labor force human capital surpasses the rural one in 2005 and has grown much faster ever since.

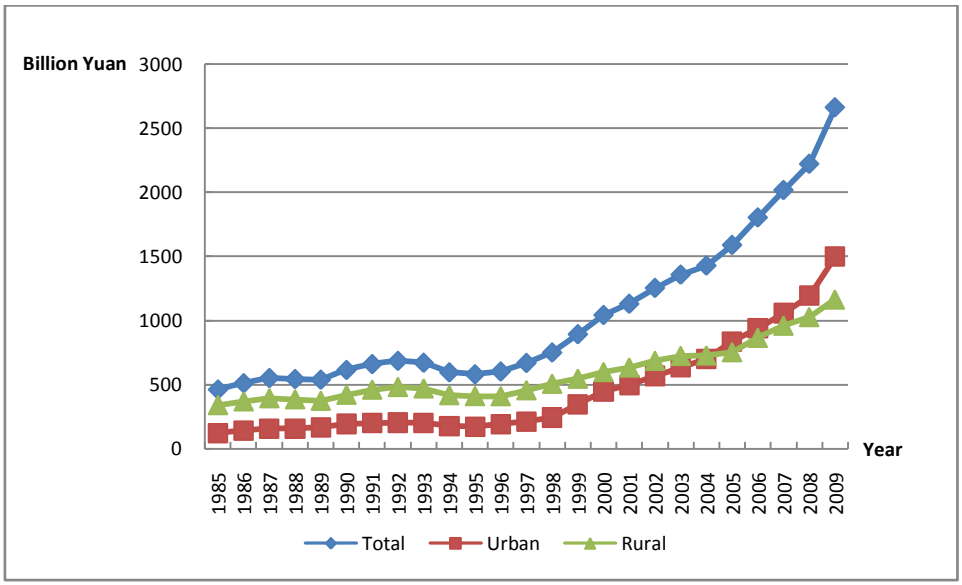


Figure AH-3.3 Real Labor Force Human Capital by Region for Anhui

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table AH-3.3 reports the real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female is smaller than that for male.

Table AH-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Anhui

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	17.08	19.32	14.50	17.08	19.32	14.50
1986	19.40	22.06	16.36	18.24	20.76	15.38
1987	21.98	25.03	18.50	19.01	21.64	16.00
1988	24.98	28.66	20.79	18.04	20.69	15.02
1989	28.42	32.68	23.51	17.41	20.02	14.40
1990	32.05	36.96	26.35	19.11	22.04	15.71
1991	35.66	41.38	29.11	20.23	23.46	16.53
1992	39.43	46.04	31.96	20.67	24.12	16.77
1993	44.20	51.97	35.54	20.14	23.66	16.19
1994	49.12	58.12	39.14	17.66	20.89	14.09
1995	54.36	64.76	42.98	17.09	20.35	13.53
1996	61.67	73.77	48.35	17.63	21.09	13.84
1997	68.75	82.74	53.39	19.45	23.39	15.12
1998	77.01	93.09	59.30	21.77	26.29	16.78
1999	89.15	108.78	67.60	25.63	31.24	19.46
2000	102.64	126.28	76.36	29.23	35.92	21.78
2001	112.95	139.95	83.51	31.91	39.51	23.63
2002	124.92	155.71	91.81	35.66	44.41	26.25
2003	138.58	173.50	101.57	38.84	48.58	28.51
2004	154.36	194.70	112.50	41.31	52.05	30.16
2005	174.22	220.80	126.86	45.87	58.10	33.45
2006	197.61	251.31	142.25	51.45	65.37	37.09
2007	227.61	289.39	163.40	56.30	71.53	40.46
2008	262.32	333.95	187.87	61.07	77.68	43.76
2009	307.80	391.81	219.60	72.18	91.84	51.53

Table AH-3.4 reports the real average labor force human capital by region.

The real average labor force human capital is much smaller in rural area than in urban area.

Table AH-3.4 Nominal and Real Average Labor Force Human Capital by Region for Anhui

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	17.08	29.63	14.81	17.08	29.63	14.81
1986	19.40	33.37	16.69	18.24	31.54	15.67
1987	21.98	37.44	18.83	19.01	32.20	16.32
1988	24.98	42.74	21.27	18.04	30.28	15.48
1989	28.42	48.70	23.91	17.41	29.82	14.65
1990	32.05	55.47	26.84	19.11	33.10	16.00
1991	35.66	61.57	29.92	20.23	34.21	17.13
1992	39.43	68.19	33.30	20.67	34.82	17.66
1993	44.20	76.19	37.19	20.14	34.01	17.09
1994	49.12	84.37	41.32	17.66	29.56	15.03
1995	54.36	92.84	45.97	17.09	28.07	14.71
1996	61.67	103.78	51.28	17.63	28.50	14.96
1997	68.75	116.24	57.17	19.45	31.33	16.56
1998	77.01	130.08	63.56	21.77	34.95	18.43
1999	89.15	145.76	70.24	25.63	40.13	20.78
2000	102.64	168.48	78.08	29.23	45.97	22.98
2001	112.95	183.30	85.45	31.91	50.01	24.83
2002	124.92	200.67	93.47	35.66	55.25	27.52
2003	138.58	219.75	102.77	38.84	59.43	29.75
2004	154.36	241.68	112.19	41.31	62.67	30.99
2005	174.22	268.08	123.44	45.87	68.82	33.46
2006	197.61	294.89	143.34	51.45	74.66	38.51
2007	227.61	331.95	166.27	56.30	79.82	42.46
2008	262.32	376.16	190.90	61.07	85.32	45.82
2009	307.80	441.27	218.33	72.18	101.23	52.70

Chapter 12 Human capital for Shandong

1. Total human capital

Human capital stocks of Shandong are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table SD-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[63]

Table SD-1.1 Nominal and Real Human Capital, Nominal GDP for Shandong

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	2,463		2,463		68	36.19
1986	2,772		2,656		74	37.36
1987	3,337		2,958		89	37.40
1988	3,668		2,749		112	32.82
1989	4,169		2,653		129	32.22
1990	4,964		3,053		151	32.85
1991	5,549		3,250		181	30.65
1992	6,303		3,470		220	28.70
1993	7,204		3,525		277	26.00
1994	8,181		3,240		384	21.28
1995	9,371		3,159		495	18.92
1996	10,371		3,176		588	17.63
1997	11,647		3,462		654	17.82
1998	13,112		3,913		702	18.67
1999	14,734		4,414		749	19.66

[63] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban areas separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
2000	17,001	17,004	5,061	5,057	834	20.39
2001	18,616	18,625	5,420	5,421	920	20.25
2002	20,984	21,018	6,134	6,141	1,028	20.42
2003	23,581	23,646	6,803	6,817	1,208	19.52
2004	26,609	26,699	7,398	7,417	1,502	17.71
2005	30,947	31,077	8,456	8,485	1,837	16.85
2006	35,110	35,280	9,484	9,525	2,190	16.03
2007	39,910	40,140	10,316	10,372	2,578	15.48
2008	45,440	45,760	11,152	11,225	3,093	14.69
2009	52,440	52,820	12,848	12,935	3,390	15.47

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure SD-1.1 shows real and nominal human capital for Shandong reported in Table SD-1.1 As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

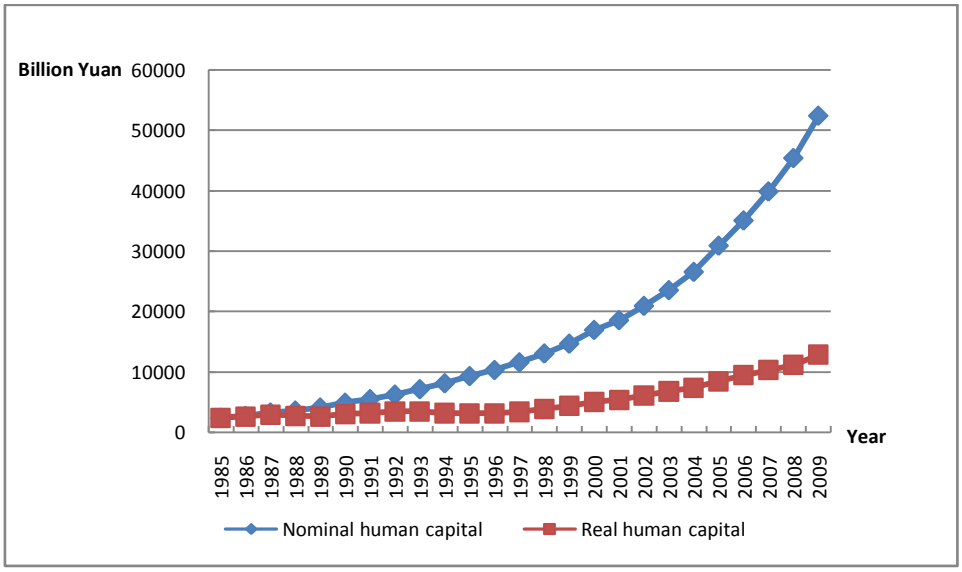


Figure SD-1.1 Nominal and Real Human Capital for Shandong

In order to get a sense of the magnitude of the human capital in Shandong, we also present the ratio of nominal human capital to nominal GDP in Table SD-1.1.[64] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure SD-1.2, nominal human capital is substantially higher than nominal GDP for Shandong. There is a decrease from 1990 to 1996. The ratio of human capital to GDP in Shandong from 1996 to 2001 increases slowly and after 2001, the ratio decreases slowly in a small scale.

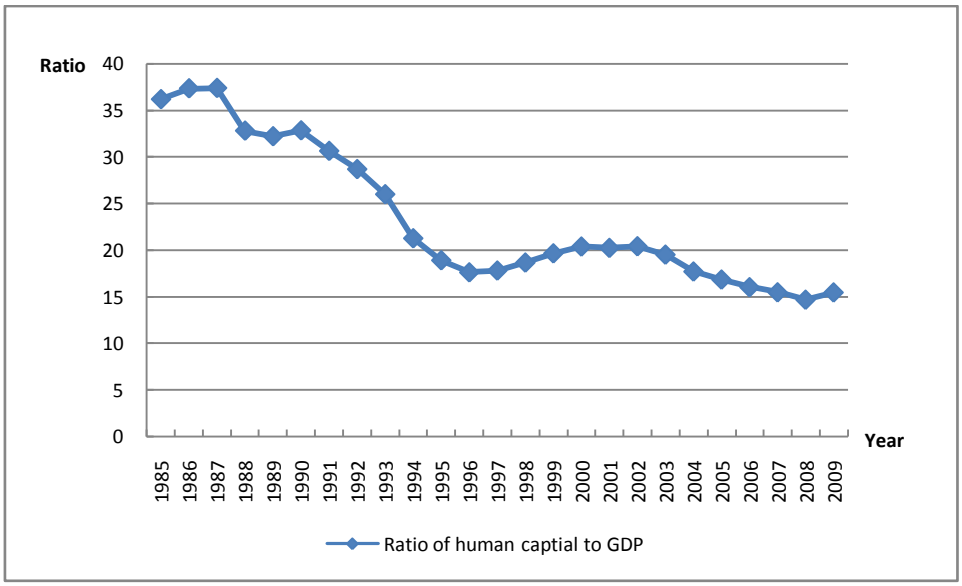


Figure SD-1.2 Ratio of Human Capital to GDP for Shandong

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table SD-1.2 shows real human capital for Shandong by

[64] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

gender and region. The results based on five education categories show that the human capital for Shandong during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Shandong increases from 2.46 trillion Yuan to 12.85 trillion Yuan (calculated by 1985 comparable price), which has increased by 4 times. The annual growth rate of human capital over this period increases to 6.88%.[65]

From 1985 to 2009, human capital for male in Shandong increases from 1.46trillion Yuan to 8.36 trillion Yuan, the human capital for female in Shandong increases from 0.99 trillion Yuan to 4.48 trillion Yuan. During the same period, the annual growth rates of human capital are 7.26% and 6.26 % for male and female respectively. The gender gap in the estimated human capital increases from 0.46 trillion Yuan in 1985 to 3.88 trillion Yuan in 2009. In 2009, the human capital for male is about 2 times the amount of that for female in Shandong.

From 1985 to 2009, rural human capital in Shandong increases from 1.66 trillion Yuan to 3.49 trillion Yuan, the urban human capital in Shandong increases from 0.83 trillion Yuan to 9.36 trillion Yuan. During the same period, the annual growth rates of human capital are 3.09% and 10.23 % for rural and urban areas respectively. The region gap in the estimated human capital increases from -0.86 trillion Yuan in 1985 to 5.87 trillion Yuan in 2009. In 2009, the human capital for urban areas is about 3 times the amount of that for rural areas in Shandong.

[65] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

Table SD-1.2 Real Human Capital by Gender and Region for Shandong[66]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	2,463	1,464	999	803	1,660
1986	2,656	1,580	1,075	887	1,769
1987	2,958	1,792	1,167	1,086	1,872
1988	2,749	1,678	1,071	989	1,760
1989	2,653	1,626	1,027	1,009	1,644
1990	3,053	1,884	1,169	1,219	1,834
1991	3,250	2,022	1,228	1,374	1,876
1992	3,470	2,163	1,308	1,489	1,981
1993	3,525	2,208	1,317	1,533	1,992
1994	3,240	2,042	1,199	1,434	1,806
1995	3,159	1,998	1,161	1,425	1,734
1996	3,176	2,013	1,163	1,501	1,675
1997	3,462	2,197	1,266	1,690	1,772
1998	3,913	2,491	1,422	1,971	1,942
1999	4,414	2,823	1,592	2,288	2,126
2000	5,061	3,228	1,832	2,702	2,359
2001	5,420	3,475	1,947	3,074	2,346
2002	6,134	3,944	2,190	3,637	2,497
2003	6,803	4,383	2,420	4,191	2,612
2004	7,398	4,780	2,618	4,737	2,661
2005	8,456	5,460	2,995	5,561	2,895
2006	9,484	6,149	3,335	6,349	3,135
2007	10,316	6,694	3,623	7,119	3,197
2008	11,152	7,247	3,905	7,923	3,229
2009	12,848	8,364	4,484	9,361	3,487

[66] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Figure SD-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason why male real human capital is higher than female real human capital is the earlier retirement age for women (age 55 vs. age 60 for men based on China Labor Law). Accordingly, men have a longer time to generate income in the market. Another reason is higher educational attainment for men. Moreover, the male-female income gap has been expanding. The results based on six education categories show the similar trends.

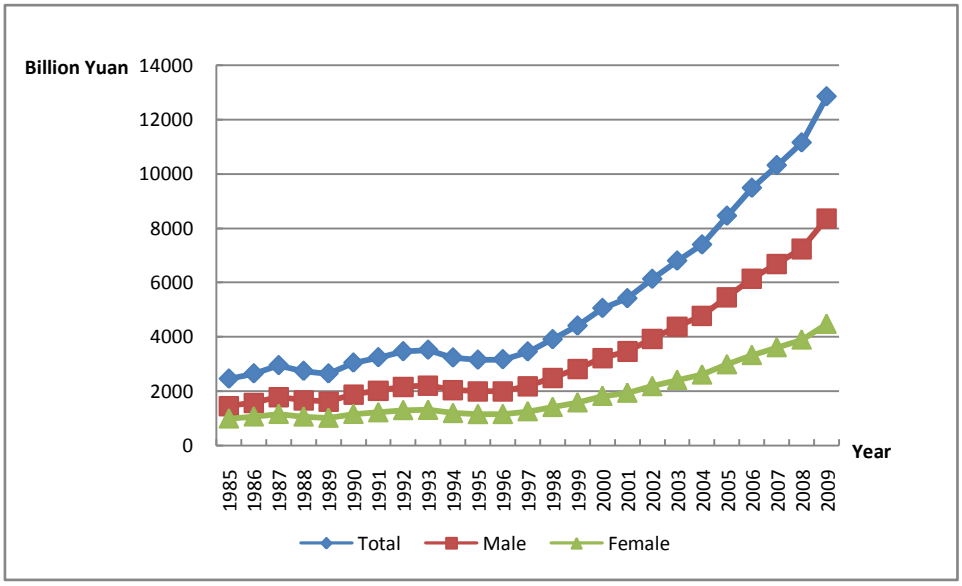


Figure SD-1.3 Real Human Capital by Gender for Shandong

Figure SD-1.4 shows the real human capital for urban and rural separately. As previously noted, before 1998, real human capital in rural areas is larger than that in urban areas. Since 1997, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly. The urban human capital surpasses the rural human capital in 1998, and the region gap has the trend of expanding.

There are several reasons for such a trend. First, in the early years, the rural population is significantly larger than the urban population, and thus has larger amount of human capital. The change of increased urban population in the later years is, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the enlarged education gap between the urban and rural population. Urban areas usually have a larger proportion of educated population than rural areas.

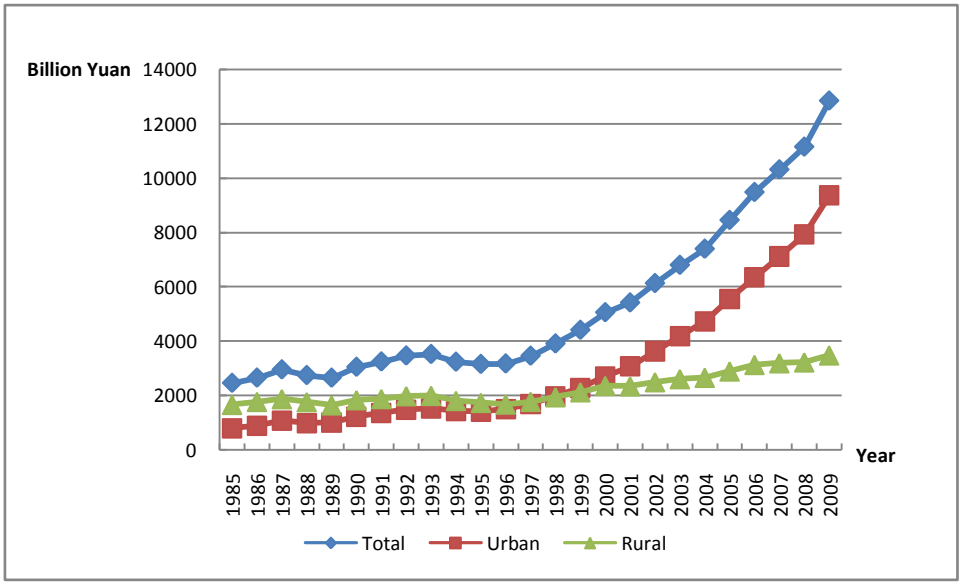


Figure SD-1.4 Real Human Capital by Region for Shandong

Finally we calculate real human capital indices using 1985 as the baseline year. The results for each group are reported in Table SD-1.3.

Table SD-1.3 Real Human Capital Index for Shandong (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	107.83	107.97	107.62	110.44	106.57
1987	120.10	122.42	116.83	135.26	112.77
1988	111.62	114.63	107.25	123.18	106.02
1989	107.72	111.11	102.78	125.67	99.04
1990	123.96	128.73	116.98	151.82	110.48
1991	131.96	138.15	122.93	171.13	113.01
1992	140.89	147.78	130.96	185.45	119.34
1993	143.12	150.86	131.89	190.93	120.00
1994	131.55	139.49	120.04	178.60	108.80
1995	128.26	136.55	116.19	177.48	104.46
1996	128.95	137.55	116.46	186.95	100.90
1997	140.57	150.12	126.72	210.49	106.75
1998	158.88	170.21	142.35	245.49	116.99
1999	179.22	192.89	159.35	284.97	128.07
2000	205.49	220.57	183.41	336.53	142.11
2001	220.07	237.44	194.88	382.86	141.33
2002	249.06	269.49	219.26	452.98	150.42
2003	276.22	299.49	242.25	521.98	157.35
2004	300.38	326.61	262.09	589.99	160.30
2005	343.34	373.08	299.83	692.61	174.40
2006	385.07	420.16	333.87	790.76	188.86
2007	418.86	457.40	362.70	886.66	192.59
2008	452.80	495.18	390.93	986.80	194.52
2009	521.66	571.51	448.89	1,165.90	210.06

Figure SD-1.5 shows the index of real total human capital for Shandong. Before 1997 the index grows quite steadily; it accelerates after that year.

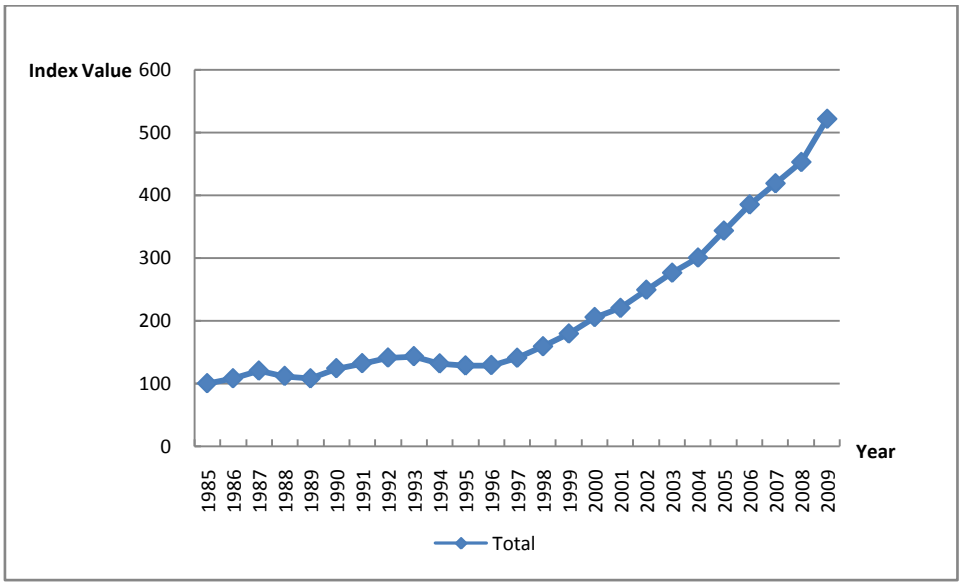


Figure SD-1.5 Real Human Capital Index for Shandong

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table SD-2.1 shows the human capital per capita by gender for Shandong. Based on the five education categories, real human capital per capita for male increases from 42,120 Yuan to 204,661 Yuan, increases by around 4 times; real human capital per capita for female increases from 31,587 Yuan to 120,616 Yuan, by around 3 times. From 1985 to 2009, the annual growth rate is 6.59% for male, and 5.58% for female.

Table SD-2.1 Nominal and Real Human Capital Per Capita by Gender for Shandong

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	37.11	42.12	31.59	37.11	42.12	31.59
1986	41.51	47.11	35.33	39.77	45.13	33.85
1987	46.88	54.29	38.76	41.56	48.11	34.39
1988	52.51	61.01	43.08	39.35	45.67	32.34
1989	58.92	68.64	48.12	37.50	43.65	30.65
1990	65.90	77.25	53.29	40.53	47.48	32.78
1991	74.60	86.01	61.19	43.69	50.35	35.87
1992	84.00	97.53	68.29	46.24	53.64	37.68
1993	95.35	111.40	76.77	46.66	54.43	37.65
1994	107.77	126.83	85.71	42.68	50.16	34.05
1995	121.94	145.95	94.95	41.11	49.14	32.08
1996	138.05	166.44	106.48	42.28	50.92	32.68
1997	153.86	185.52	118.63	45.73	55.11	35.32
1998	171.78	207.57	131.88	51.27	61.90	39.40
1999	192.18	233.33	146.35	57.57	69.88	43.88
2000	217.11	265.03	164.59	64.63	78.84	49.04
2001	247.71	303.70	186.37	72.12	88.39	54.32
2002	279.22	343.03	209.05	81.62	100.27	61.15
2003	314.46	387.44	234.49	90.72	111.76	67.65
2004	355.90	440.29	263.67	98.95	122.42	73.29
2005	400.51	495.23	297.09	109.44	135.36	81.10
2006	451.49	559.63	332.98	121.96	151.26	89.86
2007	512.26	636.32	376.65	132.41	164.58	97.30
2008	582.66	722.86	428.65	143.00	177.46	105.12
2009	671.93	834.82	492.50	164.63	204.66	120.62

Figure SD-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for male and female. Real human capital per capita for male and female both exhibit an accelerating growth after 1996. The male-female gap has been widening.

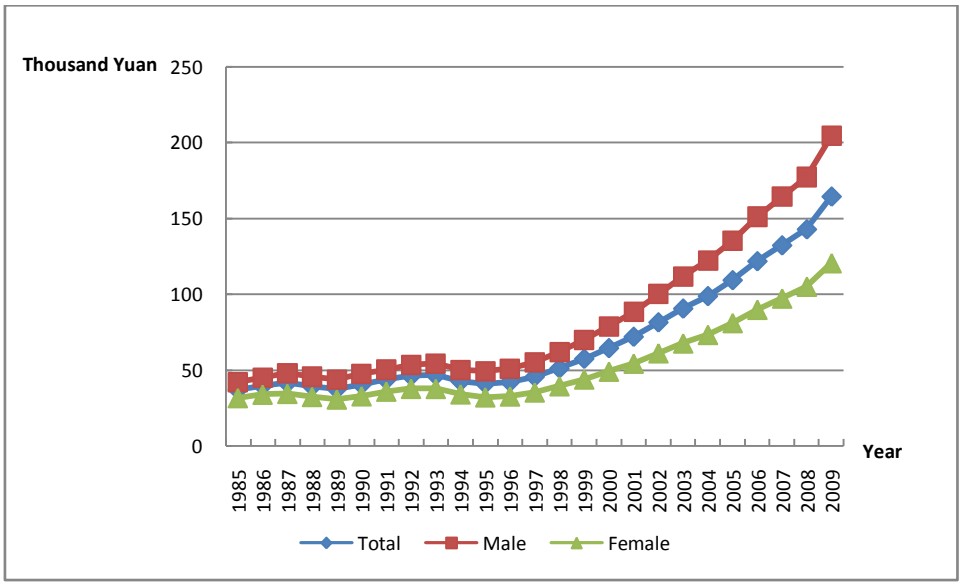


Figure SD-2.1 Real Human Capital Per Capita by Gender for Shandong

Table SD-2.2 reports the results of human capital per capita measured in nominal and real terms for Shandong by urban and rural areas separately. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that in rural areas. The urban human capital per capita increases from 56,318 Yuan to 217,385 Yuan and the rural human capital per capita increases from 31,826 Yuan to 99,858 Yuan. The human capital per capita in urban areas grows much faster than the one in rural areas.

Table SD-2.2 Nominal and Real Human Capital Per Capita by Region for Shandong

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	37.11	56.32	31.83	37.11	56.32	31.83
1986	41.51	62.04	35.56	39.77	59.09	34.16
1987	46.88	68.11	39.55	41.56	59.46	35.37
1988	52.51	76.96	44.20	39.35	55.71	33.79
1989	58.92	85.95	49.17	37.50	53.77	31.62
1990	65.90	96.34	54.34	40.53	58.74	33.60
1991	74.60	109.94	59.95	43.69	63.12	35.64
1992	84.00	124.01	66.59	46.24	65.56	37.85
1993	95.35	140.66	74.79	46.66	64.89	38.40
1994	107.77	158.96	83.34	42.68	58.48	35.16
1995	121.94	181.09	93.51	41.11	57.04	33.46
1996	138.05	203.70	103.45	42.28	58.06	33.96
1997	153.86	228.42	112.92	45.73	63.09	36.20
1998	171.78	256.55	123.48	51.27	71.07	39.98
1999	192.18	288.50	134.86	57.57	79.93	44.29
2000	217.11	325.21	148.83	64.63	89.03	49.22
2001	247.71	367.77	163.99	72.12	99.58	52.96
2002	279.22	411.16	180.26	81.62	112.80	58.27
2003	314.46	458.44	197.98	90.72	124.90	63.06
2004	355.90	512.86	218.48	98.95	135.91	66.53
2005	400.51	575.63	241.54	109.44	150.89	71.82
2006	451.49	634.06	271.07	121.96	164.56	79.81
2007	512.26	709.97	302.43	132.41	177.52	84.56
2008	582.66	797.55	337.54	143.00	190.46	88.87
2009	671.93	909.76	379.59	164.63	217.39	99.86

Figure SD-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, real human capital per capita for urban and rural both exhibit an accelerating growth after 1996. Based on five education categories, the ratio of urban to rural increases from 1.78 in 1985 to 2.18 in 2009, the absolute size of human capital has been on

the rise. From 1985 to 2009, the annual growth rate is 5.63% for the urban area, and 4.76% for the rural area.

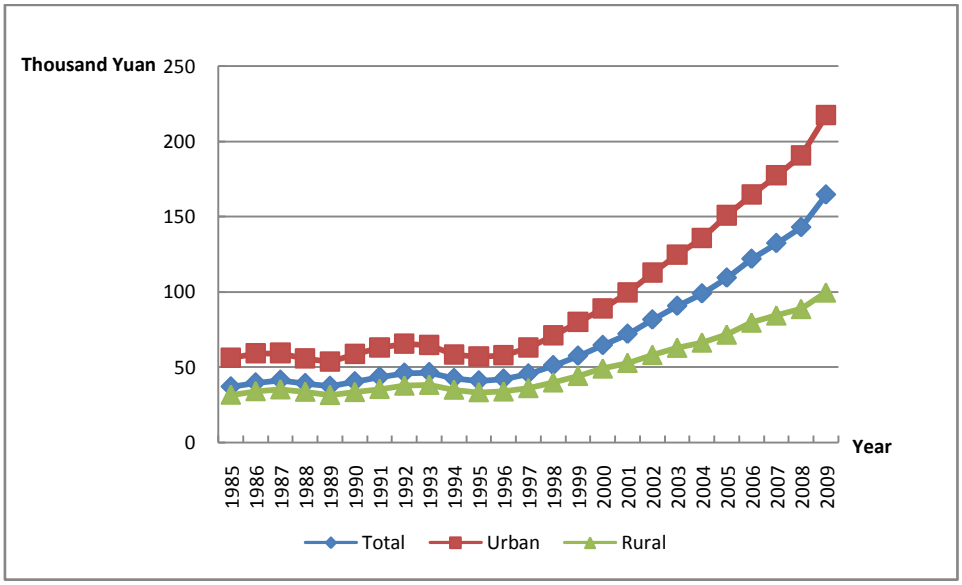


Figure SD-2.2 Real Human Capital Per Capita by Region for Shandong

Figure SD-2.3 shows the real human capital per capita index for Shandong. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

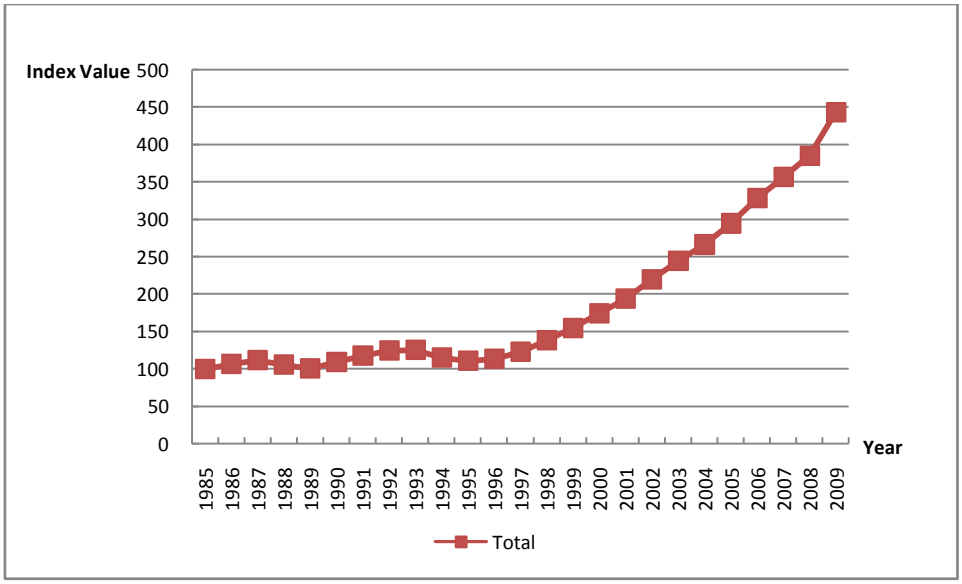


Figure SD-2.3 Real Human Capital Per Capita Index for Shandong

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table SD-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table SD-3.1 Labor Force Human Capital and Nominal GDP for Shandong

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,067		1,067		68	15.68
1986	1,235		1,183		74	16.64
1987	1,553		1,377		89	17.40
1988	1,704		1,277		112	15.24
1989	1,975		1,257		129	15.26
1990	2,418		1,487		151	16.00
1991	2,510		1,471		181	13.86
1992	2,826		1,558		220	12.87
1993	3,195		1,567		277	11.53
1994	3,580		1,422		384	9.31
1995	4,121		1,393		495	8.32
1996	4,592		1,412		588	7.80
1997	5,286		1,579		654	8.09
1998	6,059		1,818		702	8.63
1999	6,828		2,059		749	9.11
2000	8,158	80,38	2,441	2,405	834	9.78
2001	8,436	83,34	2,476	2,447	920	9.17

2002	9,465	93,81	2,791	2,767	1,028	9.21
2003	10,767	10,711	3,134	3,117	1,208	8.91
2004	12,139	12,127	3,401	3,396	1,502	8.08
2005	14,304	14,285	3,936	3,929	1,837	7.79
2006	16,418	16,415	4,469	4,464	2,190	7.50
2007	18,598	18,598	4,842	4,838	2,578	7.21
2008	21,060	21,074	5,195	5,196	3,093	6.81
2009	24,399	24,421	6,001	6,003	3,390	7.20

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure SD-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keep increasing.

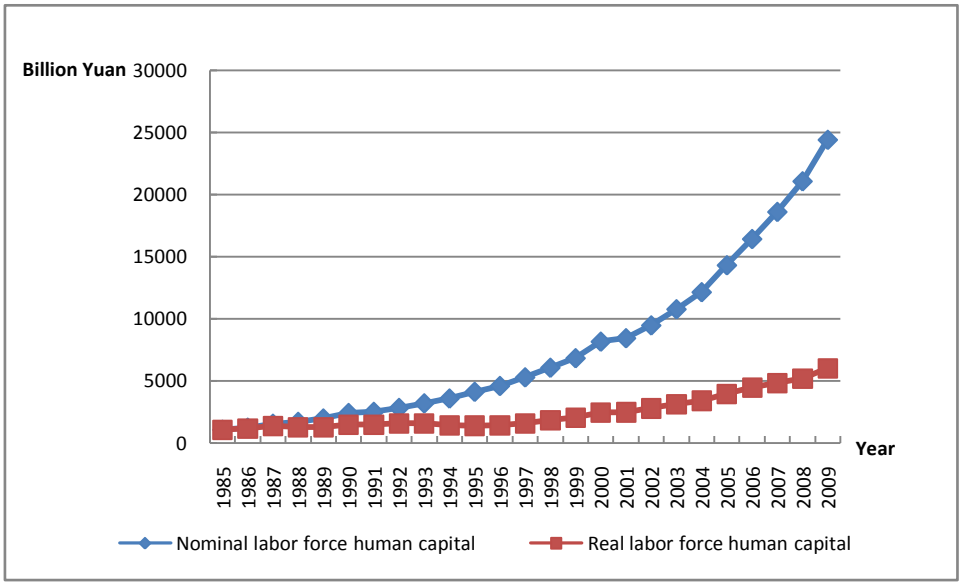


Figure SD-3.1 Nominal and Real Labor Force Human Capital for Shandong

We also calculate the ratio of labor force human capital to GDP. The results are reported in the last column of Table SD-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Fig-

ure SD-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio remains between 6 and 18 and generally shows a decreasing trend.

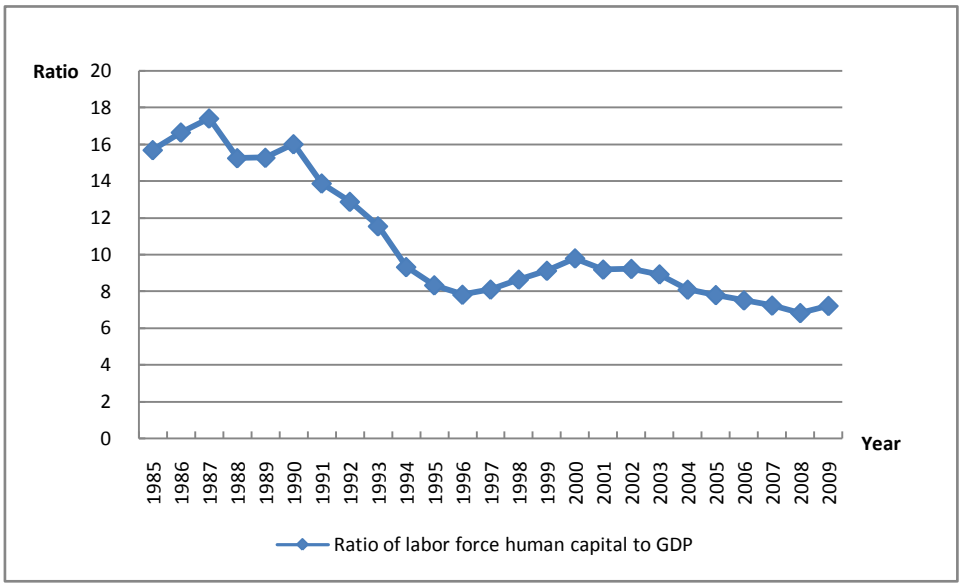


Figure SD-3.2 Ratio of Labor Force Human Capital to GDP for Shandong

Table SD-3.2 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real human capital. Urban real labor force human capital surpasses its rural counterpart for the first time in 2000. The region gap has increased from -0.479 trillion Yuan in 1985 to around 2.27 trillion Yuan in 2009.

Table SD-3.2 Nominal and Real Labor Force Human Capital by Region for Shandong

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	1,067	294	773	1,067	294	773
1986	1,235	365	870	1,183	348	836
1987	1,553	550	1,003	1,377	480	897
1988	1,704	611	1,093	1,277	442	836
1989	1,975	751	1,224	1,257	470	787
1990	2,418	963	1,455	1,487	587	900
1991	2,510	1,028	1,482	1,471	590	881
1992	2,826	1,214	1,612	1,558	642	916
1993	3,195	1,420	1,775	1,567	655	912
1994	3,580	1,642	1,938	1,422	604	818
1995	4,121	1,893	2,228	1,393	596	797
1996	4,592	2,200	2,392	1,412	627	785
1997	5,286	2,611	2,675	1,579	721	857
1998	6,059	3,086	2,973	1,818	855	963
1999	6,828	3,570	3,258	2,059	989	1,070
2000	8,158	4,528	3,630	2,441	1,240	1,201
2001	8,436	4,756	3,680	2,476	1,288	1,188
2002	9,465	5,483	3,982	2,791	1,504	1,287
2003	10,767	6,403	4,364	3,134	1,744	1,390
2004	12,139	7,480	4,659	3,401	1,982	1,419
2005	14,304	9,014	5,290	3,936	2,363	1,573
2006	16,418	10,480	5,938	4,469	2,721	1,748
2007	18,598	12,180	6,418	4,842	3,047	1,795
2008	21,060	14,280	6,780	5,195	3,410	1,785
2009	24,399	17,310	7,089	6,001	4,136	1,865

Figure SD-3.3 shows real labor force human capital by region. The pattern of labor force human capital is almost the same as that of real human capital. The urban labor force human capital surpasses the rural one in 2000 and has grown much faster ever since.

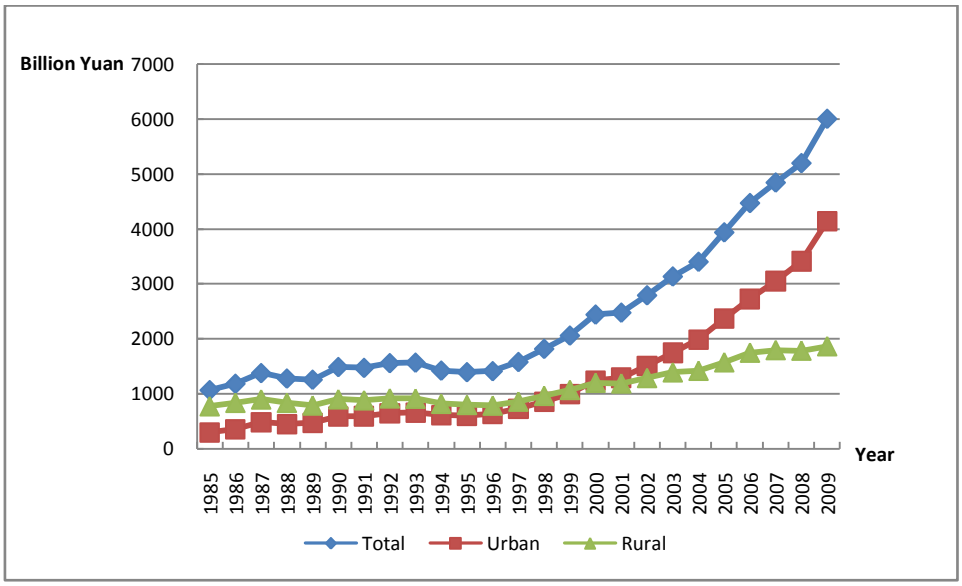


Figure SD-3.3 Real Labor Force Human Capital by Region for Shandong

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table SD-3.3 reports the real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female is smaller than that for male.

Table SD-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Shandong

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	27.09	31.06	22.79	27.09	31.06	22.79
1986	30.59	35.33	25.47	29.31	33.85	24.41
1987	35.21	41.08	28.87	31.22	36.41	25.62
1988	39.41	46.11	32.11	29.55	34.53	24.14
1989	44.30	51.97	35.86	28.19	33.05	22.85
1990	49.71	58.76	39.79	30.57	36.12	24.48
1991	53.52	61.29	44.27	31.37	35.90	25.98
1992	60.18	69.68	49.00	33.17	38.36	27.08
1993	67.51	78.82	54.28	33.10	38.57	26.70
1994	75.22	88.58	59.78	29.87	35.10	23.83
1995	85.64	104.11	65.58	28.96	35.15	22.24
1996	95.96	117.57	72.60	29.51	36.10	22.38
1997	107.41	132.19	80.58	32.08	39.42	24.12
1998	119.73	148.13	89.05	35.92	44.39	26.76
1999	132.35	164.40	97.90	39.91	49.53	29.55
2000	151.07	188.11	110.89	45.20	56.21	33.22
2001	166.59	208.52	121.29	48.90	61.16	35.66
2002	184.86	232.26	133.62	54.51	68.45	39.46
2003	207.06	260.89	148.92	60.27	75.89	43.39
2004	231.22	293.05	164.74	64.78	82.07	46.19
2005	257.27	326.77	182.54	70.79	89.90	50.25
2006	291.62	371.81	204.78	79.38	101.16	55.75
2007	330.34	420.17	233.04	86.00	109.35	60.63
2008	375.40	476.12	264.57	92.60	117.48	65.24
2009	437.26	554.98	307.28	107.54	136.52	75.52

Table SD-3.4 reports the real average labor force human capital classified by urban and rural areas separately. The average labor force human capital is much smaller in rural area than in urban area. The average labor

force human capital is much smaller in rural area than in urban area. The number for urban is about 1.9 times that for rural in 2009.

Table SD-3.4 Nominal and Real Average Labor Force Human Capital by Region for Shandong

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	27.09	37.74	24.44	27.09	37.74	24.44
1986	30.59	42.59	27.35	29.31	40.56	26.27
1987	35.21	48.22	30.65	31.22	42.09	27.42
1988	39.41	54.38	34.17	29.55	39.36	26.12
1989	44.30	61.13	37.89	28.19	38.24	24.36
1990	49.71	69.08	41.93	30.57	42.12	25.92
1991	53.52	75.62	44.48	31.37	43.42	26.44
1992	60.18	84.51	49.41	33.17	44.68	28.08
1993	67.51	94.49	55.03	33.10	43.59	28.25
1994	75.22	104.67	60.77	29.87	38.51	25.64
1995	85.64	119.66	69.07	28.96	37.69	24.71
1996	95.96	133.68	76.01	29.51	38.11	24.95
1997	107.41	150.85	83.70	32.08	41.67	26.83
1998	119.73	169.53	91.82	35.92	46.97	29.73
1999	132.35	188.01	100.04	39.91	52.09	32.85
2000	151.07	217.71	109.45	45.20	59.60	36.20
2001	166.59	237.96	119.97	48.90	64.43	38.74
2002	184.86	261.26	132.08	54.51	71.68	42.70
2003	207.06	288.71	146.39	60.27	78.66	46.63
2004	231.22	318.01	160.31	64.78	84.28	48.81
2005	257.27	352.62	176.71	70.79	92.43	52.55
2006	291.62	390.01	201.21	79.38	101.22	59.24
2007	330.34	436.41	226.11	86.00	109.12	63.22
2008	375.40	492.79	250.48	92.60	117.68	65.94
2009	437.26	573.94	277.15	107.54	137.14	72.91

Chapter 13 Human capital for Henan

1. Total human capital

Human capital stocks of Henan are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in TableHeN-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI(in 1985 Yuan).[67]

Table HeN-1.1 Nominal and Real Human Capital, Nominal GDP for Henan

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,643		1,643		45	36.36
1986	1,876		1,786		50	37.31
1987	2,200		1,975		61	36.08
1988	2,484		1,872		75	33.16
1989	2,872		1,806		85	33.76
1990	3,383		2,111		93	36.20
1991	3,756		2,306		105	35.92
1992	4,270		2,510		128	33.37
1993	4,865		2,588		166	29.30
1994	5,506		2,347		222	24.84

[67] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	6,364		2,329		299	21.30
1996	7,344		2,417		363	20.21
1997	8,521		2,704		404	21.09
1998	9,807		3,185		431	22.76
1999	11,318		3,782		452	25.05
2000	13,253	13,021	4,463	4,378	505	26.23
2001	14,925	14,953	4,974	4,980	553	26.97
2002	16,853	16,880	5,594	5,601	604	27.92
2003	19,359	19,419	6,314	6,327	687	28.19
2004	22,204	22,276	6,857	6,875	855	25.96
2005	26,200	26,300	7,912	7,938	1,059	24.75
2006	30,720	30,900	9,127	9,171	1,236	24.85
2007	35,580	35,810	10,003	10,060	1,501	23.70
2008	40,920	41,210	10,722	10,796	1,802	22.71
2009	47,770	48,170	12,575	12,670	1,948	24.52

Note: The ratio of human capital to GDP is based on the current values for that year.

The trends of human capital measured in nominal and real terms are presented in Figure HeN-1.1. Both the nominal and real human capital exhibit a rising trend.

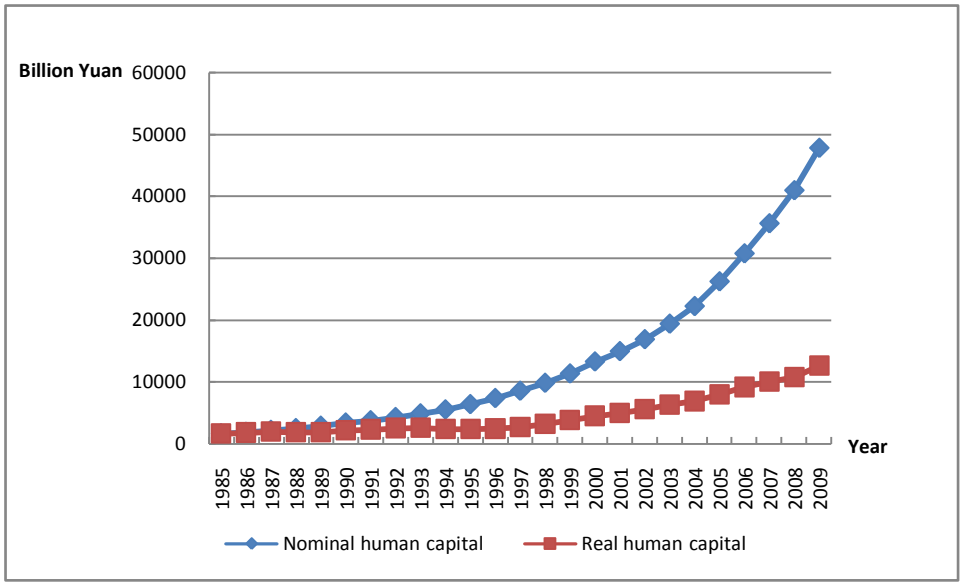


Figure HeN-1.1 Nominal and Real Human Capital for Henan

In order to get a sense of the magnitude of the human capital in Beijing, we also present the ratio of nominal human capital to nominal GDP in Table HeN-1.1.[68] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio could also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure HeN-1.2, nominal human capital is substantially higher than nominal GDP for Henan. The ratio of human capital to GDP in Henan from 1985 to 2009 decreases as a whole, it decreases at a considerable rate during 1990 and 1996. From 1996 to 2003, the ratio increases slowly in small scale, but decreases again after 1993.

[68] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

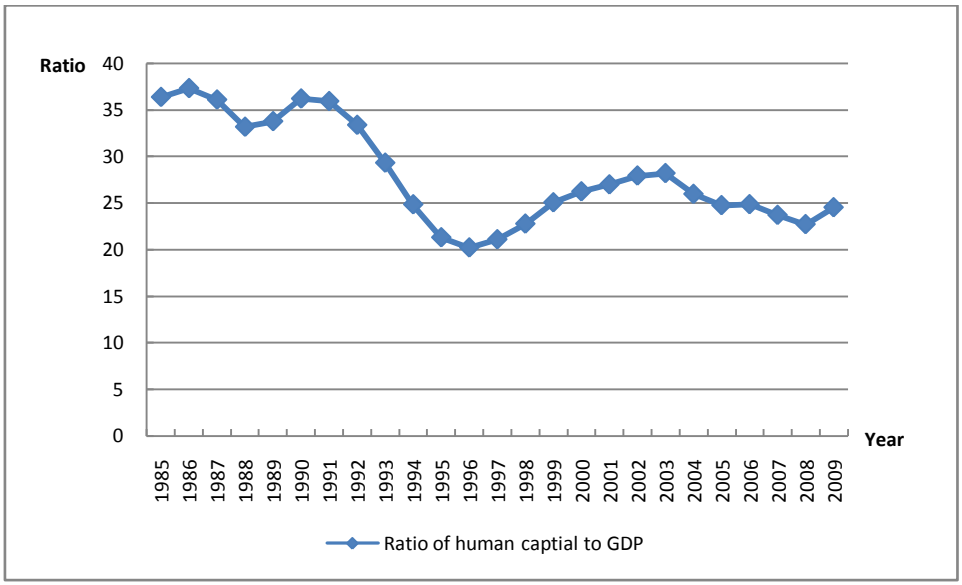


Figure HeN-1.2 Ratio of Human Capital to GDP for Henan

Real human capital calculated by five categories shows different trends over time. We calculate the real values here using CPI. Table HeN-1.2 reports the human capital real values for Henan classified by gender and region. The results based on five education categories show that the human capital for Henan during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Henan increases from 1.643 trillion Yuan to 12.575 trillion Yuan (calculated by 1985 comparable price), it has increased by 7 times, the annual growth rate of human capital over this period increases to 8.48%.[69]

From 1985 to 2009, male human capital in Henan increases from 0.987 trillion Yuan to 8.057 trillion Yuan. The human capital for female in Henan increases from 0.656 trillion Yuan to 4.517 trillion Yuan. During the same period, the annual growth rates of human capital are 8.75% and 8.04% for

[69] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

male and female respectively. The gender gap in the estimated human capital increases from 0.33 trillion Yuan in 1985 to 3.54 trillion Yuan in 2009. In 2009, the male human capital is about 1.78 times the amount of that for female in Henan.

From 1985 to 2009, rural human capital in Henan increases from 1.15 trillion Yuan to 4.353 trillion Yuan; the urban human capital in Henan increases from 0.493 trillion Yuan to 8.222 trillion Yuan. During the same period, the annual growth rates of human capital are 5.55% and 11.73 % for rural and urban areas respectively. The region gap in the estimated human capital increases from -0.657 trillion Yuan in 1985 to 3.869 trillion Yuan in 2009. In 2009, the urban human capital is about 1.89 times the amount of that for rural in Henan.

Table HeN-1.2 Real Human Capital by Gender and Region for Henan[70]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	1,643	987	656	493	1,150
1986	1,786	1,079	708	530	1,256
1987	1,975	1,200	775	580	1,395
1988	1,872	1,142	731	547	1,325
1989	1,806	1,107	699	561	1,245
1990	2,111	1,303	808	670	1,441
1991	2,306	1,427	879	733	1,573
1992	2,510	1,558	952	792	1,718
1993	2,588	1,617	972	827	1,761
1994	2,347	1,474	873	744	1,603
1995	2,329	1,459	870	745	1,584

[70] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1996	2,417	1,522	895	895	1,522
1997	2,704	1,703	1,001	1,086	1,618
1998	3,185	2,017	1,168	1,354	1,831
1999	3,782	2,404	1,378	1,701	2,081
2000	4,463	2,845	1,617	2,041	2,422
2001	4,974	3,172	1,801	2,418	2,556
2002	5,594	3,571	2,024	2,816	2,778
2003	6,314	4,032	2,280	3,312	3,002
2004	6,857	4,398	2,459	3,708	3,149
2005	7,912	5,060	2,852	4,386	3,526
2006	9,127	5,856	3,270	5,320	3,807
2007	10,003	6,419	3,586	6,056	3,947
2008	10,722	6,864	3,858	6,742	3,980
2009	12,575	8,057	4,517	8,222	4,353

Figure HeN-1.3 shows that the real human capital for male and female for Henan both exhibit a rising trend from 1985 to 2009. Before 1996, different human capital all grow quite slowly, starting from 1996, both the growth of human capital for male and female accelerate, the gender gap, which has been fairly stable, then appears to be expanding.

The situation that the human capital for male is higher than that for female is consistent with that at the national level. One reason is the older retirement age for male; male has longer time to generate income from market, and thus end up with a higher lifetime income relative to female.[71] Also the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[71] To ensure the consistent of urban and rural, we define the working age for male and female in rural area as 60 and 55.

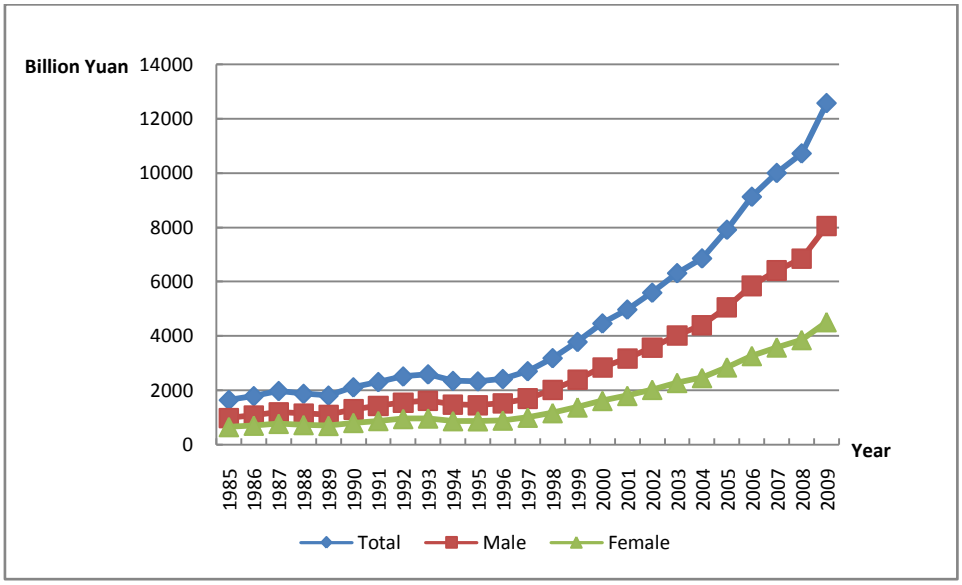


Figure HeN-1.3 Real Human Capital by Gender for Henan

Figure HeN-1.4 shows the human capital real values for urban and rural separately. Before 2002, the rural human capital is larger than that for urban. Starting from 2002, however, the urban human capital is rising much more rapidly while rural human capital keeps growing quite slowly, which results in an increasingly larger gap between rural and urban. Thus we could see that human capital changes almost simultaneously with urban human capital. Moreover, the gap shows a trend of further expansion as the human capital for urban increases much faster in later periods.

One reason that results in the gap between rural and urban is the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another one is the education gap between the rural and urban population.

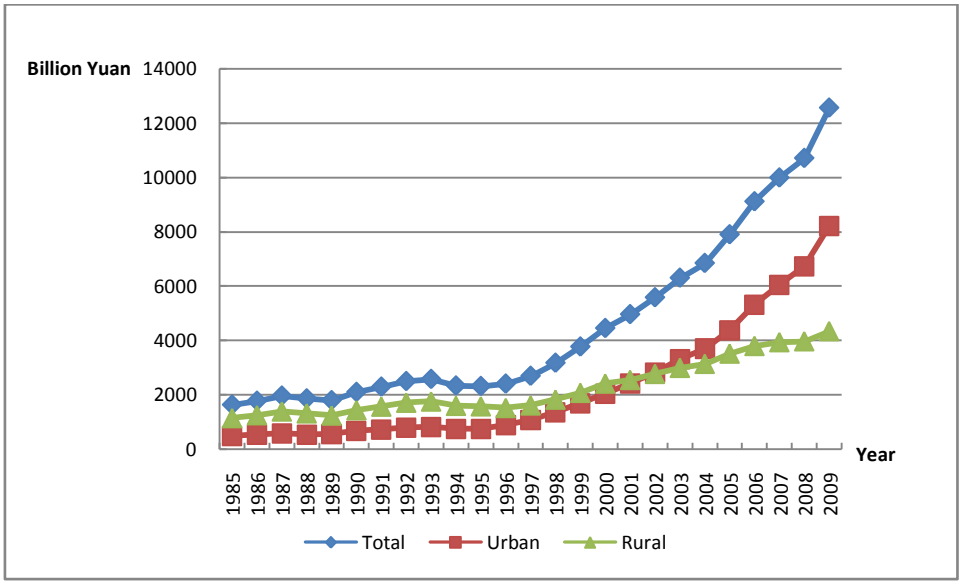


Figure HeN-1.4 Real Human Capital by Region for Henan

Human capital indices reflect the trend of human capital directly. Table HeN-1.3 reports a set of indices of real human capital classified by gender and region for Henan from 1985 to 2009. We calculate them using 1985 as the base year and setting its value at 100.

Table HeN-1.3 Real Human Capital Index for Henan (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	108.74	109.26	107.96	107.63	109.22
1987	120.22	121.54	118.20	117.70	121.30
1988	113.97	115.63	111.44	111.04	115.22
1989	109.97	112.12	106.64	113.95	108.26
1990	128.51	131.98	123.23	135.99	125.30
1991	140.36	144.55	134.04	148.70	136.78
1992	152.79	157.77	145.28	160.74	149.39
1993	157.58	163.75	148.27	167.97	153.13
1994	142.88	149.32	133.21	151.04	139.39
1995	141.76	147.75	132.66	151.16	137.74

1996	147.12	154.17	136.51	181.61	132.35
1997	164.62	172.49	152.77	220.46	140.70
1998	193.90	204.29	178.20	274.87	159.22
1999	230.24	243.49	210.28	345.31	180.96
2000	271.70	288.16	246.73	414.33	210.61
2001	302.81	321.28	274.81	490.86	222.26
2002	340.56	361.69	308.77	571.66	241.57
2003	384.39	408.39	347.83	672.35	261.04
2004	417.45	445.46	375.13	752.74	273.83
2005	481.68	512.51	435.09	890.38	306.61
2006	555.64	593.13	498.86	1,079.98	331.04
2007	608.97	650.16	547.06	1,229.40	343.22
2008	652.75	695.23	588.56	1,368.66	346.09
2009	765.55	816.06	689.09	1,669.10	378.52

Figure HeN-1.5 shows the index of real human capital. It's obvious that the human capital has been rising much more rapidly since 1997.

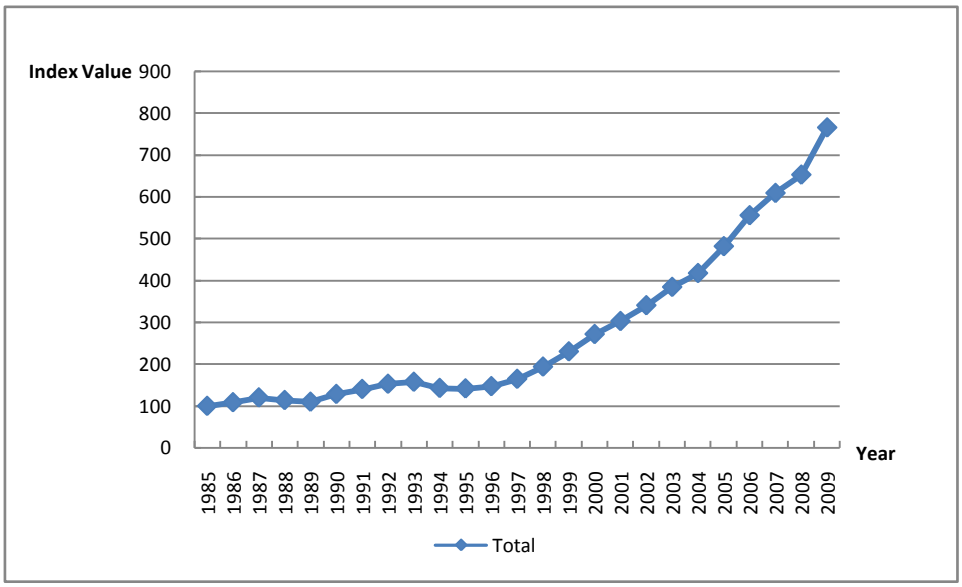


Figure HeN-1.5 Real Human Capital Index for Henan

2. Human capital per capita

The increase in the human capital can be caused by population growth, demographic change (like age at retirement), urbanization (like region migration), higher educational attainment, higher return to education, higher return to on-the-job training, etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital to non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it could exclude the population factor influence to a large extent, thus it could serve as a better indicator of the average human capital.

Table HeN-2.1 presents the trends of human capital per capita measured in nominal and real terms for Henan classified by gender. Human capital per capita for male remains higher than that for female. Real human capital per capita for male increases from 27,499 Yuan to 180,389 Yuan, increasing by around 6 times; real human capital per capita for female increases from 19,898 Yuan to 112,560 Yuan, increasing by around 6 times. From 1985 to 2009, the annual growth rate is 7.84% for male, and 7.22% for female.

Table HeN-2.1 Nominal and Real Human Capital Per Capita by Gender for Henan

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	23.86	27.50	19.90	23.86	27.50	19.90
1986	26.84	31.06	22.23	25.55	29.56	21.18
1987	30.05	34.94	24.68	26.98	31.34	22.19

1988	34.10	39.72	27.90	25.70	29.89	21.08
1989	38.61	44.97	31.54	24.28	28.27	19.84
1990	43.47	50.74	35.30	27.12	31.66	22.03
1991	49.02	57.31	39.66	30.09	35.15	24.39
1992	55.22	64.68	44.52	32.46	37.96	26.24
1993	62.41	73.61	49.77	33.21	39.11	26.55
1994	70.27	83.43	55.42	29.95	35.52	23.69
1995	78.43	93.39	61.81	28.70	34.11	22.66
1996	91.42	107.54	72.82	30.08	35.34	24.02
1997	105.39	123.76	84.10	33.44	39.24	26.74
1998	120.61	142.63	95.17	39.17	46.27	30.97
1999	138.45	164.17	108.64	46.27	54.82	36.37
2000	158.78	191.90	121.70	53.47	64.54	41.06
2001	183.59	221.81	140.78	61.18	73.87	46.96
2002	207.06	249.91	158.91	68.73	82.94	52.80
2003	236.94	285.28	182.36	77.28	93.01	59.45
2004	271.80	326.98	208.85	83.94	101.01	64.45
2005	310.70	377.29	236.67	93.83	113.98	71.42
2006	363.83	442.74	275.93	108.10	131.58	81.90
2007	420.85	512.18	319.24	118.32	144.02	89.71
2008	483.42	587.44	367.47	126.67	154.01	96.26
2009	563.36	685.33	427.79	148.30	180.39	112.56

Figure HeN-2.1 shows that the real human capital per capita for male is higher than that for female for Henan from 1985 to 2009. Before 1997, different human capital all grow quite slowly, starting from 1997, both the growth of human capital for male and female accelerate, the gender gap is fairly stable and appears to be expanding.

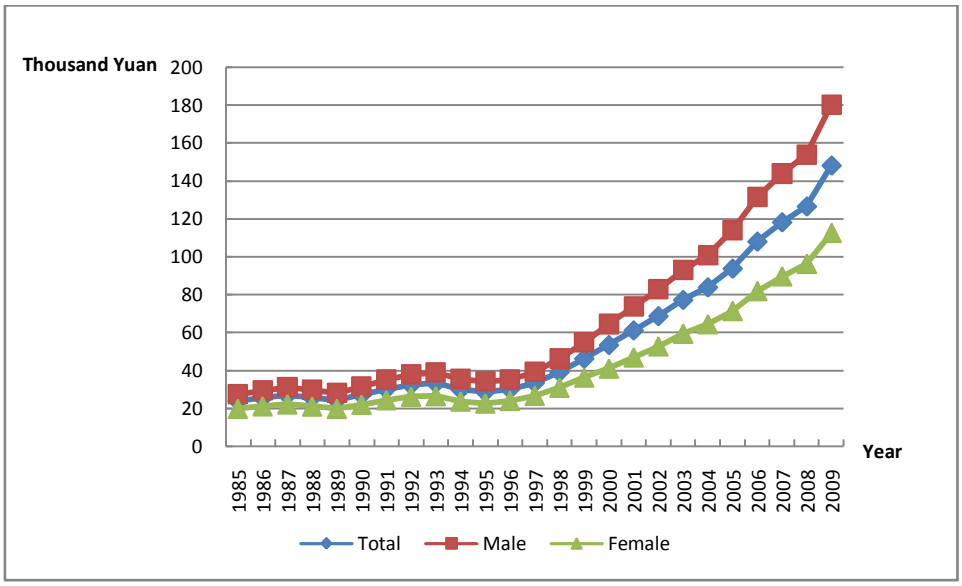


Figure HeN-2.1 Real Human Capital Per Capita by Gender for Henan

Table HeN-2.2 reports the results of human capital per capita measured in nominal and real terms for Henan classified by region separately. From 1986 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The real human capital per capita for urban increases from 47,848 Yuan to 254,426 Yuan; the real human capital per capita for rural increases from 19,641 Yuan to 83,026 Yuan. The human capital per capita in urban areas grows much faster than the one for rural.

Table HeN-2.2 Nominal and Real Human Capital Per Capita by Region for Henan

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	23.86	47.85	19.64	23.86	47.85	19.64
1986	26.84	53.77	22.05	25.55	50.35	21.14
1987	30.05	60.38	24.65	26.98	52.44	22.44
1988	34.10	68.65	27.87	25.70	49.08	21.48

1989	38.61	78.10	31.32	24.28	48.59	19.79
1990	43.47	88.39	35.04	27.12	54.72	21.94
1991	49.02	100.91	39.09	30.09	59.44	24.48
1992	55.22	114.45	43.63	32.46	62.59	26.56
1993	62.41	129.49	49.08	33.21	64.04	27.08
1994	70.27	145.36	55.01	29.95	56.42	24.58
1995	78.43	162.93	61.21	28.70	54.10	23.51
1996	91.42	198.16	67.14	30.08	60.09	23.26
1997	105.39	227.65	74.97	33.44	67.41	25.00
1998	120.61	258.69	83.36	39.17	78.25	28.62
1999	138.45	293.58	92.99	46.27	91.93	32.88
2000	158.78	334.64	105.95	53.47	105.74	37.77
2001	183.59	373.63	119.07	61.18	117.23	42.15
2002	207.06	408.95	132.55	68.73	128.57	46.65
2003	236.94	462.77	147.78	77.28	143.06	51.29
2004	271.80	520.38	166.59	83.94	152.63	54.85
2005	310.70	591.27	186.90	93.83	169.86	60.28
2006	363.83	680.87	210.62	108.10	193.28	66.92
2007	420.85	770.03	236.70	118.32	207.36	71.35
2008	483.42	866.85	264.57	126.67	219.18	73.92
2009	563.36	994.40	298.36	148.30	254.43	83.03

Figure HeN-2.2 reflects the trend of human capital per capita measured in real terms and classified by region. As is shown in the graph, the size of the difference between urban and rural expands rapidly after 1997, this is partly due to the long-term stagnant status in the rural area before 2002. Based on five education categories, the ratio of urban to rural increases from 2.44 in 1985 to 3.06 in 2009, which indicates a rising size of region gap on human capital per capita. From 1985 to 2009, the annual growth rate is 6.96% for the urban area, and 6.01% for the rural area.

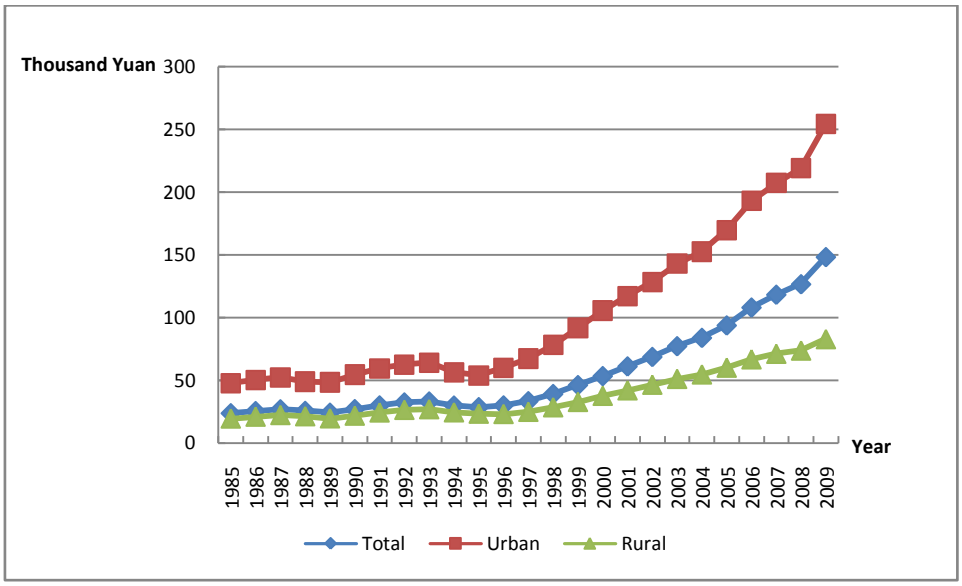


Figure HeN-2.2 Real Human Capital Per Capita by Region for Henan

Similarly, we construct a set of real human capital per capita indices with its corresponding value in 1985 set as 100.

Figure HeN-2.3 shows the human capital per capita index for Henan. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

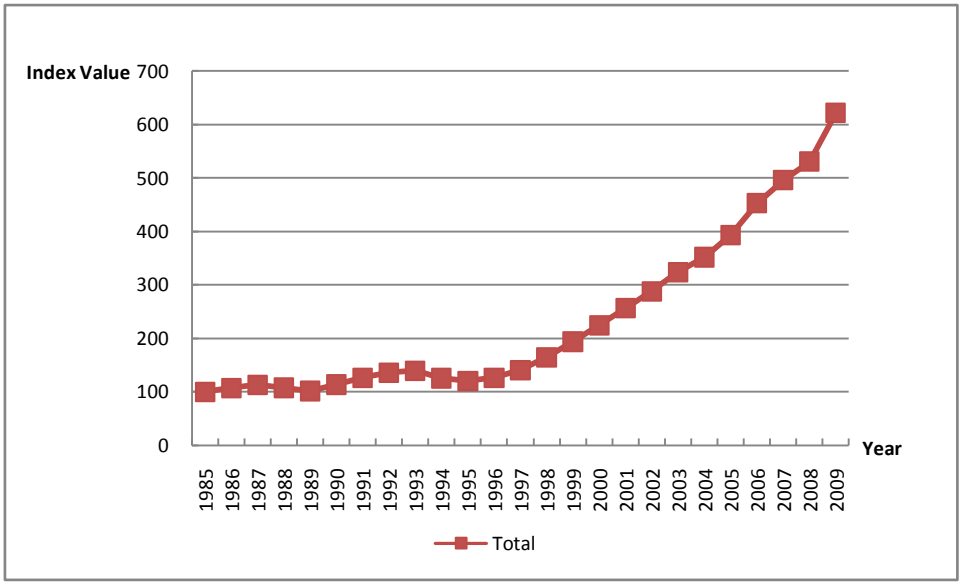


Figure HeN-2.3 Real Human Capital Per Capita Index for Henan

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimated approach of labor force human capital is the same as that of human capital we illustrates above. Based on the income parameter for Henan and the discount rate valued at 4.58%，the labor force human capital for Henan is reported in Table HeN-3.1. The real values in this table are calculated by using CPI as the deflator with respect to nominal values. We also calculate the ratio of labor force human capital measured in nominal terms to nominal GDP. The results are reported in the last column of Table HeN-3.1.

Table HeN-3.1 Labor Force Human Capital and Nominal GDP for Henan

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	721		721		45	15.97
1986	840		801		50	16.70
1987	1,007		906		61	16.52
1988	1,125		851		75	15.02
1989	1,331		838		85	15.65
1990	1,629		1,017		93	17.42
1991	1,764		1,087		105	16.87

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1992	1,984		1,173		128	15.50
1993	2,234		1,196		166	13.45
1994	2,496		1,074		222	11.26
1995	2,891		1,070		299	9.68
1996	3,027		1,014		363	8.33
1997	3,415		1,103		404	8.45
1998	3,896		1,290		431	9.04
1999	4,396		1,499		452	9.73
2000	5,065	4,896	1,739	1,679	505	10.02
2001	5,556	5,497	1,885	1,865	553	10.04
2002	6,304	6,247	2,126	2,107	604	10.44
2003	7,450	7,402	2,467	2,451	687	10.85
2004	8,500	8,479	2,664	2,657	855	9.94
2005	10,607	10,569	3,246	3,233	1,059	10.02
2006	12,127	12,097	3,661	3,649	1,236	9.81
2007	13,861	13,822	3,963	3,950	1,501	9.23
2008	15,643	15,609	4,166	4,155	1,802	8.68
2009	18,038	17,999	4,809	4,797	1,948	9.26

Note: The ratio of human capital to GDP is based on the current values for that year.

The trends of labor force human capital in both real and nominal terms for Henan are presented in Figure HeN-3.1. From 1985 to 2009, labor force human capital keeps rising.

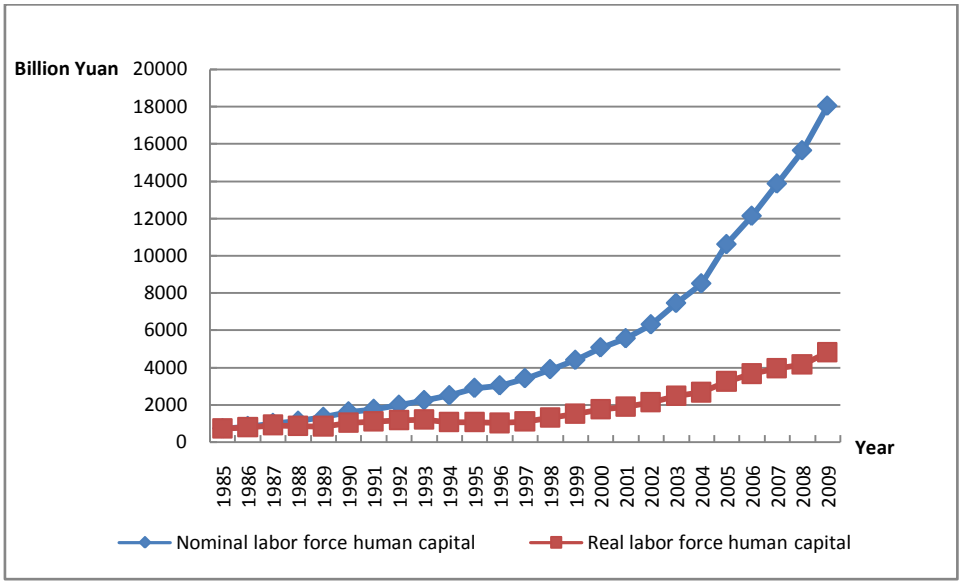


Figure HeN-3.1 Nominal and Real Labor Force Human Capital for Henan

Similar to the analysis of human capital, in order to get a sense of the magnitude of the labor force human capital, we construct the ratio of labor force human capital measured in nominal terms to nominal GDP. It's shown in Figure HeN-3.2. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of annual labor force human capital is much higher than that of GDP. The ratio of human capital to GDP in Henan decreases at a considerable rate from 1990 to 1996. From 1996 to 2003, the ratio increases slightly, but it decreases overall again from 2003 to 2009.

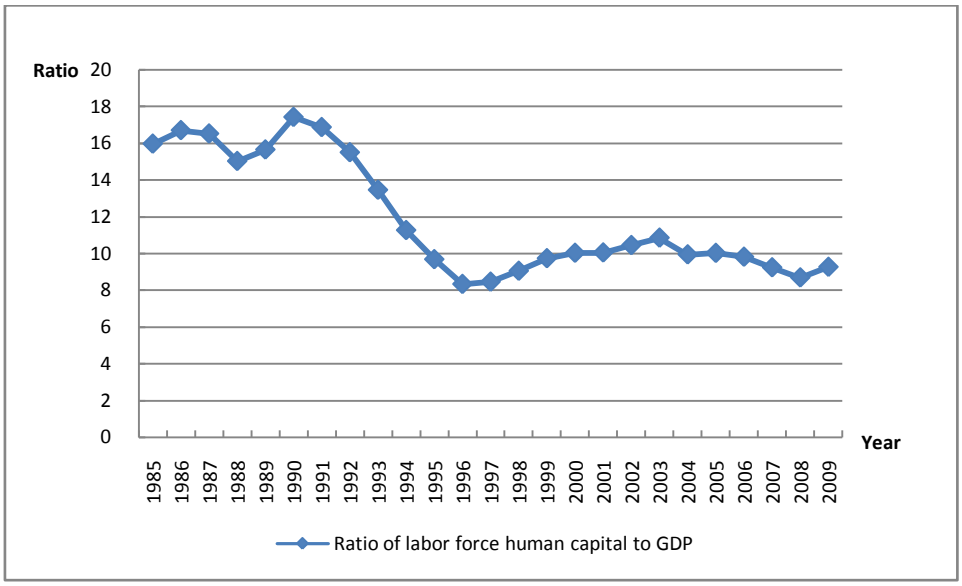


Figure HeN-3.2 Ratio of Labor Force Human Capital to GDP for Henan

Table HeN-3.2 shows the labor force human capital real values for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table HeN-3.2 Nominal and Real Labor Force Human Capital by Region for Henan

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	721	178	543	721	178	543
1986	840	209	631	801	196	605
1987	1,007	251	756	906	218	688
1988	1,125	294	831	851	210	641
1989	1,331	361	971	838	224	614
1990	1,629	449	1,180	1,017	278	739

1991	1,764	487	1,277	1,087	287	800
1992	1,984	553	1,431	1,173	302	871
1993	2,234	627	1,607	1,196	310	887
1994	2,496	701	1,795	1,074	272	802
1995	2,891	790	2,101	1,070	263	807
1996	3,027	814	2,213	1,014	247	767
1997	3,415	952	2,463	1,103	282	821
1998	3,896	1,155	2,741	1,290	349	941
1999	4,396	1,394	3,002	1,499	437	1,062
2000	5,065	1,664	3,401	1,739	526	1,213
2001	5,556	2,034	3,522	1,885	638	1,247
2002	6,304	2,468	3,836	2,126	776	1,350
2003	7,450	3,134	4,316	2,467	969	1,498
2004	8,500	3,756	4,744	2,664	1,102	1,562
2005	10,607	4,948	5,659	3,246	1,421	1,825
2006	12,127	5,698	6,429	3,661	1,618	2,043
2007	13,861	6,691	7,170	3,963	1,802	2,161
2008	15,643	7,705	7,938	4,166	1,948	2,218
2009	18,038	9,366	8,672	4,809	2,396	2,413

Figure HeN-3.3 shows the labor force human capital real values for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The rural labor force human capital is larger than the one for urban during 1985 and 2009, but the gap is shrinking because the labor force urban human capital grows rapidly than the one for rural, especially after year 1997.

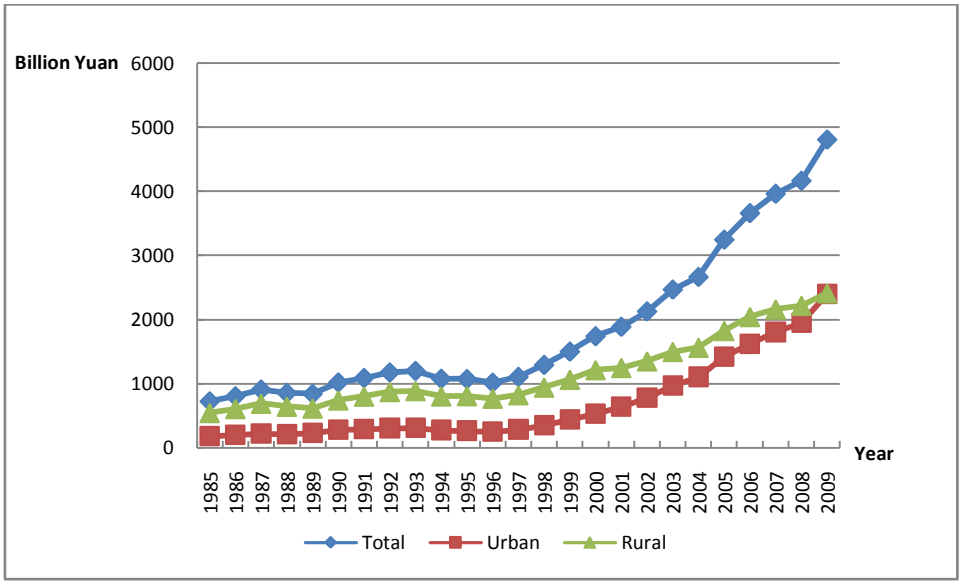


Figure HeN-3.3 Real Labor Force Human Capital by Region for Henan

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table HeN-3.3 reports the real average labor force human capital classified by gender. And the average labor force human capital for female is smaller than that for male. More specifically, the number for male is about 1.74 times that for female in 2009.

Table HeN-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Henan

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	18.19	20.99	15.18	18.19	20.99	15.18
1986	20.50	23.84	16.93	19.54	22.71	16.14
1987	23.09	26.92	18.98	20.78	24.21	17.10
1988	26.27	30.77	21.38	19.87	23.25	16.20
1989	29.86	34.99	24.19	18.80	22.02	15.23
1990	33.73	39.56	27.19	21.06	24.70	16.98
1991	37.53	44.21	30.08	23.12	27.21	18.56
1992	41.79	49.36	33.37	24.72	29.15	19.79
1993	46.67	55.53	36.87	24.99	29.72	19.80
1994	51.71	61.97	40.50	22.26	26.64	17.47
1995	57.07	68.71	44.42	21.11	25.39	16.47
1996	61.54	72.57	48.91	20.61	24.27	16.41
1997	68.97	81.44	54.68	22.28	26.29	17.69
1998	77.49	91.97	60.98	25.67	30.44	20.22
1999	86.67	103.20	67.89	29.54	35.14	23.16
2000	99.06	121.40	75.12	34.00	41.63	25.81
2001	111.96	137.86	84.36	37.99	46.74	28.66
2002	126.53	156.68	94.52	42.67	52.80	31.91
2003	145.34	180.57	107.85	48.12	59.76	35.74
2004	164.46	204.89	121.40	51.54	64.16	38.09
2005	189.76	237.06	139.27	58.07	72.50	42.67
2006	216.31	271.74	156.96	65.30	82.00	47.42
2007	247.25	310.41	178.85	70.69	88.69	51.18
2008	279.21	350.51	201.51	74.36	93.28	53.70
2009	323.43	405.71	233.04	86.23	108.17	62.17

Table HeN-3.4 reports the real average labor force human capital classified by region separately. The average labor force human capital is

much smaller in rural area than in urban area. The number for urban is about 1.99 times that for rural.

Table HeN-3.4 Nominal and Real Average Labor Force Human Capital by Region for Henan

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	18.19	31.51	15.98	18.19	31.51	15.98
1986	20.50	35.46	17.98	19.54	33.20	17.23
1987	23.09	39.73	20.26	20.78	34.51	18.44
1988	26.27	45.64	22.84	19.87	32.63	17.61
1989	29.86	52.41	25.71	18.80	32.61	16.25
1990	33.73	59.95	28.87	21.06	37.12	18.08
1991	37.53	66.68	32.19	23.12	39.28	20.16
1992	41.79	74.03	35.76	24.72	40.49	21.77
1993	46.67	82.83	39.85	24.99	40.96	21.99
1994	51.71	91.41	44.15	22.26	35.48	19.73
1995	57.07	100.55	49.10	21.11	33.39	18.87
1996	61.54	108.80	53.08	20.61	32.99	18.39
1997	68.97	121.84	59.08	22.28	36.08	19.70
1998	77.49	136.23	65.63	25.67	41.21	22.54
1999	86.67	151.13	72.27	29.54	47.32	25.56
2000	99.06	174.56	81.84	34.00	55.16	29.17
2001	111.96	195.16	89.96	37.99	61.23	31.85
2002	126.53	218.02	99.45	42.67	68.54	35.00
2003	145.34	249.48	111.61	48.12	77.12	38.73
2004	164.46	276.47	124.49	51.54	81.09	40.99
2005	189.76	315.23	140.79	58.07	90.56	45.41
2006	216.31	350.37	161.64	65.30	99.46	51.36
2007	247.25	392.15	183.91	70.69	105.60	55.44
2008	279.21	434.66	207.48	74.36	109.90	57.97
2009	323.43	504.35	233.45	86.23	129.04	64.96

Chapter 14 Human capital for Hubei

1. Total human capital

Human capital stocks of Hubei are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table HB-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[72]

Table HB-1.1 Nominal and Real Human Capital, Nominal GDP for Hubei

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,221		1,221		40	30.82
1986	1,397		1,326		44	31.59
1987	1,610		1,421		52	31.09
1988	1,901		1,411		63	30.34
1989	2,172		1,388		72	30.29
1990	2,493		1,531		82	30.24
1991	2,827		1,654		91	30.95
1992	3,193		1,708		109	29.34
1993	3,666		1,657		133	27.65
1994	4,166		1,498		170	24.49

[72] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	4,744		1,421		211	22.49
1996	5,547		1,517		250	22.19
1997	6,355		1,684		286	22.25
1998	7,391		1,987		311	23.73
1999	8,505		2,338		323	26.34
2000	9,889	9,926	2,732	2,741	355	27.89
2001	11,016	11,064	3,036	3,048	388	28.39
2002	12,164	12,218	3,359	3,373	421	28.87
2003	13,470	13,535	3,639	3,655	476	28.31
2004	14,801	14,884	3,810	3,829	563	26.27
2005	16,637	16,725	4,161	4,181	659	25.25
2006	18,852	18,958	4,640	4,665	762	24.75
2007	21,583	21,734	5,066	5,099	933	23.12
2008	24,834	25,028	5,492	5,534	1,133	21.92
2009	28,593	28,837	6,352	6,404	1,296	22.06

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure HB-1.1 graphs real and nominal human capital for Hubei in Table HB-1.1 As shown, both the nominal and real human capital rise steadily, but the nominal human capital grows faster than the real one.

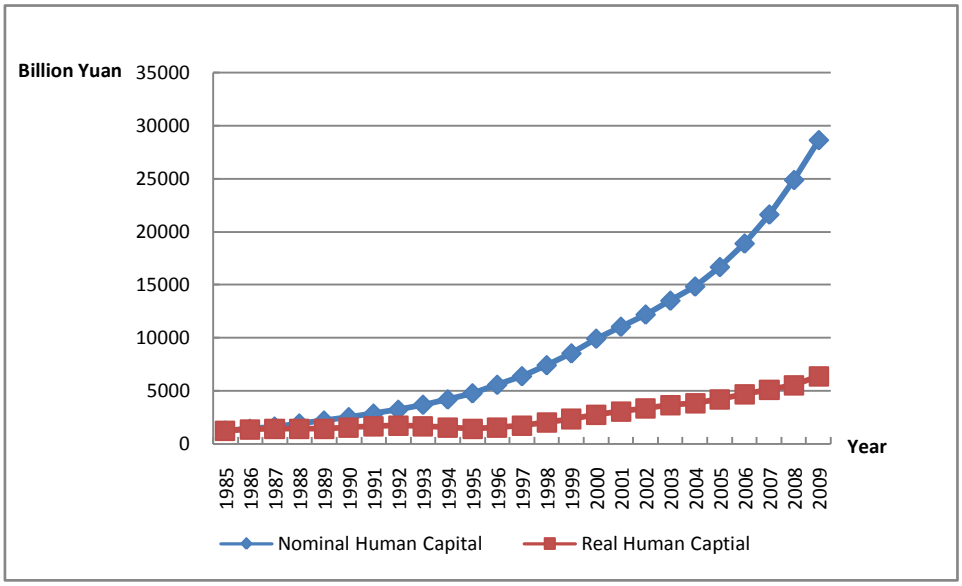


Figure HB-1.1 Nominal and Real Human Capital for Hubei

Table HB-1.1 presents the ratio of nominal human capital to nominal GDP.[73] The ratio reflects human capital's influence on sustainable growth of GDP. As shown in Figure HB-1.2, nominal human capital is substantially higher than nominal GDP for Hubei. From 1985 to 1991, the ratio approximately remains the same, and then keeps dropping steadily between 1991 and 1996. After 1996, it increases gradually and then decreases from 2002 to 2009.

[73] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

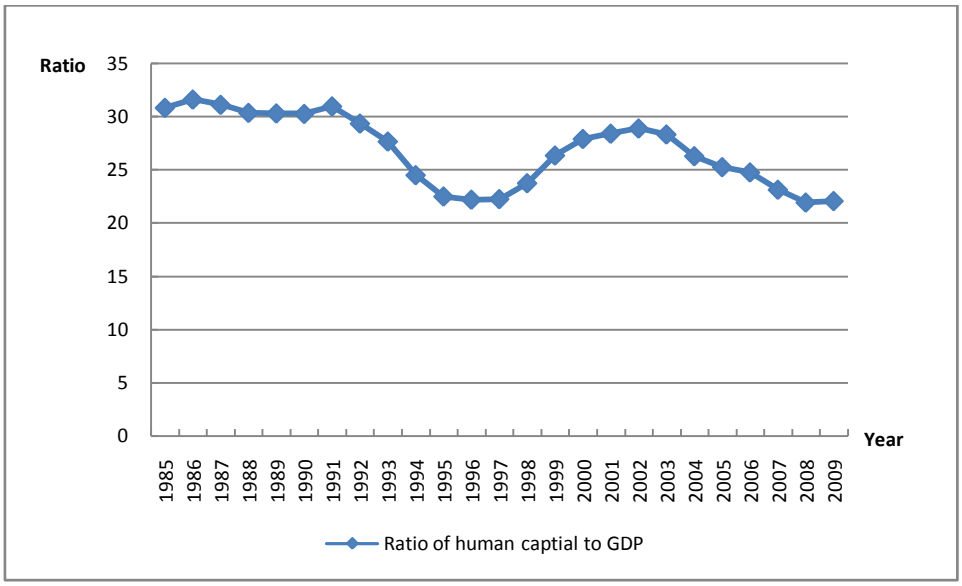


Figure HB-1.2 Ratio of Human Capital to GDP for Hubei

Table HB-1.2 shows real human capital for Hubei by gender and region. The results based on five education categories show that the human capital for Hubei during 1985 to 2009 grows rapidly. More specifically, the human capital for Hubei increases from 1.22 trillion Yuan to 6.35 (calculated by 1985 price). The annual growth rate of human capital over this period increases to 6.87%.[74]

From 1985 to 2009, male human capital in Hubei increases from 0.740 trillion Yuan to 4.174, and the human capital for female in Hubei increases from 0.481 trillion Yuan to 2.177. During the same period, the annual growth rate of human capital is 7.21% and 6.29 % for male and female respectively. The gender gap in the estimated human capital increases from 0.259 trillion Yuan in 1985 to 1.997 in 2009. In 2009, the male human capital is about twice as big as that for female in Hubei.

From 1985 to 2009, rural human capital in Hubei increases from 0.659 trillion Yuan to 1.735; the urban human capital in Hubei increases from

[74] The annual growth rate here is the mean of the annual log growth rate.

0.562 trillion Yuan to 4.617. During the same period, the annual growth rate of human capital is 4.03% and 8.77% for rural and urban areas respectively.

The region gap in the estimated human capital increases from -0.097 trillion Yuan in 1985 to 2.882 in 2009. In 2009, the urban human capital is about 2.7 times as big as rural in Hubei.

Table HB-1.2 Real Human Capital by Gender and Region for Hubei[75]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	1,221	740	481	562	659
1986	1,326	803	523	615	711
1987	1,421	871	550	673	748
1988	1,411	875	536	703	707
1989	1,388	867	521	722	666
1990	1,531	962	569	808	723
1991	1,654	1,044	610	867	786
1992	1,708	1,082	626	893	815
1993	1,657	1,058	599	886	772
1994	1,498	963	536	801	697
1995	1,421	910	512	765	657
1996	1,517	974	544	860	657
1997	1,684	1,088	596	989	695
1998	1,987	1,287	700	1,225	762
1999	2,338	1,518	820	1,499	839
2000	2,732	1,773	959	1,787	945
2001	3,036	1,962	1,074	1,998	1,038
2002	3,359	2,177	1,183	2,238	1,121
2003	3,639	2,357	1,282	2,438	1,201
2004	3,810	2,457	1,353	2,576	1,234
2005	4,161	2,724	1,437	2,830	1,331

[75] Discrepancies are due to rounding errors.

Year	Total	Male	Female	Urban	Rural
2006	4,640	3,042	1,599	3,188	1,452
2007	5,066	3,324	1,742	3,538	1,528
2008	5,492	3,600	1,892	3,927	1,565
2009	6,352	4,174	2,177	4,617	1,735

Figure HB-1.3 shows that real human capital by five education categories accelerates during 1996-2009. One possible reason that men's real human capital is higher than women's is because the men generally retire later than women in China (age 55 vs. age 60 for men based on China Labor Law). Hence, men generally have a longer work history and more life-time earnings than women. Another possibility could be that men typically have more education than women. It is also noteworthy that the male-female income gap has been widening. The results based on six education categories show similar trends.

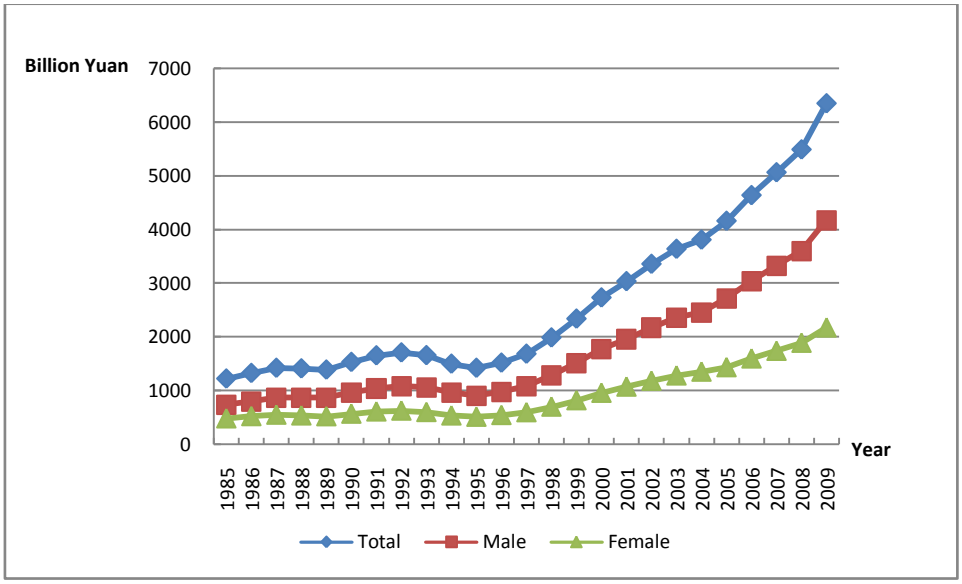


Figure HB-1.3 Real Human Capital by Gender for Hubei

Figure HB-1.4 shows the real human capital for urban and rural separately. Before 1988, the rural human capital is larger than the urban human capital. Since 1996, however, the real human capital in the urban area has been rising fast, while the real human capital in the rural area grows quite slowly. As a result, the region gap has been enlarged.

There are several possible reasons for such a trend. First, in the early years, the rural population is significantly larger than the urban population, and thus has larger amount of human capital. This is changed in later years as a result of rapid urbanization and a large scale rural-to-urban migration. Second, urban area usually has more education than rural.

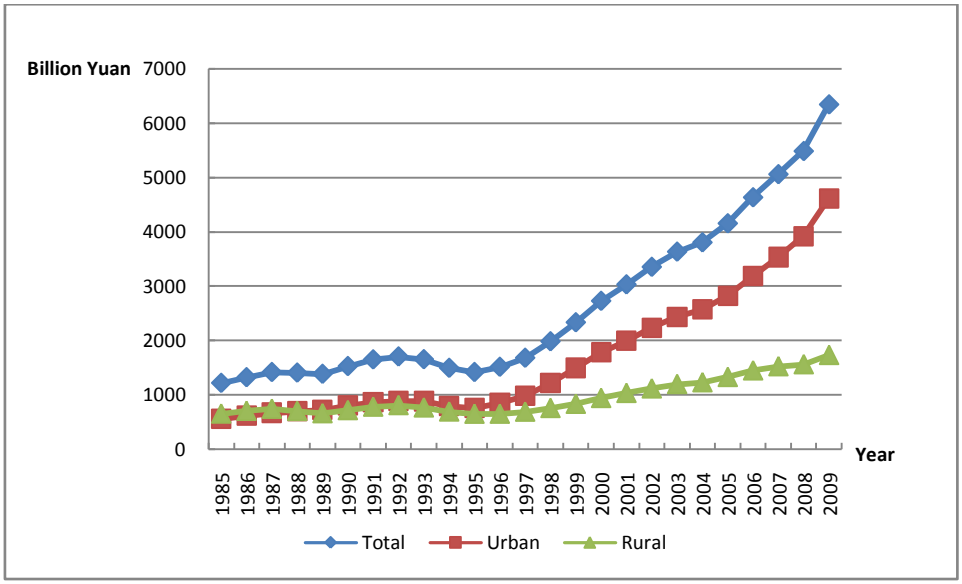


Figure HB-1.4 Real Human Capital by Region for Hubei

Finally we calculate real human capital indices using 1985 as the base year. The results for each group are reported in Table HB-1.3.

Table HB-1.3 Real Human Capital Index for Hubei (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	108.56	108.44	108.71	109.47	107.78
1987	116.40	117.70	114.38	119.86	113.45
1988	115.52	118.17	111.41	125.19	107.28
1989	113.65	117.12	108.29	128.53	100.97
1990	125.38	130.04	118.19	143.88	109.62
1991	135.43	141.01	126.83	154.40	119.26
1992	139.87	146.17	130.16	159.01	123.57
1993	135.72	142.93	124.59	157.62	117.06
1994	122.68	130.05	111.31	142.54	105.75
1995	116.38	122.90	106.32	136.08	99.59
1996	124.24	131.54	112.99	153.04	99.70
1997	137.89	146.97	123.88	176.09	105.34
1998	162.72	173.83	145.52	218.05	115.58
1999	191.44	205.08	170.42	266.82	127.21
2000	223.77	239.54	199.29	318.08	143.39
2001	248.63	265.05	223.22	355.64	157.44
2002	275.08	294.11	245.96	398.36	170.03
2003	298.01	318.51	266.49	433.96	182.16
2004	312.01	331.96	281.31	458.53	187.17
2005	340.76	368.09	298.59	503.74	201.88
2006	379.99	411.07	332.36	567.46	220.23
2007	414.87	449.13	362.11	629.76	231.76
2008	449.76	486.42	393.35	699.00	237.37
2009	520.19	563.98	452.55	821.82	263.16

Figure HB-1.5 shows the index of real human capital. It is obvious that the human capital has been rising much more rapidly since 1995.

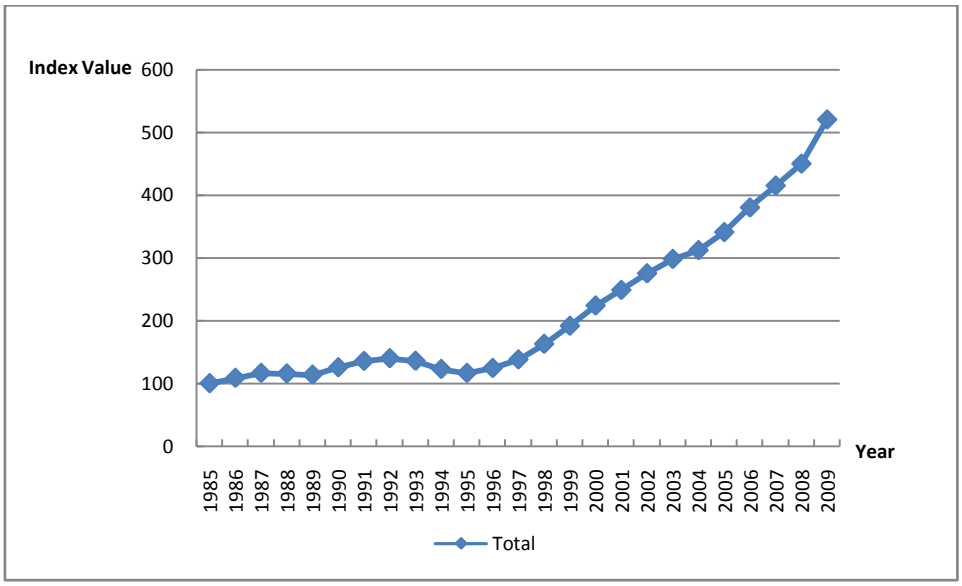


Figure HB-1.5 Real Human Capital Index for Hubei

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table HB-2.1 shows the human capital per capita by gender for Hubei. Based on the 5 education categories, real human capital per capita increases from 31,640 Yuan to 148,060 Yuan for male and from 22,790 Yuan to 89,780 Yuan for female. From 1985 to 2009, the annual growth rate is 6.43% for male and 5.71% for female.

Table HB-2.1 Nominal and Real Human Capital Per Capita by Gender for Hubei

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	27.44	31.64	22.79	27.44	31.64	22.79
1986	30.74	35.48	25.51	29.18	33.68	24.22
1987	34.84	40.89	28.23	30.76	36.09	24.93
1988	40.44	47.64	32.44	30.01	35.32	24.10
1989	45.60	53.76	36.40	29.13	34.34	23.27
1990	50.75	60.00	40.26	31.17	36.84	24.72
1991	56.62	67.08	44.68	33.12	39.22	26.16
1992	63.09	75.27	49.29	33.75	40.23	26.40
1993	71.59	86.05	55.21	32.37	38.85	25.00
1994	80.70	97.39	61.63	29.02	34.96	22.22
1995	90.56	109.00	69.57	27.13	32.61	20.88
1996	105.11	127.18	80.12	28.75	34.73	21.97
1997	120.28	146.28	90.75	31.87	38.71	24.09
1998	139.70	170.01	105.17	37.56	45.66	28.31
1999	160.85	195.81	120.84	44.21	53.79	33.25
2000	186.35	226.31	140.44	51.49	62.50	38.82
2001	207.41	250.99	157.41	57.16	69.16	43.39
2002	230.10	279.52	173.63	63.54	77.21	47.96
2003	256.10	311.81	192.84	69.19	84.23	52.09
2004	283.25	343.82	214.59	72.91	88.54	55.23
2005	315.93	385.64	235.18	79.02	96.48	58.82
2006	358.58	438.88	265.97	88.26	108.08	65.47
2007	411.74	503.75	305.51	96.65	118.24	71.67
2008	473.54	578.70	351.98	104.72	128.03	77.80
2009	545.24	666.43	404.24	121.13	148.06	89.78

Figure HB-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for both male and female. Both exhibit an accelerating growth after 1996. Yet, the male-female gap has been widening.

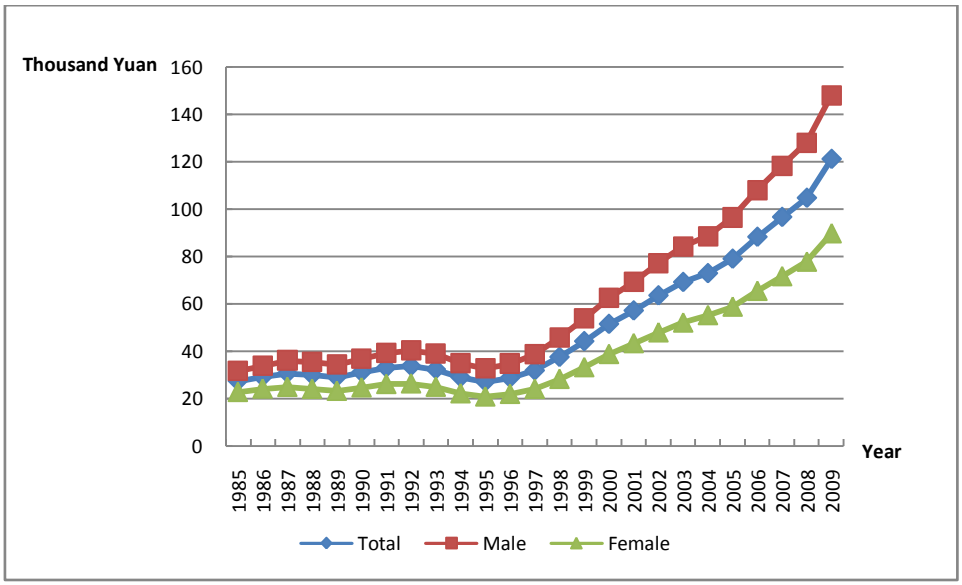


Figure HB-2.1 Real Human Capital Per Capita by Gender for Hubei

Table HB-2.2 reports the results of real human capital per capita for Hubei by region. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The urban human capital per capita increases from 54,740 Yuan to 190,090 Yuan, and the rural human capital per capita increases from 19,230 Yuan to 61,630 Yuan. The human capital per capita in urban areas grows much faster than rural.

Table HB-2.2 Nominal and Real Human Capital Per Capita by Region for Hubei

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	27.44	54.74	19.23	27.44	54.74	19.23
1986	30.74	60.51	21.52	29.18	57.08	20.53
1987	34.84	66.91	24.09	30.76	58.07	21.60
1988	40.44	77.21	26.94	30.01	55.61	20.62
1989	45.60	84.95	30.12	29.13	53.63	19.50
1990	50.75	93.00	33.58	31.17	56.94	20.68
1991	56.62	103.59	37.31	33.12	59.72	22.18
1992	63.09	114.74	41.56	33.75	59.87	22.86
1993	71.59	128.00	46.55	32.37	56.21	21.77
1994	80.70	143.67	52.06	29.02	49.68	19.62
1995	90.56	160.32	58.34	27.13	46.16	18.34
1996	105.11	182.70	65.01	28.75	47.74	18.94
1997	120.28	205.42	72.86	31.87	52.31	20.49
1998	139.70	237.63	81.19	37.56	61.81	23.06
1999	160.85	269.78	90.53	44.21	72.20	26.16
2000	186.35	308.75	102.17	51.49	82.63	30.06
2001	207.41	343.87	112.50	57.16	91.66	33.17
2002	230.10	377.96	124.36	63.54	101.56	36.37
2003	256.10	418.43	136.93	69.19	109.58	39.54
2004	283.25	459.07	151.36	72.91	115.05	41.30
2005	315.93	508.94	168.62	79.02	124.19	44.55
2006	358.58	574.93	189.93	88.26	138.36	49.24
2007	411.74	660.40	212.90	96.65	151.79	52.52
2008	473.54	754.80	238.23	104.72	164.45	54.72
2009	545.24	866.35	268.38	121.13	190.09	61.63

Figure HB-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, both urban and rural exhibit an accelerate growth after 1996. Based on five education categories, the ratio of urban to rural increases from 2.84 in 1985 to 3.08 in 2009, which indicates a rising size of region gap on human capital per capita .

From 1985 to 2009, the annual growth rate is 5.19% for the urban area, and 4.85% for the rural area.

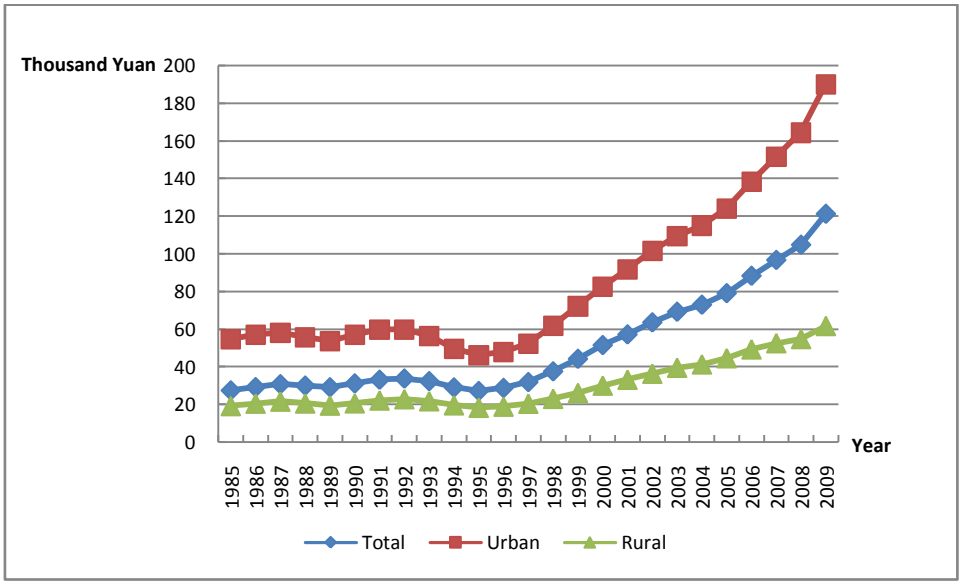


Figure HB-2.2 Real Human Capital Per Capita by Region for Hubei

Figure HB-2.3 shows the real human capital per capita index for Hubei. As seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

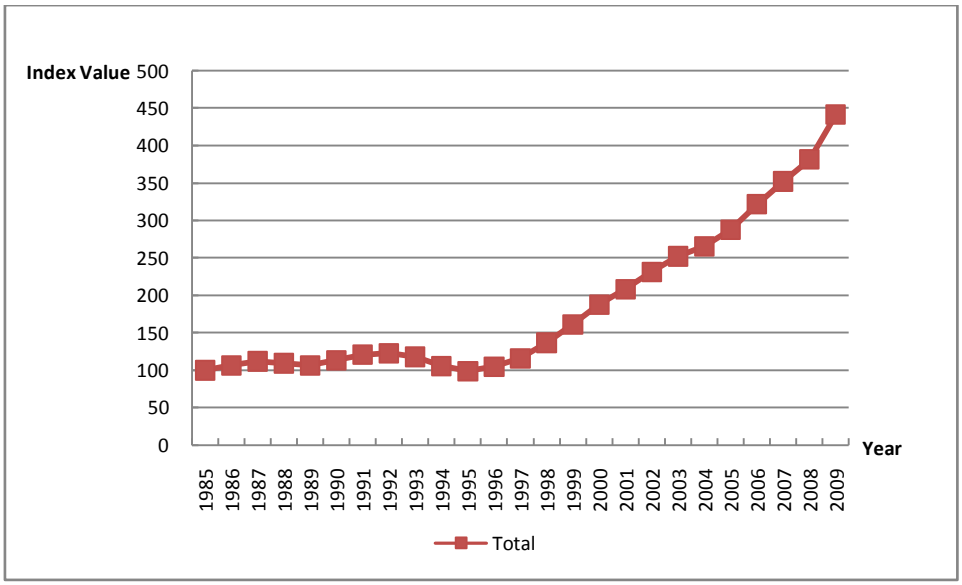


Figure HB-2.3 Real Human Capital Per Capita Index for Hubei

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital among the population who are over 15 years old, not retired and out-of-school. Labor force human capital is estimated in the same way as before. The labor force human capital is reported in Table HB-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table HB-3.1 Labor Force Human Capital and Nominal GDP for Hubei

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	541		541		40	13.66
1986	635		603		44	14.35
1987	749		662		52	14.46
1988	879		655		63	14.03
1989	1,038		664		72	14.47
1990	1,240		761		82	15.04
1991	1,387		813		91	15.19
1992	1,572		843		109	14.45
1993	1,799		815		133	13.57
1994	2,004		723		170	11.78
1995	2,232		671		211	10.58
1996	2,610		717		250	10.44
1997	3,037		808		286	10.63
1998	3,549		958		311	11.40
1999	4,127		1,138		323	12.78

2000	4,855	4,770	1,346	1,323	355	13.69
2001	5,290	5,214	1,466	1,445	388	13.63
2002	5,811	5,750	1,613	1,596	421	13.79
2003	6,471	6,444	1,760	1,752	476	13.60
2004	7,120	7,120	1,844	1,843	563	12.64
2005	8,128	8,124	2,043	2,042	659	12.33
2006	9,072	9,065	2,246	2,243	762	11.91
2007	10,014	10,010	2,366	2,364	933	10.73
2008	11,301	11,299	2,512	2,511	1,133	9.98
2009	13,179	13,176	2,940	2,939	1,296	10.17

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure HB-3.1. Similar to the trend of total human capital, from 1985 to 2009, both nominal and real labor force human capital keep increasing.

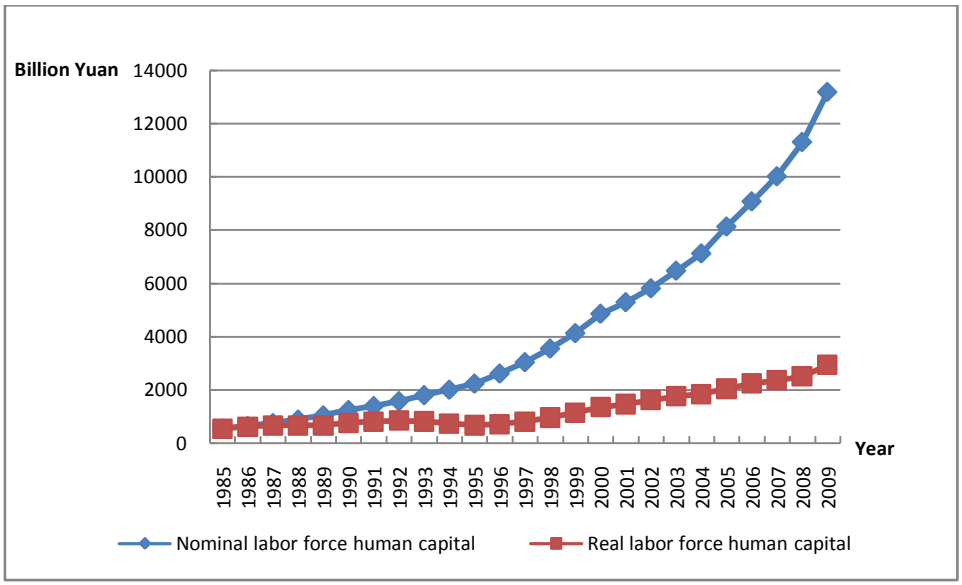


Figure HB-3.1 Nominal and Real Labor Force Human Capital for Hubei

We also calculate the ratio of nominal labor force human capital to nominal GDP. The results are reported in the last column of Table HB-3.1. As before, the ratio could reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure HB-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for total human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio of nominal labor force human capital to nominal GDP increases slightly from 1985 to 1991, followed by a drastic drop from 1992 to 1996. After a rebound from 1997 to 2003, it experiences a rapid drop again.

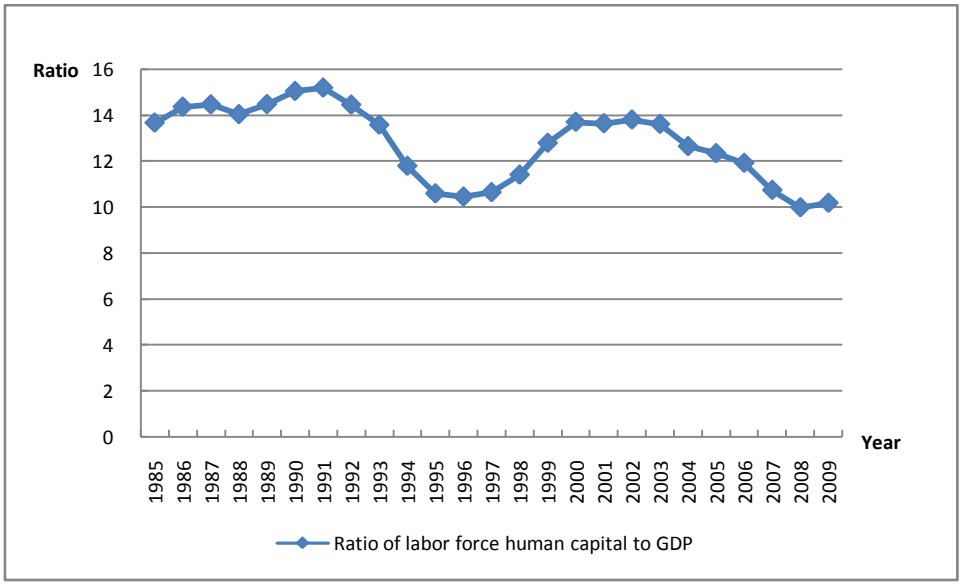


Figure HB-3.2 Ratio of Labor Force Human Capital to GDP for Hubei

Table HB-3.2 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real total human capital. Urban real labor force human capital surpasses its rural counterpart for the first time in 1996.

Table HB-3.2 Nominal and Real Labor Force Human Capital by Region for Hubei

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	541	209	332	541	209	332
1986	635	253	382	603	238	364
1987	749	317	432	662	275	387
1988	879	393	486	655	283	372
1989	1,038	493	544	664	311	352
1990	1,240	612	628	761	375	387
1991	1,387	676	712	813	390	423
1992	1,572	776	796	843	405	438
1993	1,799	916	883	815	402	413
1994	2,004	1,028	976	723	356	368
1995	2,232	1,148	1,084	671	331	341
1996	2,610	1,438	1,172	717	376	341
1997	3,037	1,730	1,307	808	441	368
1998	3,549	2,098	1,451	958	546	412
1999	4,127	2,538	1,589	1,138	679	459
2000	4,855	3,079	1,776	1,346	824	523
2001	5,290	3,320	1,970	1,466	885	581
2002	5,811	3,635	2,176	1,613	977	636
2003	6,471	4,032	2,439	1,760	1,056	704
2004	7,120	4,456	2,664	1,844	1,117	727
2005	8,128	5,157	2,971	2,043	1,258	785
2006	9,072	5,708	3,364	2,246	1,374	872
2007	10,014	6,212	3,802	2,366	1,428	938
2008	11,301	7,038	4,263	2,512	1,533	979
2009	13,179	8,440	4,739	2,940	1,852	1,088

Figure HB-3.3 shows real labor force human capital for urban and rural respectively. The pattern of labor force human capital is almost the same as that of real total human capital. The urban labor force human capital surpasses the rural one in 1996 and grows much faster afterwards.

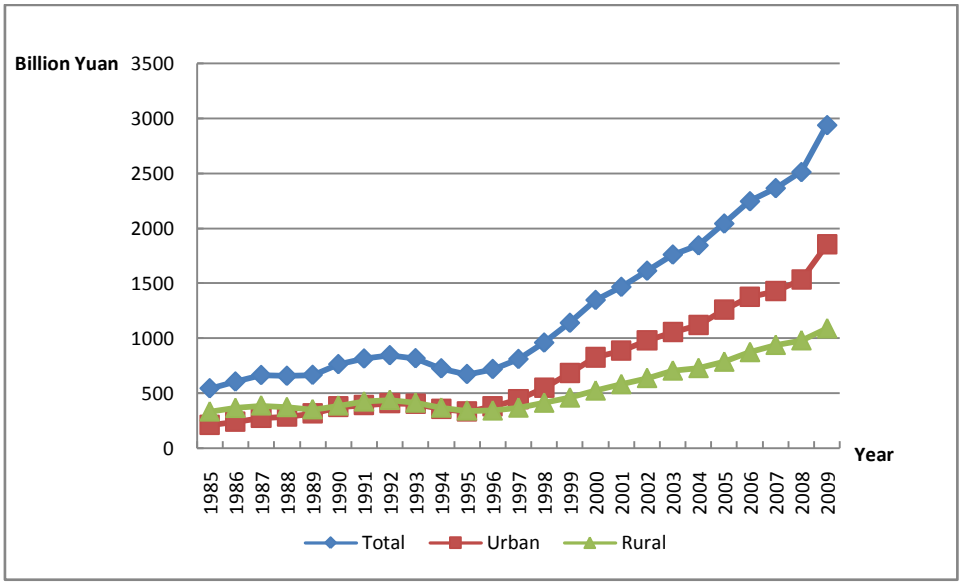


Figure HB-3.3 Real Labor Force Human Capital by Region for Hubei

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of people who are over 15 years old, not retired and out of school.

Table HB-3.3 reports the real average labor force human capital by gender. The table shows that the real average labor force human capital for female is smaller than that for male.

Table HB-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Hubei

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	20.99	24.35	17.26	20.99	24.35	17.26
1986	23.66	27.58	19.33	22.47	26.19	18.36
1987	27.06	31.92	21.76	23.93	28.22	19.26
1988	30.92	36.57	24.61	23.04	27.22	18.37
1989	35.35	41.92	27.89	22.62	26.80	17.85
1990	40.05	47.60	31.36	24.59	29.22	19.27
1991	44.28	52.73	34.56	25.93	30.88	20.27
1992	49.17	58.92	38.04	26.36	31.56	20.43
1993	55.35	66.85	42.31	25.09	30.26	19.21
1994	61.14	74.07	46.52	22.07	26.70	16.83
1995	67.11	81.48	50.88	20.18	24.47	15.34
1996	77.59	94.97	57.90	21.31	26.05	15.95
1997	88.71	109.12	65.53	23.61	29.00	17.48
1998	101.60	125.46	74.34	27.42	33.83	20.10
1999	116.03	143.56	84.47	32.00	39.58	23.32
2000	133.19	165.58	96.13	36.94	45.90	26.69
2001	144.93	180.34	104.50	40.16	49.94	28.98
2002	159.00	198.41	113.91	44.13	55.06	31.65
2003	175.28	219.29	125.09	47.68	59.62	34.06
2004	192.27	240.82	136.74	49.80	62.32	35.43
2005	213.58	267.77	151.25	53.68	67.30	38.04
2006	238.25	299.07	168.48	58.98	74.01	41.73
2007	264.83	333.27	185.76	62.57	78.72	43.90
2008	298.49	375.76	209.08	66.35	83.55	46.49
2009	346.40	436.62	241.08	77.28	97.40	53.80

Table HB-3.4 reports the real average labor force human capital by region. The real average labor force human capital is much smaller in rural

area than in urban area.

Table HB-3.4 Nominal and Real Average Labor Force Human Capital by Region for Hubei

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	20.99	36.08	16.57	20.99	36.08	16.57
1986	23.66	40.35	18.61	22.47	38.07	17.76
1987	27.06	45.10	20.89	23.93	39.14	18.74
1988	30.92	51.51	23.42	23.04	37.10	17.92
1989	35.35	58.04	26.14	22.62	36.64	16.92
1990	40.05	64.72	29.17	24.59	39.63	17.96
1991	44.28	71.65	32.43	25.93	41.31	19.28
1992	49.17	79.39	35.93	26.36	41.42	19.76
1993	55.35	88.09	39.95	25.09	38.68	18.68
1994	61.14	96.38	44.09	22.07	33.33	16.61
1995	67.11	104.75	48.66	20.18	30.16	15.29
1996	77.59	120.41	54.14	21.31	31.46	15.77
1997	88.71	136.95	60.58	23.61	34.87	17.03
1998	101.60	156.08	67.67	27.42	40.60	19.22
1999	116.03	176.65	75.11	32.00	47.27	21.70
2000	133.19	201.42	83.88	36.94	53.90	24.68
2001	144.93	218.97	92.45	40.16	58.37	27.26
2002	159.00	239.11	101.90	44.13	64.25	29.80
2003	175.28	262.19	113.04	47.68	68.66	32.64
2004	192.27	286.27	124.08	49.80	71.74	33.86
2005	213.58	316.77	136.46	53.68	77.30	36.05
2006	238.25	349.11	155.05	58.98	84.01	40.20
2007	264.83	385.26	175.46	62.57	88.55	43.28
2008	298.49	430.25	197.93	66.35	93.74	45.46
2009	346.40	502.39	223.17	77.28	110.23	51.25

Chapter 15 Human capital for Hunan

1. Total human capital

Human capital stocks of Hunan are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table HuN-1.1. column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[76]

Table HuN-1.1 Nominal and Real Human Capital, Nominal GDP for Hunan

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,315		1,315		35	37.56
1986	1,466		1,391		40	36.87
1987	1,655		1,435		47	35.24
1988	1,917		1,326		58	32.82
1989	2,185		1,273		64	34.10
1990	2,518		1,462		74	33.82
1991	2,815		1,570		83	33.78
1992	3,140		1,598		99	31.82
1993	3,520		1,534		124	28.28
1994	3,951		1,372		165	23.95

[76] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	4,447		1,296		213	20.86
1996	5,141		1,385		254	20.24
1997	5,934		1,553		285	20.83
1998	6,833		1,779		303	22.58
1999	7,870		2,033		321	24.48
2000	9,186	9,178	2,339	2,336	355	25.87
2001	10,268	10,260	2,637	2,634	383	26.80
2002	11,529	11,529	2,973	2,973	415	27.77
2003	12,863	12,868	3,231	3,231	466	27.60
2004	14,524	14,529	3,481	3,482	564	25.74
2005	16,124	16,123	3,775	3,775	651	24.76
2006	18,569	18,576	4,285	4,286	757	24.53
2007	21,370	21,383	4,660	4,664	920	23.23
2008	24,546	24,582	5,036	5,043	1,116	22.00
2009	28,072	28,102	5,781	5,789	1,306	21.50

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure HN-1.1 graphs real and nominal human capital for Hunan reported in Table HN-1.1. As is shown, both the nominal and real human capital rise steadily and nominal human capital grows faster than the real one.

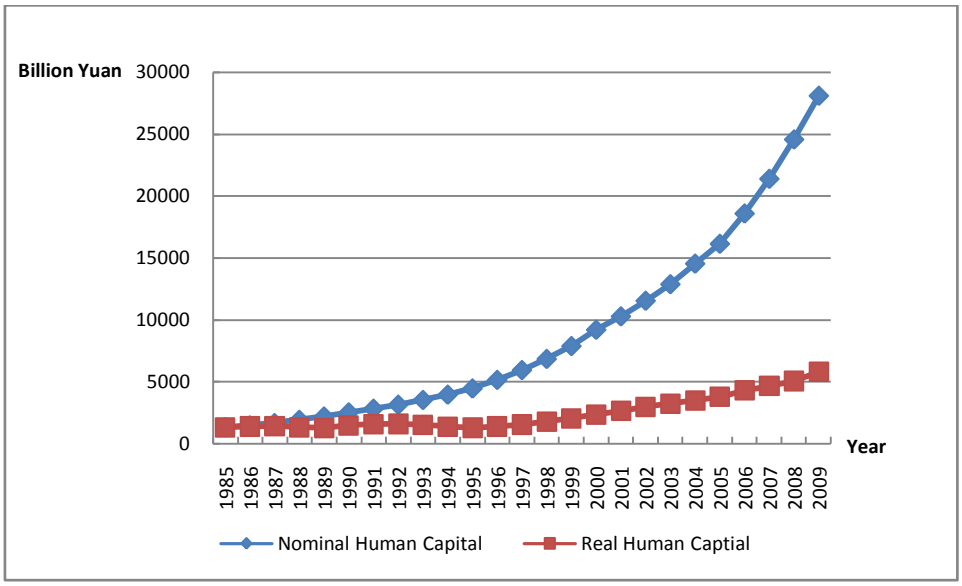


Figure HuN-1.1 Nominal and Real Human Capital for Hunan

In order to get a sense of the magnitude of the human capital in Hunan, we also present the ratio of nominal human capital to nominal GDP in Table HuN-1.1.[77] The ratio can reflect human capital's influence on sustainable growth of GDP. As is shown in Figure HuN-1.2, nominal human capital is substantially higher than nominal GDP for Hunan. From 1985 to 1988, the ratio of human capital to GDP in Hunan keeps dropping and remains nearly the same from 1989 to 1991. After 1991, however, the ratio decreases rapidly, but it increases again and keeps growing steadily until 2003. There is a steady decrease between 2003 and 2009. The decreasing ratio of human capital to GDP may also indicate possible constraints on the future GDP growth.

[77] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

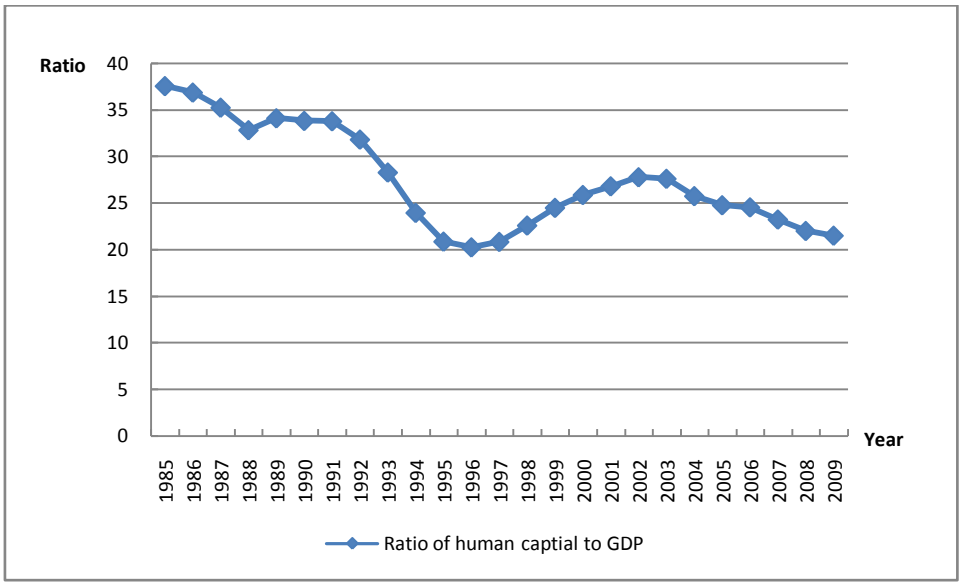


Figure HuN-1.2 Ratio of Human Capital to GDP for Hunan

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table HuN-1.2 shows real human capital for Hunan by gender and region. The results based on five education categories show that the human capital for Hunan during 1985 to 2009 grows rapidly. More specifically, the human capital for Hunan increases from 1.32 trillion Yuan to 5.78 trillion Yuan (calculated by 1985 comparable price), and it has increased by 4 times，the average annual growth rate of human capital over this period increases to 6.17%.[78]

From 1985 to 2009, male human capital in Hunan increases from 0.794 trillion Yuan to 3.745 trillion Yuan, the human capital for female in Beijing increases from 0.521 trillion Yuan to 1.398 trillion Yuan. During the same period, the annual growth rates of human capital are 6.46% and 5.68 % for male and female respectively. The gender gap in the estimated human capital increases from 0.273 trillion Yuan in 1985 to 1.709 trillion Yuan in 2009. In 2009, the male human capital is about 1.8 times the amount of that

[78] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

for female in Hunan.

From 1985 to 2009, rural human capital in Hunan increases from 0.976 trillion Yuan to 1.852 trillion Yuan, the urban human capital in Hunan increased from 0.339 trillion Yuan to 3.929 trillion Yuan. During the same period, the annual growth rates of human capital are 2.67% and 10.21 % for rural and urban areas respectively. The region gap in the estimated human capital increases from 0.637 trillion Yuan in 1985 to 2.077 trillion Yuan in 2009. In 2009, the urban human capital is about 2 times the amount of that for rural in Hunan.

Table HuN-1.2 Real Human Capital by Gender and Region for Hunan[79]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	1,315	794	521	339	976
1986	1,391	840	552	348	1,043
1987	1,435	876	559	354	1,081
1988	1,326	812	514	351	974
1989	1,273	783	491	355	919
1990	1,462	902	560	425	1,037
1991	1,570	970	599	458	1,112
1992	1,598	989	608	464	1,134
1993	1,534	953	580	458	1,076
1994	1,372	854	517	428	944
1995	1,296	811	485	416	880
1996	1,385	871	515	511	874
1997	1,553	982	571	634	919
1998	1,779	1,131	648	792	987
1999	2,033	1,298	736	990	1,043
2000	2,339	1,500	839	1,194	1,145
2001	2,637	1,687	949	1,386	1,251
2002	2,973	1,898	1,074	1,617	1,356

[79] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
2003	3,231	2,060	1,171	1,840	1,391
2004	3,481	2,217	1,264	2,077	1,404
2005	3,775	2,418	1,357	2,301	1,474
2006	4,285	2,758	1,527	2,674	1,611
2007	4,660	3,007	1,654	3,013	1,647
2008	5,036	3,253	1,784	3,362	1,674
2009	5,781	3,745	2,036	3,929	1,852

Figure HuN-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason male real human capital is higher than female real human capital is the earlier retirement age for women (age 55 vs. age 60 for men based on China Labor Law). Accordingly, men have a longer time to generate income in the market. Another reason is higher educational attainment for men. Moreover, the male-female income gap has been on expanding. The results based on six education categories show similar trends.

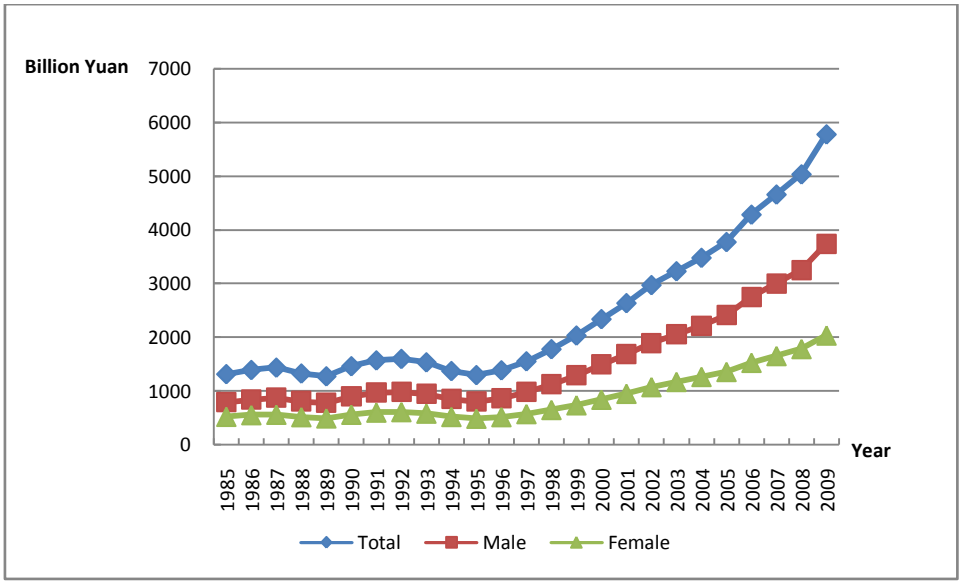


Figure HuN-1.3 Real Human Capital by Gender for Hunan

Figure HuN-1.4 shows the real human capital for urban and rural respectively. Before 2000, the rural human capital is larger than the urban human capital. Since 1996, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly, the urban human capital surpasses the rural human capital in 2000, and the region gap has the trend of expanding.

There are several reasons for such a trend. First, in the early years, the rural population is significantly larger than the urban population, and thus have larger amount of human capital. This change in the later years is, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the education gap between the urban and rural population. Urban areas usually have a larger proportion of educated population than rural areas.

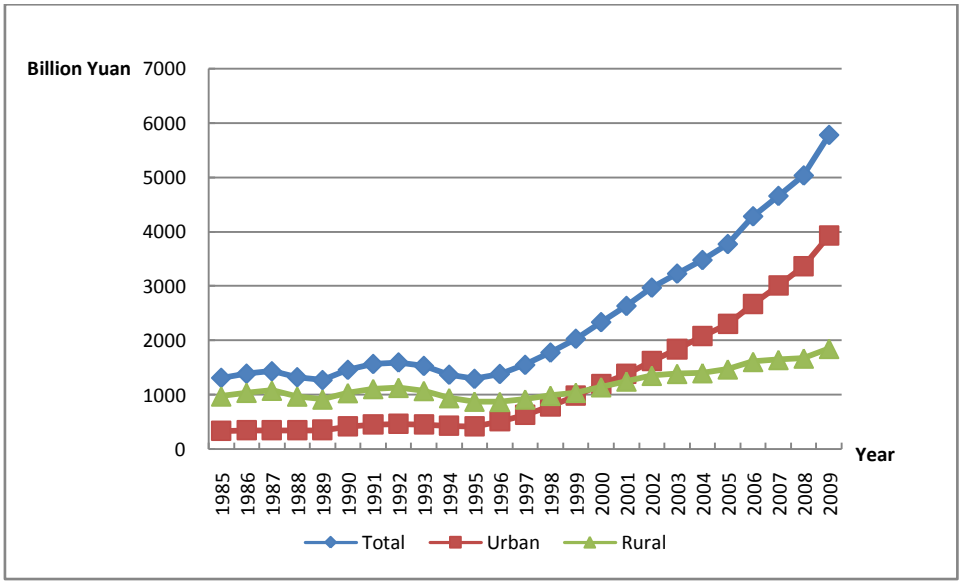


Figure HuN-1.4 Real Human Capital by Region for Hunan

Finally we calculate real human capital indices using 1985 as the base year. The results for each group are reported in Table HuN-1.3.

Table HuN-1.3 Real Human Capital Index for Hunan (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.84	105.83	105.93	102.80	106.90
1987	109.18	110.37	107.41	104.55	110.79
1988	100.84	102.24	98.69	103.72	99.84
1989	96.87	98.59	94.26	104.66	94.17
1990	111.19	113.70	107.43	125.32	106.28
1991	119.41	122.23	115.05	135.09	113.97
1992	121.53	124.64	116.82	136.81	116.22
1993	116.69	120.11	111.42	135.15	110.28
1994	104.35	107.62	99.35	126.18	96.77
1995	98.60	102.17	93.18	122.90	90.16
1996	105.39	109.68	98.87	150.89	89.60
1997	118.15	123.71	109.70	187.07	94.22
1998	135.33	142.52	124.39	233.83	101.13
1999	154.66	163.47	141.26	292.21	106.90
2000	177.94	188.98	161.12	352.42	117.35
2001	200.61	212.60	182.28	409.09	128.22
2002	226.17	239.17	206.20	477.27	138.98
2003	245.80	259.57	224.75	543.09	142.56
2004	264.82	279.26	242.72	613.05	143.90
2005	287.18	304.67	260.52	679.16	151.07
2006	325.98	347.49	293.24	789.26	165.11
2007	354.51	378.86	317.49	889.32	168.80
2008	383.11	409.85	342.49	992.33	171.57
2009	439.79	471.84	390.94	1,159.68	189.81

Figure HuN-1.5 shows the index of real human capital. It's obvious that the human capital has been rising much more rapidly since 1995.

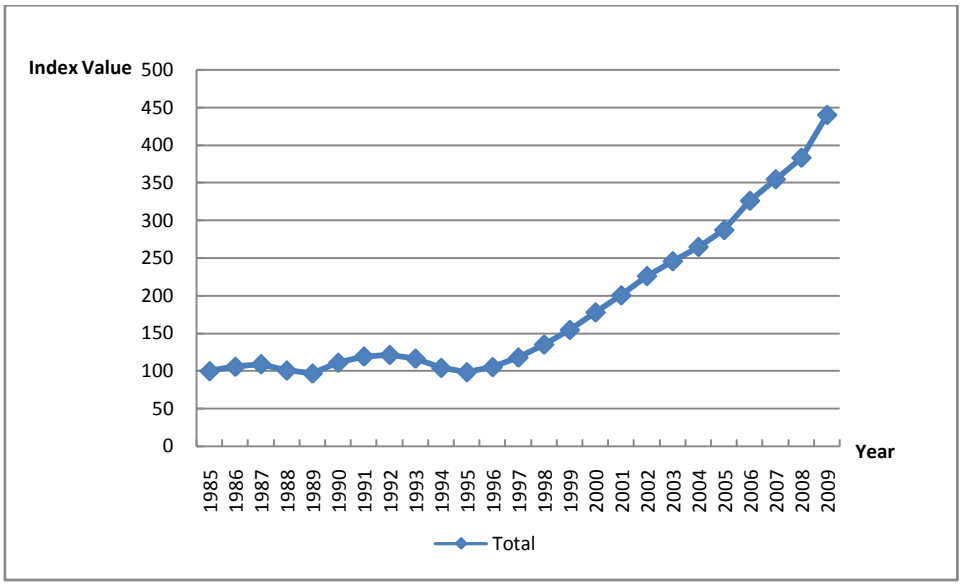


Figure HuN-1.5 Real Human Capital Index for Hunan

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table HuN-2.1 shows the human capital per capita by gender for Hunan. Based on the five education categories, the real human capital per capita for male increases from 29,500 Yuan to 122,190 Yuan, increasing by

around 3 times; the real human capital per capita for female increases from 22,050 Yuan to 74,270 Yuan, increasing by around 2 times. From 1985 to 2009, the average annual growth rate is 5.92% for male, and 5.06% for female.

Table HuN-2.1 Nominal and Real Human Capital Per Capita by Gender for Hunan

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	26.02	29.50	22.05	26.02	29.50	22.05
1986	28.85	32.70	24.46	27.38	31.05	23.22
1987	32.33	37.08	26.91	28.04	32.16	23.37
1988	36.40	41.95	30.12	25.17	28.98	20.83
1989	40.83	47.09	33.68	23.79	27.43	19.64
1990	45.74	52.89	37.54	26.55	30.70	21.81
1991	50.82	58.89	41.58	28.34	32.82	23.19
1992	56.44	65.68	45.91	28.71	33.40	23.39
1993	63.32	74.01	51.17	27.59	32.22	22.32
1994	70.89	83.08	57.06	24.61	28.83	19.82
1995	79.13	93.31	63.08	23.06	27.19	18.40
1996	91.10	108.07	71.96	24.55	29.11	19.41
1997	104.88	124.74	82.32	27.45	32.65	21.56
1998	120.67	144.09	93.95	31.42	37.51	24.47
1999	139.07	165.99	108.11	35.93	42.88	27.94
2000	159.64	191.43	123.14	40.65	48.75	31.34
2001	177.88	213.69	137.06	45.68	54.87	35.19
2002	199.52	240.78	153.14	51.45	62.08	39.48
2003	223.44	271.70	170.20	56.12	68.23	42.76
2004	252.37	308.90	191.05	60.49	74.02	45.79
2005	280.40	342.65	211.82	65.65	80.22	49.59
2006	319.83	392.12	239.93	73.81	90.50	55.37
2007	367.18	449.99	275.12	80.07	98.15	59.99

2008	420.67	516.13	314.69	86.31	105.85	64.59
2009	483.50	593.22	360.58	99.57	122.19	74.27

Figure HuN-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for males and females. Real human capital per capita for both male and female exhibit an accelerated growth after 1996. The male-female gap has been widening.

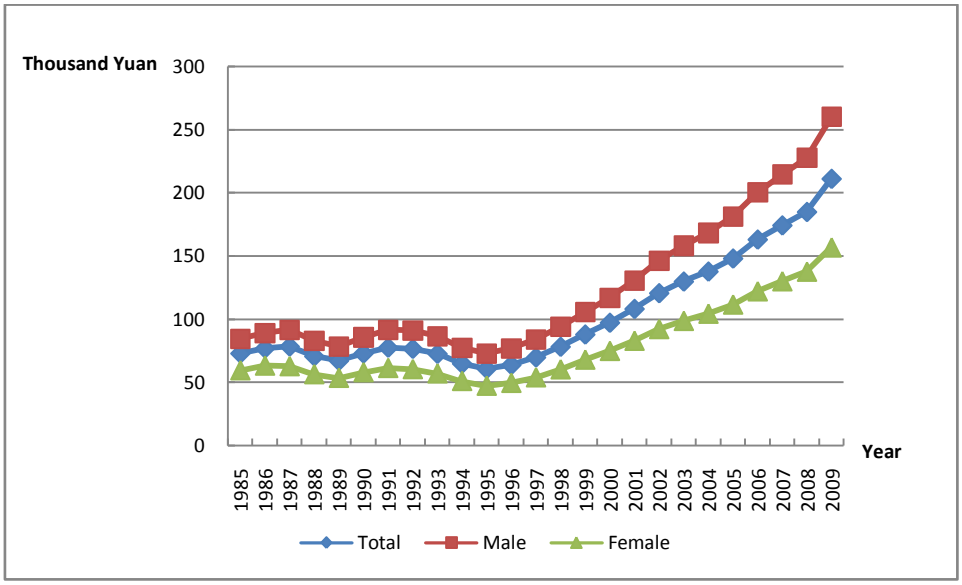


Figure HuN-2.1 Real Human Capital Per Capita by Gender for Hunan

Table HuN-2.2 reports the results of human capital per capita measured in nominal and real terms for Hunan classified by region separately. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The per capita urban human capital increases from 50,710 Yuan to 154,370 Yuan, the per capita rural human capital increases from 22,270 Yuan to 56,820 Yuan. The human capital per capita in urban areas grows much faster than the one for rural.

Table HuN-2.2 Nominal and Real Human Capital Per Capita by Region for Hunan

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	26.02	50.71	22.27	26.02	50.71	22.27
1986	28.85	56.26	24.83	27.38	53.38	23.58
1987	32.33	63.66	27.73	28.04	54.27	24.21
1988	36.40	72.69	30.78	25.17	49.29	21.42
1989	40.83	81.55	34.17	23.79	47.15	19.97
1990	45.74	88.34	38.07	26.55	50.77	22.21
1991	50.82	98.54	42.14	28.34	53.88	23.68
1992	56.44	108.75	46.61	28.71	52.39	24.27
1993	63.32	120.56	51.87	27.59	49.47	23.21
1994	70.89	135.15	57.47	24.61	44.44	20.47
1995	79.13	149.83	63.88	23.06	41.72	19.04
1996	91.10	170.98	70.65	24.55	44.41	19.46
1997	104.88	193.21	78.55	27.45	48.72	21.11
1998	120.67	218.65	87.19	31.42	54.86	23.41
1999	139.07	247.49	96.79	35.93	62.34	25.63
2000	159.64	276.57	109.17	40.65	68.78	28.51
2001	177.88	305.03	119.90	45.68	76.70	31.53
2002	199.52	339.95	131.79	51.45	85.82	34.87
2003	223.44	374.36	144.38	56.12	93.20	36.69
2004	252.37	416.07	159.25	60.49	99.51	38.29
2005	280.40	457.45	175.11	65.65	107.15	40.96
2006	319.83	509.86	197.21	73.81	117.55	45.58
2007	367.18	576.52	221.88	80.07	126.35	47.97
2008	420.67	650.69	249.22	86.31	134.78	50.17
2009	483.50	742.83	280.99	99.57	154.37	56.82

Figure HuN-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, real human capital per capita for urban and rural both exhibit an accelerated growth after 1996. Based on five education categories, the ratio of urban to rural increases from 2.28 in 1985 to 2.71 in 2009, the absolute size of human capital has been on the rise. From 1985 to 2009, the average annual growth rate is 4.63% for the

urban area, and 3.9% for the rural area.

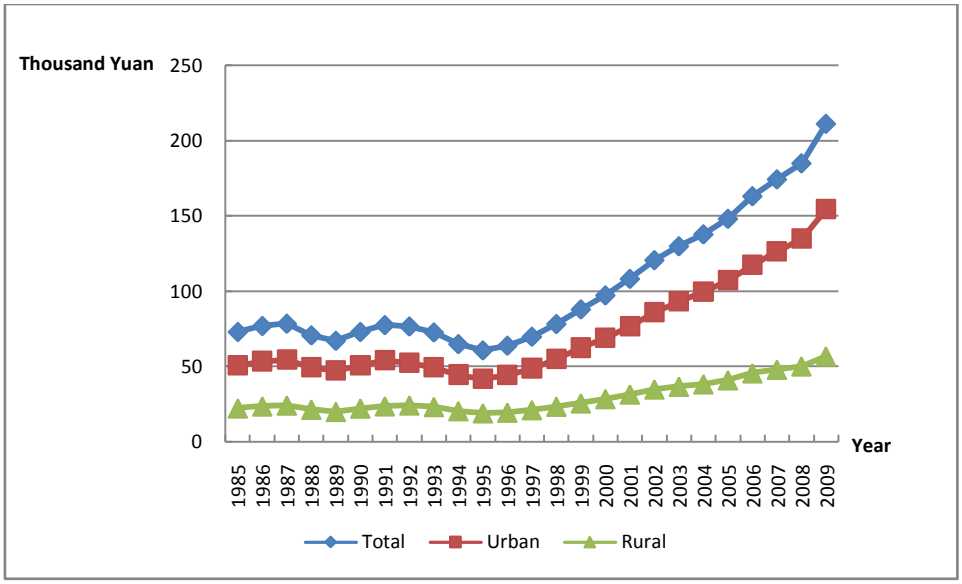


Figure HuN-2.2 Real Human Capital Per Capita by Region for Hunan

Figure HuN-2.3 shows the real human capital per capita index for Hunan. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

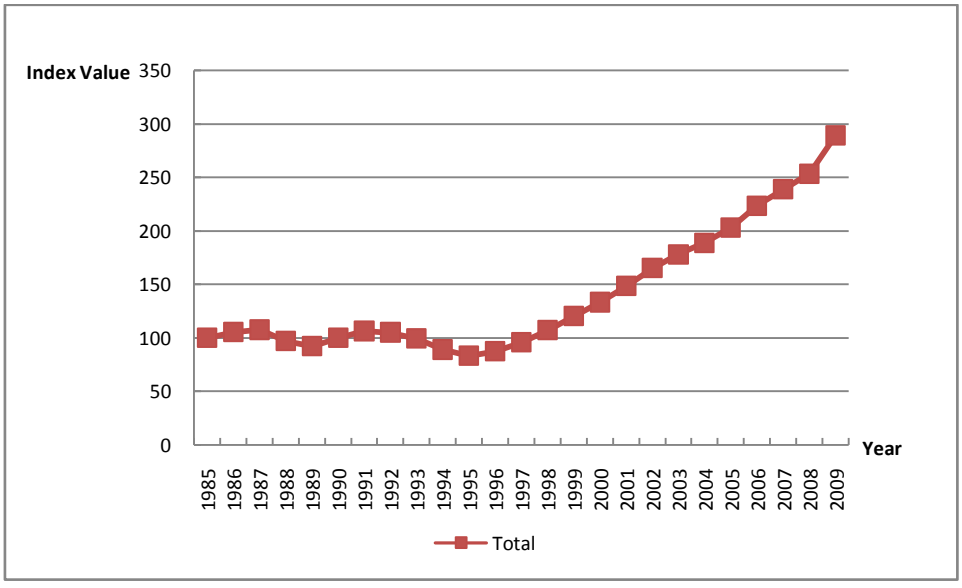


Figure HuN-2.3 Real Human Capital Per Capita Index for Hunan

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table HuN-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table HuN-3.1 Labor Force Human Capital and Nominal GDP for Hunan

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	599		599		35	17.13
1986	687		652		40	17.26
1987	786		684		47	16.75
1988	916		635		58	15.69
1989	1,052		614		64	16.42
1990	1,233		717		74	16.56
1991	1,378		770		83	16.53
1992	1,537		786		99	15.57
1993	1,723		755		124	13.84
1994	1,902		664		165	11.53
1995	2,110		618		213	9.90
1996	2,404		651		254	9.46
1997	2,786		733		285	9.78
1998	3,274		857		303	10.82
1999	3,809		988		321	11.85

2000	4,493	4,411	1,148	1,128	355	12.65
2001	4,952	4,874	1,276	1,256	383	12.92
2002	5,482	5,416	1,420	1,402	415	13.20
2003	6,196	6,149	1,559	1,547	466	13.30
2004	6,949	6,931	1,667	1,662	564	12.32
2005	7,925	7,901	1,855	1,849	651	12.17
2006	9,104	9,081	2,101	2,096	757	12.03
2007	10,306	10,280	2,244	2,239	920	11.20
2008	11,679	11,654	2,389	2,384	1,116	10.47
2009	13,521	13,486	2,778	2,772	1,306	10.35

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure HuN-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keep increasing.

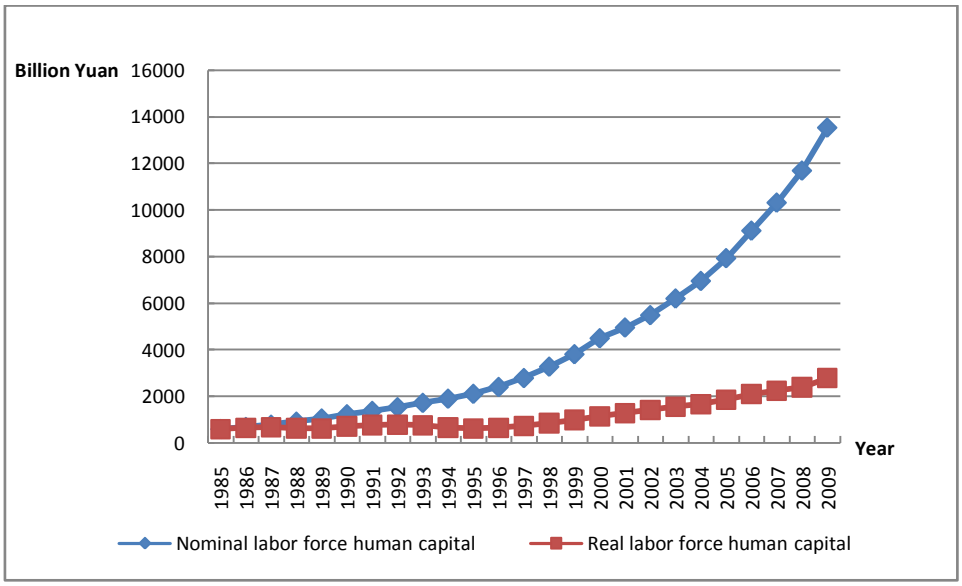


Figure HuN-3.1 Nominal and Real Labor Force Human Capital for Hunan

We also calculate the ratio of labor force human capital to GDP. The

results are reported in the last column of Table GS-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure GS-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio of labor force human capital to GDP in Hunan from 1990 to 1996 decreases at a considerable rate, it rebounds from 1997 to 2003 and drops again afterwards.

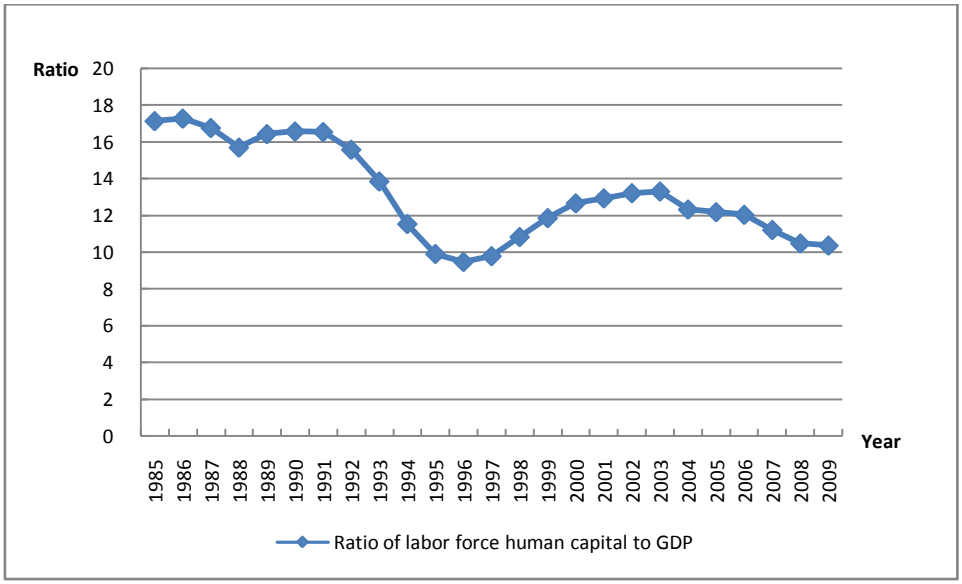


Figure HuN-3.2 Ratio of Labor Force Human Capital to GDP for Hunan

Table HuN-3.2 shows the nominal and real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. Urban real labor force human capital surpasses its rural counterpart for the first time in 2004.

Table HuN-3.2 Nominal and Real Labor Force Human Capital by Region for Hunan

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	599	103	496	599	103	496
1986	687	119	567	652	113	539
1987	786	145	641	684	124	560
1988	916	172	744	635	117	518
1989	1,052	205	847	614	119	495
1990	1,233	281	952	717	162	555
1991	1,378	311	1,067	770	170	600
1992	1,537	361	1,176	786	174	613
1993	1,723	431	1,292	755	177	578
1994	1,902	504	1,398	664	166	498
1995	2,110	583	1,527	618	162	455
1996	2,404	735	1,669	651	191	460
1997	2,786	944	1,842	733	238	495
1998	3,274	1,229	2,045	857	308	549
1999	3,809	1,580	2,229	988	398	590
2000	4,493	2,018	2,475	1,148	502	646
2001	4,952	2,265	2,687	1,276	570	707
2002	5,482	2,569	2,913	1,420	649	771
2003	6,196	2,986	3,210	1,559	743	816
2004	6,949	3,504	3,445	1,667	838	828
2005	7,925	4,060	3,865	1,855	951	904
2006	9,104	4,785	4,319	2,101	1,103	998
2007	10,306	5,573	4,733	2,244	1,221	1,023
2008	11,679	6,533	5,146	2,389	1,353	1,036
2009	13,521	7,920	5,601	2,778	1,646	1,132

Figure HuN-3.3 shows real labor force human capital for urban and rural respectively. The pattern of labor force human capital is almost the same as that of real human capital. The urban labor force human capital surpasses the rural one in 2004 and has grown much faster since 1996.

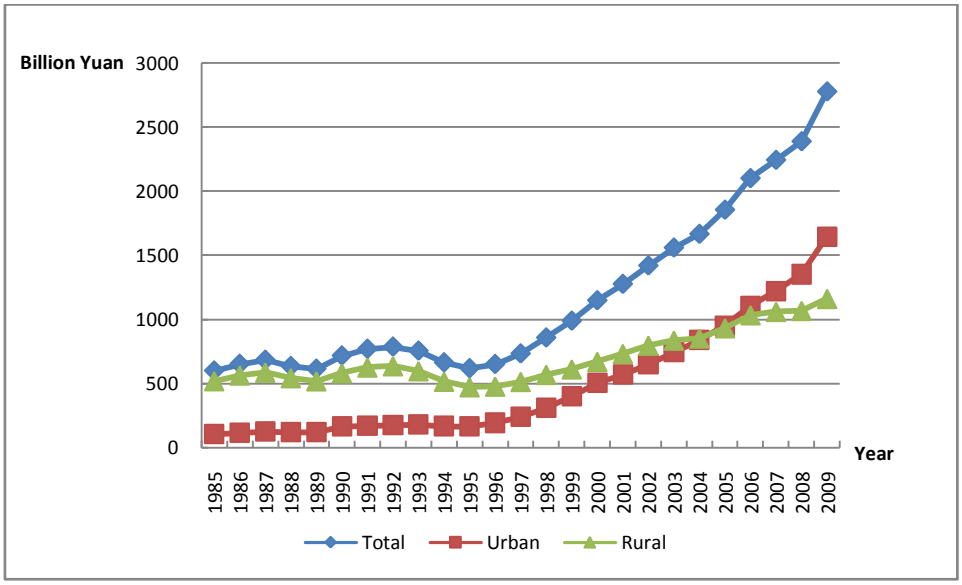


Figure HuN-3.3 Real Labor Force Human Capital by Region for Hunan

3.2 Average Labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table HuN-3.3 reports the nominal and real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female is smaller than that for male.

Table HuN-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Hunan

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	20.19	22.88	17.11	20.19	22.88	17.11
1986	22.62	25.73	19.08	21.48	24.44	18.11
1987	25.56	29.28	21.34	22.22	25.44	18.55
1988	28.46	32.76	23.54	19.72	22.68	16.31
1989	31.83	36.70	26.21	18.57	21.40	15.29
1990	36.04	41.80	29.36	20.95	24.30	17.07
1991	39.80	46.27	32.34	22.23	25.84	18.07
1992	43.94	51.39	35.42	22.48	26.28	18.14
1993	49.03	57.67	39.16	21.48	25.25	17.17
1994	54.10	64.12	42.72	18.87	22.36	14.92
1995	59.51	70.87	46.68	17.42	20.74	13.66
1996	67.34	80.90	52.04	18.23	21.89	14.09
1997	76.76	92.49	58.88	20.20	24.34	15.50
1998	88.01	106.70	66.77	23.05	27.94	17.49
1999	100.44	122.20	75.58	26.06	31.70	19.61
2000	114.58	140.38	85.05	29.28	35.87	21.74
2001	126.16	154.82	93.66	32.51	39.89	24.14
2002	138.98	171.65	102.34	35.99	44.44	26.50
2003	155.29	192.53	114.02	39.08	48.45	28.70
2004	172.60	215.16	126.34	41.39	51.59	30.30
2005	191.24	238.50	140.28	44.76	55.82	32.84
2006	217.45	272.59	157.94	50.19	62.92	36.46
2007	246.64	308.95	178.90	53.70	67.28	38.95
2008	279.90	350.56	202.77	57.26	71.71	41.48
2009	325.94	408.84	234.90	66.97	83.99	48.26

Table HuN-3.4 reports the nominal and real average labor force human capital by region. The real average labor force human capital is much

smaller in rural area than in urban area.

Table HuN-3.4 Nominal and Real Average Labor Force Human Capital by Region for Hunan

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	20.19	32.43	18.73	20.19	32.43	18.73
1986	22.62	36.75	20.95	21.48	34.87	19.90
1987	25.56	42.00	23.46	22.22	35.80	20.48
1988	28.46	46.55	26.19	19.72	31.57	18.23
1989	31.83	51.94	29.11	18.57	30.03	17.01
1990	36.04	58.43	32.34	20.95	33.58	18.87
1991	39.80	64.48	35.76	22.23	35.26	20.10
1992	43.94	71.12	39.41	22.48	34.26	20.52
1993	49.03	79.20	43.48	21.48	32.50	19.45
1994	54.10	87.53	47.52	18.87	28.78	16.93
1995	59.51	96.20	51.98	17.42	26.78	15.49
1996	67.34	108.08	57.76	18.23	28.07	15.91
1997	76.76	122.69	64.45	20.20	30.94	17.32
1998	88.01	139.65	72.09	23.05	35.04	19.36
1999	100.44	157.62	79.93	26.06	39.71	21.17
2000	114.58	178.39	88.73	29.28	44.36	23.17
2001	126.16	194.39	97.29	32.51	48.88	25.58
2002	138.98	213.34	106.58	35.99	53.86	28.20
2003	155.29	235.11	117.64	39.08	58.54	29.90
2004	172.60	258.40	129.06	41.39	61.80	31.03
2005	191.24	285.13	142.29	44.76	66.79	33.28
2006	217.45	317.59	160.99	50.19	73.22	37.21
2007	246.64	355.32	181.42	53.70	77.87	39.22
2008	279.90	397.75	203.68	57.26	82.39	41.00
2009	325.94	466.32	228.62	66.97	96.91	46.23

Chapter 16 Human capital for Guangdong

1. Total human capital

Human capital stocks of Guangdong are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table GD-1.1. column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[80]

Table GD-1.1 Nominal and Real Human Capital, Nominal GDP for Guangdong

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	3,931		3,931		58	68.08
1986	4,340		4,134		67	65.02
1987	4,814		4,117		85	56.86
1988	5,098		3,369		116	44.12
1989	5,767		3,120		138	41.75
1990	6,763		3,752		156	43.38
1991	7,525		4,121		189	39.75
1992	8,491		4,329		245	34.69
1993	9,665		4,055		347	27.86
1994	10,942		3,773		462	23.69

[80] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	12,554		3,793		593	21.16
1996	14,588		4,117		684	21.34
1997	17,361		4,801		777	22.33
1998	20,592		5,784		853	24.14
1999	24,763		7,070		925	26.77
2000	28,877	29,015	8,097	8,133	1,074	26.88
2001	33,096	33,313	9,334	9,392	1,204	27.49
2002	38,389	38,682	10,965	11,048	1,350	28.43
2003	43,637	44,006	12,369	12,474	1,584	27.54
2004	49,777	50,260	13,716	13,849	1,886	26.39
2005	55,244	55,799	14,902	15,051	2,256	24.49
2006	63,300	64,018	16,768	16,958	2,659	23.81
2007	72,160	73,070	18,433	18,661	3,178	22.71
2008	81,480	82,580	19,706	19,972	3,680	22.14
2009	96,890	98,300	23,992	24,329	3,948	24.54

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure GD-1.1 shows real and nominal human capital for Guangdong reported in Table GD-1.1 As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

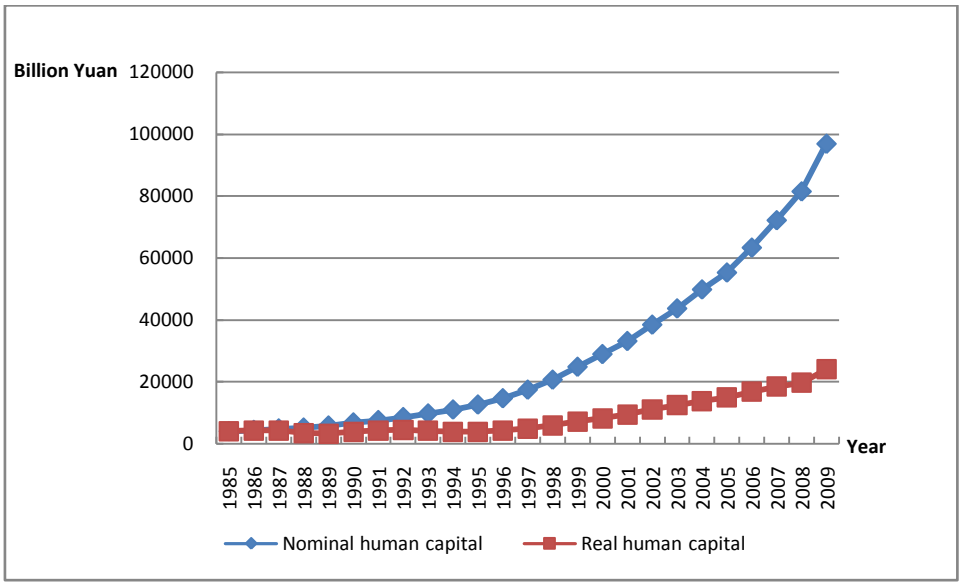


Figure GD-1.1 Nominal and Real Human Capital for Guangdong

In order to get a sense of the magnitude of the human capital in Guangdong, we also present the ratio of nominal human capital to nominal GDP in Table GD-1.1.[81] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure GD-1.2, nominal human capital is substantially higher than nominal GDP for Guangdong. The ratio of human capital to GDP in Guangdong from 1990 to 1995 decreases at a considerable rate, the ratio increases slowly from 1995 to 2000.

[81] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

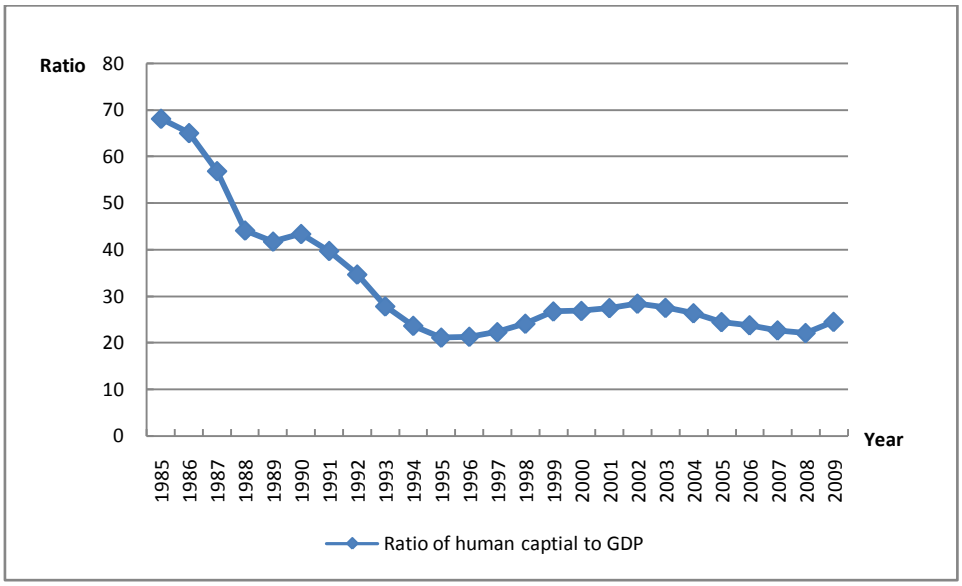


Figure GD-1.2 Ratio of Human Capital to GDP for Guangdong

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table GD-1.2 shows real human capital for Guangdong by gender, and by urban or rural areas. The results based on five education categories show that the human capital for Guangdong during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Guangdong increases from 3.9 trillion Yuan to 23.99 trillion Yuan (calculated by 1985 comparable price), which has increases by 5 times. The average annual growth rate of human capital over this period increases to 7.53%.[82]

From 1985 to 2009, human capital for male in Guangdong increases from 2.507 trillion Yuan to 15.332 trillion Yuan, the human capital for female in Guangdong increases from 1.424 trillion Yuan to 8.652 trillion Yuan. During the same period, the average annual growth rates of human capital are 7.54% and 7.51 % for male and female respectively. The gender

[82] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

gap in the estimated human capital increases from 1.083 trillion Yuan in 1985 to 6.68 trillion Yuan in 2009. In 2009, the male human capital is about 1.8 times the amount of that for female in Guangdong.

From 1985 to 2009, rural human capital in Guangdong increases from 1.791 trillion Yuan to 3.342 trillion Yuan, the urban human capital in Guangdong increases from 2.14 trillion Yuan to 20.65 trillion Yuan. During the same period, the average annual growth rates of human capital are 2.5% and 9.45 % for rural and urban areas respectively. The region gap in the estimated human capital increases from 0.349 trillion Yuan in 1985 to 17.308 trillion Yuan in 2009. In 2009, human capital in urban areas is about 6 times the amount of that in rural areas in Guangdong.

Table GD-1.2 Real Human Capital by Gender and Region for Guangdong[83]

Year	Total	Male	Female	Urban	Rural
1985	3,931	2,507	1,424	2,140	1,791
1986	4,134	2,647	1,488	2,268	1,866
1987	4,117	2,644	1,474	2,246	1,871
1988	3,369	2,155	1,214	1,865	1,504
1989	3,120	1,985	1,134	1,759	1,361
1990	3,752	2,378	1,375	2,166	1,586
1991	4,121	2,615	1,506	2,389	1,732
1992	4,329	2,752	1,577	2,533	1,796
1993	4,055	2,587	1,468	2,408	1,647
1994	3,773	2,418	1,355	2,291	1,482
1995	3,793	2,437	1,355	2,444	1,349

[83] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1996	4,117	2,645	1,472	2,709	1,408
1997	4,801	3,089	1,713	3,319	1,482
1998	5,784	3,724	2,060	4,179	1,605
1999	7,070	4,547	2,522	5,316	1,754
2000	8,097	5,207	2,890	6,228	1,869
2001	9,334	6,009	3,325	7,319	2,015
2002	10,965	7,057	3,909	8,771	2,194
2003	12,369	8,053	4,322	10,020	2,349
2004	13,716	8,942	4,779	11,280	2,436
2005	14,902	9,682	5,222	12,380	2,522
2006	16,768	10,950	5,820	14,050	2,718
2007	18,433	12,029	6,400	15,590	2,843
2008	19,706	12,860	6,845	16,800	2,906
2009	23,992	15,332	8,652	20,650	3,342

Figure GD-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason why male real human capital is higher than female real human capital is the earlier retirement age for women (age 55 vs. age 60 for men based on China Labor Law). Accordingly, men have a longer time to generate income in the market. Another reason is higher educational attainment for men. Moreover, the male-female income gap has been on expanding. The results based on six education categories show the similar trends.

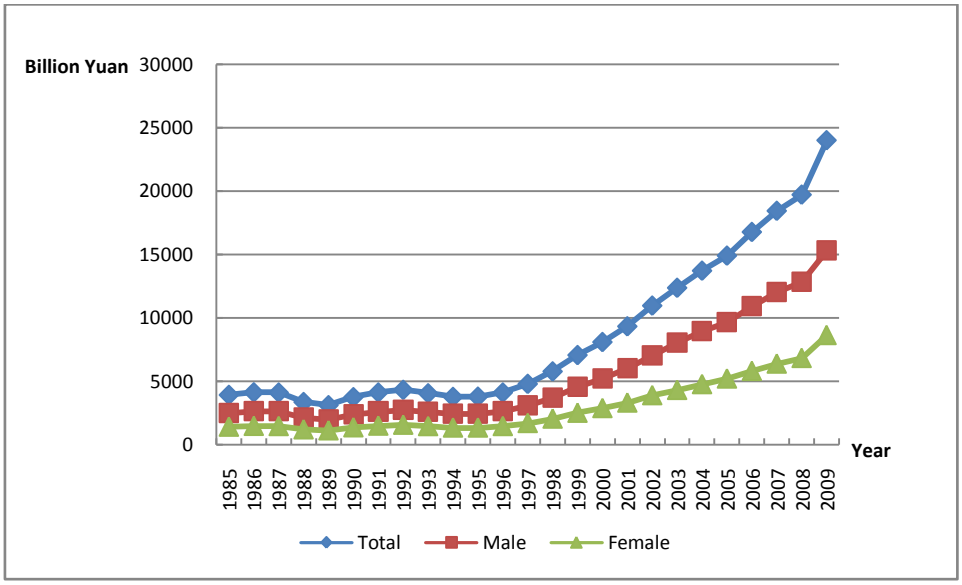


Figure GD-1.3 Real Human Capital by Gender for Guangdong

Figure GD-1.4 shows the real human capital for urban and rural areas separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1997, human capital for urban areas is about 1-2 times the amount of that for rural areas. Since 1996, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly, which results in a larger region gap.

This change is, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the enlarged education gap between the urban and rural population. Urban areas usually have a larger proportion of educated population than rural areas.

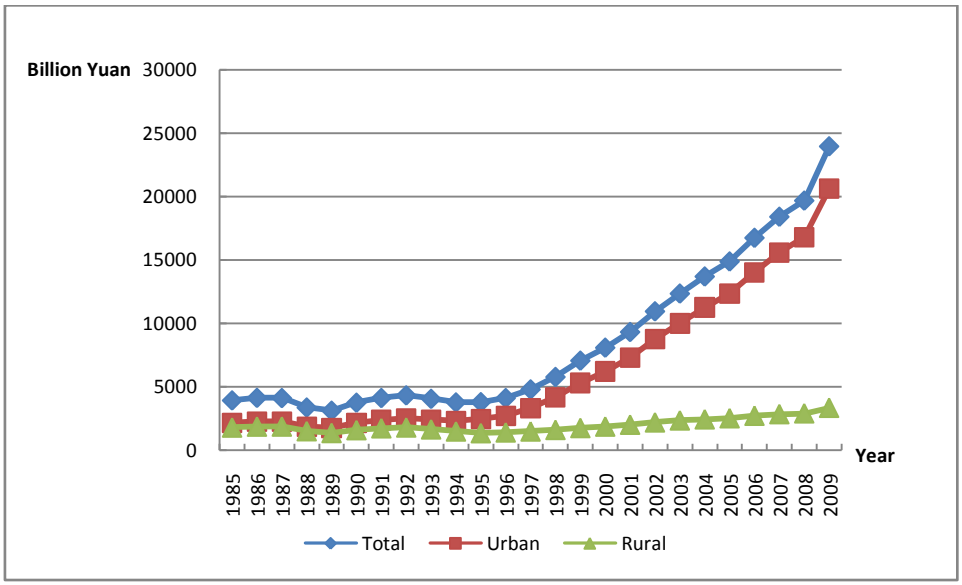


Figure GD-1.4 Real Human Capital by Region for Guangdong

Finally we calculate real human capital indices using 1985 as the base year. The results for each group are reported in Table GD-1.3.

Table GD-1.3 Real Human Capital Index for Guangdong (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.16	105.58	104.44	105.98	104.19
1987	104.73	105.46	103.46	104.95	104.47
1988	85.70	85.94	85.23	87.15	83.98
1989	79.37	79.19	79.62	82.20	75.99
1990	95.45	94.83	96.53	101.21	88.55
1991	104.83	104.31	105.72	111.64	96.71
1992	110.12	109.77	110.72	118.36	100.28
1993	103.15	103.19	103.05	112.52	91.96
1994	95.98	96.43	95.16	107.06	82.75
1995	96.49	97.21	95.16	114.21	75.32
1996	104.73	105.52	103.37	126.59	78.62

1997	122.13	123.21	120.28	155.09	82.75
1998	147.14	148.54	144.61	195.28	89.61
1999	179.85	181.37	177.11	248.41	97.93
2000	205.98	207.70	202.95	291.03	104.36
2001	237.45	239.69	233.47	342.01	112.51
2002	278.94	281.49	274.44	409.86	122.50
2003	314.65	321.22	303.45	468.22	131.16
2004	348.92	356.68	335.58	527.10	136.01
2005	379.09	386.20	366.64	578.50	140.82
2006	426.56	436.78	408.68	656.54	151.76
2007	468.91	479.82	449.35	728.50	158.74
2008	501.30	512.96	480.60	785.05	162.26
2009	610.33	611.57	607.50	964.95	186.60

Figure GD-1.5 shows the index of real total human capital for Guangdong. Before 1997 the index grows quite steadily; it accelerates after that year.

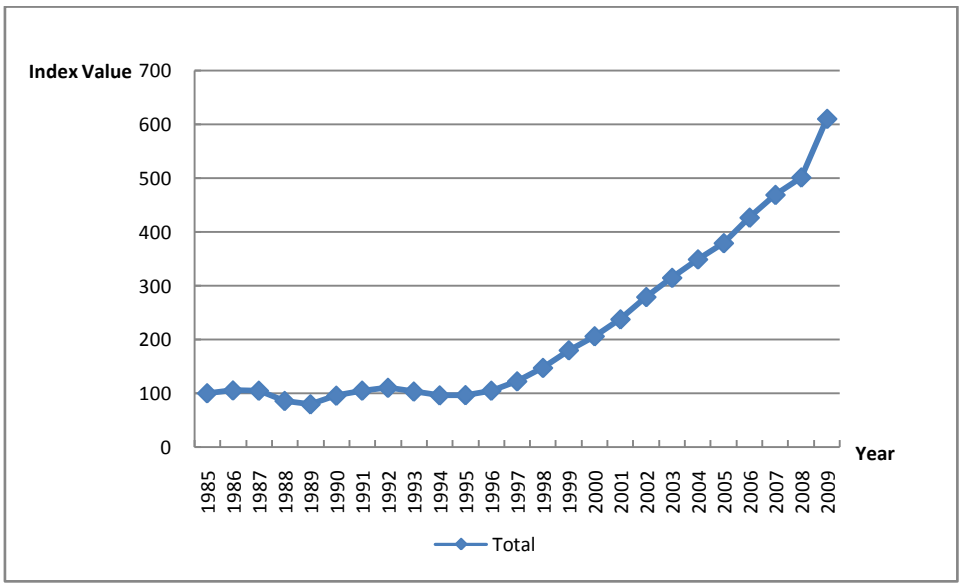


Figure GD-1.5 Real Human Capital Index for Guangdong

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), higher educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table GD-2.1 shows the human capital per capita by gender for Guangdong. Based on the five education categories, the real human capital per capita for male increases from 69,878 Yuan to 327,342 Yuan, increasing by around 3 times. Real human capital per capita for female increases from 55,978 Yuan to 240,971 Yuan, increasing by around 3 times. From 1985 to 2009, the average annual growth rate is 6.74% for male, and 6.08% for female.

Table GD-2.1 Nominal and Real Human Capital Per Capita by Gender for Guangdong

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	69.88	81.36	55.98	69.88	81.36	55.98
1986	77.25	90.36	61.39	73.59	86.10	58.48
1987	85.68	100.44	67.80	73.27	85.89	58.00
1988	95.43	112.58	75.11	63.07	74.36	49.65
1989	105.43	125.01	82.74	57.04	67.59	44.78

1990	117.35	139.90	91.77	65.11	77.60	50.93
1991	130.55	156.41	101.42	71.50	85.58	55.59
1992	145.63	175.01	112.56	74.25	89.17	57.46
1993	164.13	198.74	125.54	68.86	83.29	52.75
1994	184.05	224.12	139.48	63.46	77.23	48.15
1995	209.59	256.78	157.49	63.32	77.53	47.61
1996	238.55	292.76	178.94	67.32	82.60	50.54
1997	277.71	342.08	207.37	76.80	94.56	57.39
1998	323.49	399.05	240.84	90.86	112.07	67.69
1999	377.30	464.27	282.09	107.72	132.50	80.55
2000	426.20	525.85	317.81	119.50	147.45	89.10
2001	486.40	600.47	362.19	137.18	169.35	102.12
2002	558.40	688.98	416.09	159.49	196.84	118.81
2003	630.29	787.30	459.61	178.66	223.31	130.29
2004	713.85	893.07	519.07	196.70	246.23	143.03
2005	789.15	987.17	575.50	212.87	266.31	155.18
2006	890.10	1,118.64	643.10	235.78	296.42	170.31
2007	1,005.38	1,262.13	727.54	256.82	322.34	185.73
2008	1,122.40	1,406.94	813.38	271.45	340.28	196.67
2009	1,321.95	1,655.91	974.11	327.34	410.07	240.97

Figure GD-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for males and females. Real human capital per capita for both male and female exhibits an accelerating growth after 1996. The male-female gap has been widening.

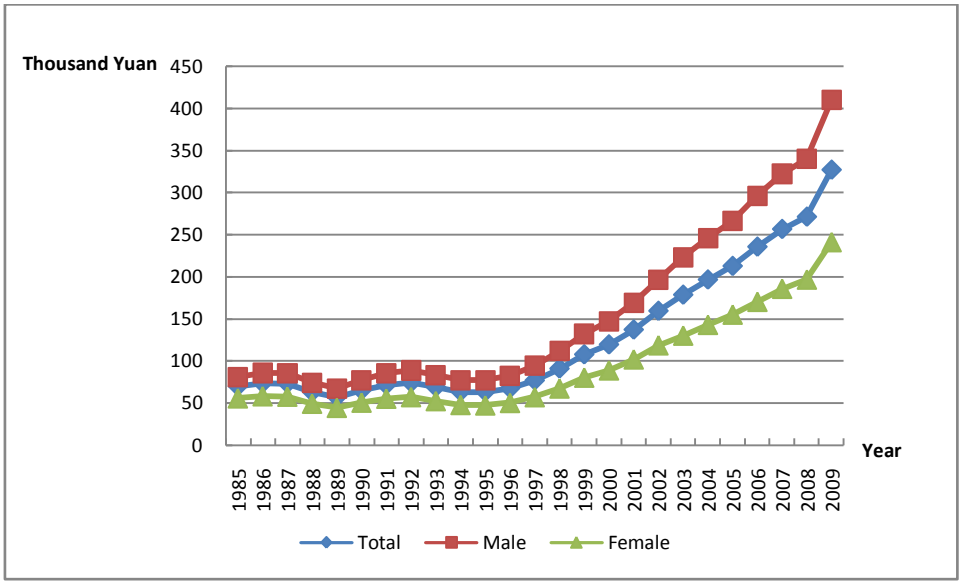


Figure GD-2.1 Real Human Capital Per Capita by Gender for Guangdong

Table GD-2.2 reports the results of human capital per capita measured in nominal and real terms for Guangdong by urban and rural separately. From 1985 to 2009, the human capital per capita in urban areas is significantly larger than that for rural. The per capita urban human capital increases from 108,766 Yuan to 419,698 Yuan, the rural human capital per capita increases from 48,999 Yuan to 138,607 Yuan. The human capital per capita in urban areas grows much faster than the one in rural areas.

Table GD-2.2 Nominal and Real Human Capital Per Capita by Region for Guangdong

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	69.88	108.77	49.00	69.88	108.77	49.00
1986	77.25	120.67	53.78	73.59	115.25	51.07
1987	85.68	134.78	59.16	73.27	114.13	51.21
1988	95.43	150.82	65.00	63.07	98.61	43.52
1989	105.43	167.47	70.76	57.04	89.83	38.71

1990	117.35	188.20	77.12	65.11	103.64	43.22
1991	130.55	209.09	84.77	71.50	112.56	47.56
1992	145.63	233.79	93.02	74.25	116.10	49.28
1993	164.13	263.93	102.82	68.86	107.43	45.16
1994	184.05	296.24	113.44	63.46	99.66	40.68
1995	209.59	326.40	124.92	63.32	97.09	38.85
1996	238.55	372.72	137.99	67.32	103.41	40.30
1997	277.71	422.01	153.41	76.80	114.68	44.14
1998	323.49	476.89	170.77	90.86	131.84	50.08
1999	377.30	542.30	189.89	107.72	152.36	57.00
2000	426.20	592.40	211.37	119.50	162.85	63.45
2001	486.40	671.29	232.33	137.18	186.03	70.02
2002	558.40	768.49	255.06	159.49	215.99	77.96
2003	630.29	859.09	281.30	178.66	239.77	85.64
2004	713.85	964.90	311.28	196.70	262.48	91.39
2005	789.15	1,051.58	342.17	212.87	280.45	97.81
2006	890.10	1,171.16	382.13	235.78	306.82	107.52
2007	1,005.38	1,307.23	424.54	256.82	330.25	115.41
2008	1,122.40	1,443.04	471.82	271.45	345.55	121.23
2009	1,321.95	1,711.01	527.43	327.34	419.70	138.61

Figure GD-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, real human capital per capita for urban and rural both exhibit an accelerated growth after 1996. Based on five education categories, the ratio of urban to rural increases from 2.22 in 1985 to 3.03 in 2009 and the absolute size of region gap has been on the rise. From 1985 to 2009, the average annual growth rate is 5.63% for the urban area, and 4.33% for the rural area.

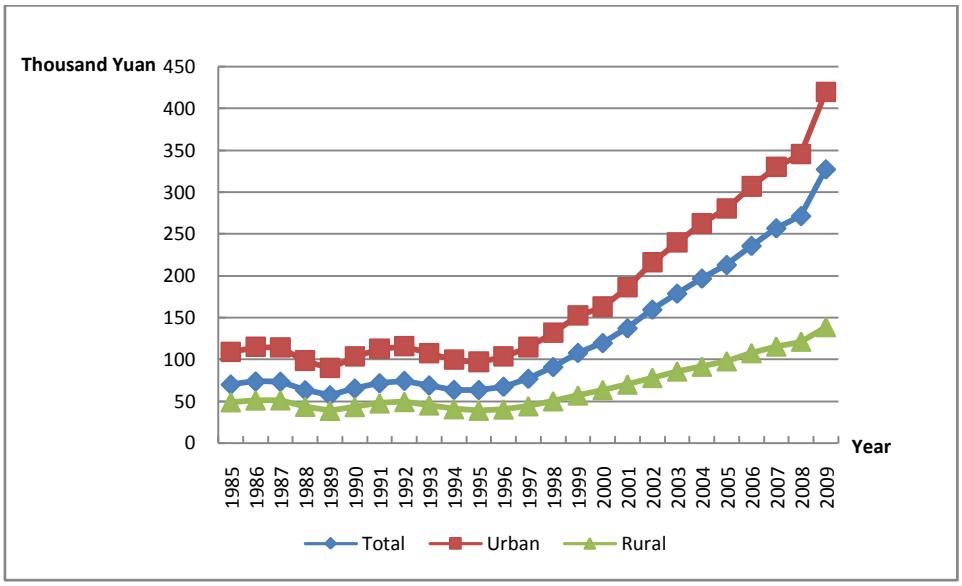


Figure GD-2.2 Real Human Capital Per Capita by Region for Guangdong

Figure GD-2.3 shows the real human capital per capita index for Guangdong. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

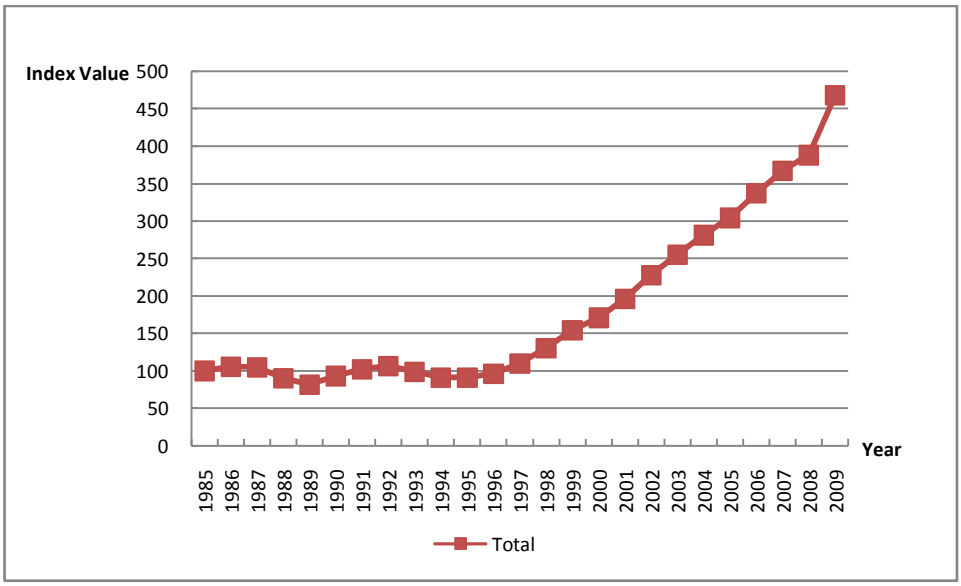


Figure GD-2.3 Real Human Capital Per Capita Index for Guangdong

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table GD-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table GD-3.1 Labor Force Human Capital and Nominal GDP for Guangdong

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	1,694		1,694		58	29.34
1986	1,875		1,786		67	28.09
1987	2,072		1,773		85	24.48
1988	2,199		1,453		116	19.03
1989	2,535		1,371		138	18.35
1990	2,992		1,660		156	19.19
1991	3,311		1,813		189	17.49
1992	3,672		1,873		245	15.00
1993	4,051		1,700		347	11.68
1994	4,393		1,516		462	9.51
1995	4,957		1,498		593	8.35
1996	5,868		1,657		684	8.59
1997	7,215		1,994		777	9.28
1998	8,883		2,493		853	10.41

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1999	10,924		3,115		925	11.81
2000	13,342	13,255	3,733	3,709	1,074	12.42
2001	14,699	14,641	4,140	4,123	1,204	12.21
2002	16,623	16,615	4,745	4,742	1,350	12.31
2003	18,791	18,861	5,324	5,344	1,584	11.86
2004	20,784	20,832	5,724	5,736	1,886	11.02
2005	23,031	23,094	6,208	6,223	2,256	10.21
2006	26,126	26,199	6,917	6,937	2,659	9.83
2007	29,199	29,298	7,457	7,482	3,178	9.19
2008	32,796	32,920	7,933	7,962	3,680	8.91
2009	34,165	34,284	8,473	8,503	3,948	8.65

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure GD-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keep increasing.

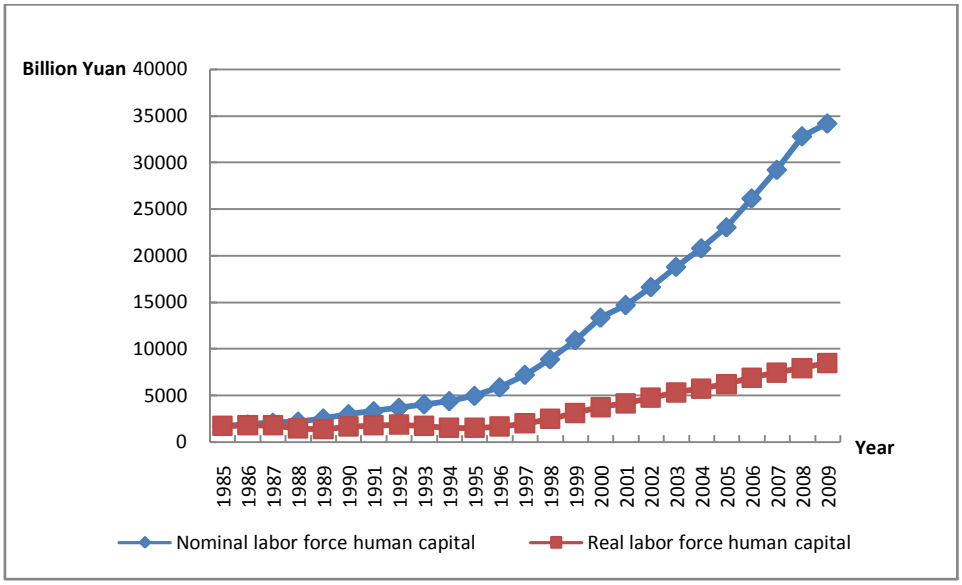


Figure GD-3.1 Nominal and Real Labor Force Human Capital for Guangdong

We also calculate the ratio of labor force human capital to GDP. The results are reported in the last column of Table GD-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure GD-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio remains between 8 and 30 and generally shows a decreasing trend.

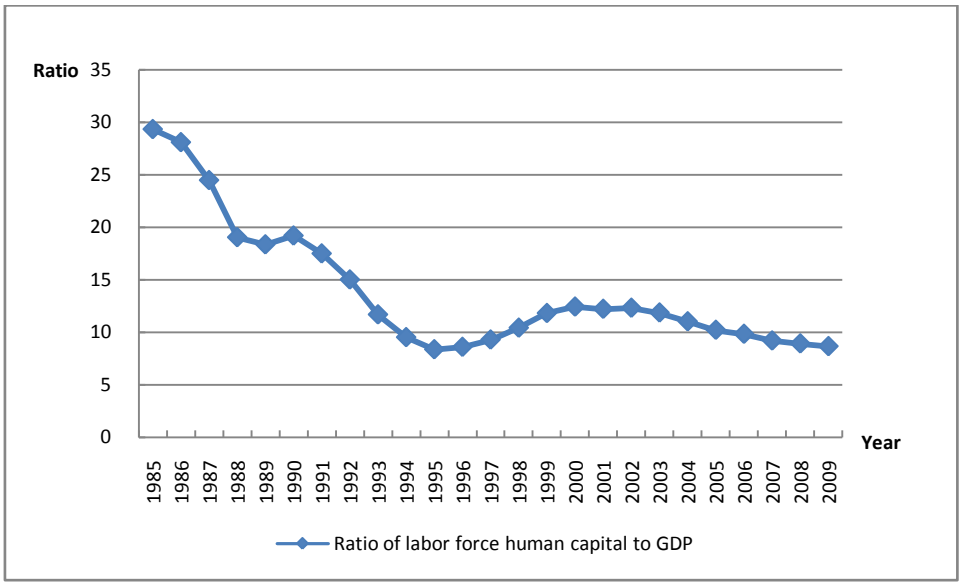


Figure GD-3.2 Ratio of Labor Force Human Capital to GDP for Guangdong

Table GD-3.2 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real human capital. The human capital for urban areas remains larger than that for rural areas from 1985 to 2009.

Table GD-3.2 Nominal and Real Labor Force Human Capital by Region for Guangdong

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	1,694	897	797	1,694	897	797
1986	1,875	992	883	1,786	948	839
1987	2,072	1,093	979	1,773	926	848
1988	2,199	1,192	1,007	1,453	779	674
1989	2,535	1,420	1,115	1,371	761	610
1990	2,992	1,735	1,257	1,660	955	705
1991	3,311	1,941	1,370	1,813	1,045	768

1992	3,672	2,185	1,487	1,873	1,085	788
1993	4,051	2,446	1,605	1,700	996	705
1994	4,393	2,686	1,707	1,516	904	612
1995	4,957	3,224	1,733	1,498	959	539
1996	5,868	3,906	1,962	1,657	1,084	573
1997	7,215	5,106	2,109	1,994	1,387	607
1998	8,883	6,631	2,252	2,493	1,833	660
1999	10,924	8,522	2,402	3,115	2,394	721
2000	13,342	10,760	2,582	3,733	2,958	775
2001	14,699	11,970	2,729	4,140	3,318	822
2002	16,623	13,710	2,913	4,745	3,854	891
2003	18,791	15,650	3,141	5,324	4,368	956
2004	20,784	17,530	3,254	5,724	4,769	955
2005	23,031	19,620	3,411	6,208	5,233	975
2006	26,126	22,360	3,766	6,917	5,857	1,060
2007	29,199	25,030	4,169	7,457	6,324	1,133
2008	32,796	28,210	4,586	7,933	6,755	1,178
2009	34,165	28,840	5,325	8,473	7,074	1,399

Figure GD-3.3 shows real labor force human capital for urban and rural areas respectively. The pattern of labor force human capital is almost the same as that of real human capital. The urban labor force human capital remains larger than the rural one during 1985 to 2009.

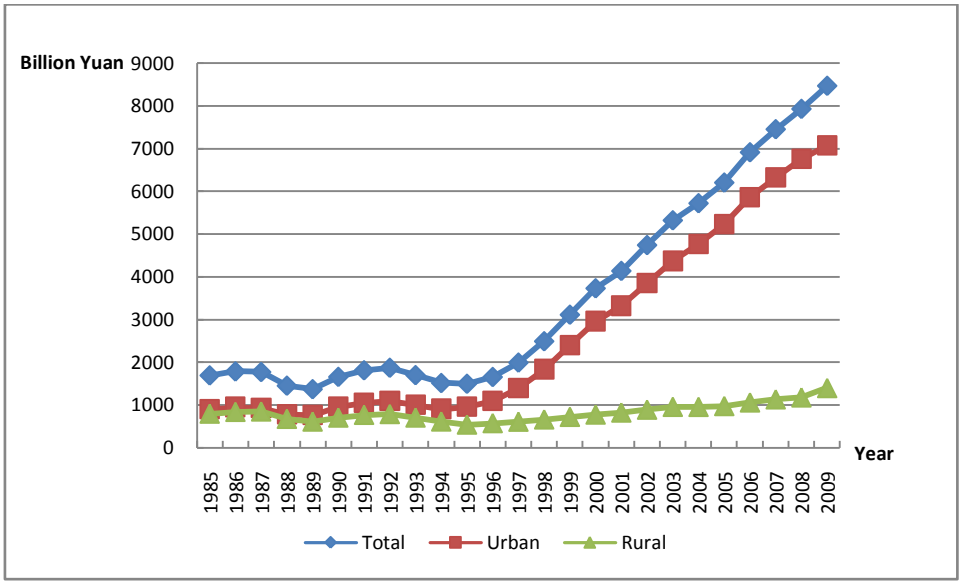


Figure GD-3.3 Real Labor Force Human Capital by Region for Guangdong

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table GD-3.3 reports the nominal and real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female is smaller than that for male.

Table GD-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Guangdong

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	50.94	59.24	40.52	50.94	59.24	40.52
1986	56.38	65.93	44.45	53.71	62.80	42.34
1987	62.17	72.96	48.64	53.20	62.45	41.61
1988	69.06	81.47	53.94	45.64	53.86	35.66
1989	76.73	90.96	60.01	41.51	49.21	32.47
1990	85.30	101.73	66.65	47.32	56.44	36.99
1991	93.85	112.65	72.79	51.40	61.66	39.90
1992	102.81	123.92	79.36	52.43	63.16	40.53
1993	113.25	137.74	86.40	47.54	57.77	36.33
1994	123.19	150.65	93.43	42.51	51.95	32.27
1995	139.30	171.64	104.84	42.10	51.85	31.71
1996	160.07	198.28	119.13	45.20	55.96	33.66
1997	189.26	235.34	140.02	52.30	65.03	38.73
1998	223.57	278.79	165.13	62.75	78.23	46.36
1999	259.52	323.82	191.82	74.00	92.33	54.71
2000	298.10	372.98	219.51	83.41	104.36	61.42
2001	327.13	412.43	237.94	92.15	116.15	67.03
2002	364.18	461.12	263.33	103.94	131.58	75.13
2003	407.95	519.87	292.22	115.59	147.25	82.78
2004	453.34	579.40	322.66	124.86	159.61	88.84
2005	503.42	644.97	356.54	135.70	173.86	96.11
2006	557.47	718.52	390.10	147.59	190.28	103.27
2007	613.90	791.79	428.42	156.78	202.18	109.40
2008	677.57	872.90	472.36	163.90	211.17	114.23
2009	741.68	954.36	526.48	183.94	236.75	130.47

Table GD-3.4 reports the nominal and real average labor force human capital by region. The real average labor force human capital is much

smaller in rural area than in urban area.

Table GD-3.4 Nominal and Real Average Labor Force Human Capital by Region for Guangdong

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	50.94	70.17	38.98	50.94	70.17	38.98
1986	56.38	77.94	42.94	53.71	74.44	40.78
1987	62.17	86.37	47.31	53.20	73.13	40.95
1988	69.06	97.03	51.36	45.64	63.44	34.39
1989	76.73	109.66	55.39	41.51	58.82	30.30
1990	85.30	123.81	59.77	47.32	68.18	33.50
1991	93.85	135.84	65.23	51.40	73.13	36.59
1992	102.81	148.95	70.81	52.43	73.97	37.51
1993	113.25	163.60	77.06	47.54	66.59	33.85
1994	123.19	177.59	83.29	42.51	59.74	29.87
1995	139.30	196.36	90.42	42.10	58.41	28.12
1996	160.07	227.70	100.62	45.20	63.18	29.38
1997	189.26	264.09	112.25	52.30	71.77	32.29
1998	223.57	304.41	124.86	62.75	84.16	36.62
1999	259.52	344.68	138.09	74.00	96.84	41.45
2000	298.10	386.46	153.19	83.41	106.24	45.98
2001	327.13	418.91	166.05	92.15	116.09	50.04
2002	364.18	464.78	180.46	103.94	130.63	55.16
2003	407.95	518.00	198.00	115.59	144.57	60.28
2004	453.34	572.61	214.82	124.86	155.77	63.07
2005	503.42	630.33	234.48	135.70	168.11	67.03
2006	557.47	686.49	264.02	147.59	179.85	74.29
2007	613.90	745.87	296.46	156.78	188.43	80.59
2008	677.57	815.25	332.29	163.90	195.22	85.38
2009	741.68	900.84	378.62	183.94	220.97	99.50

Chapter 17 Human capital for Guizhou

1. Total human capital

Human capital stocks of Guizhou are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table GZ-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[84]

Table GZ-1.1 Nominal and Real Human Capital, Nominal GDP for Guizhou

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	593		593		12	47.88
1986	669		633		14	47.95
1987	783		683		17	47.28
1988	858		627		21	40.53
1989	978		603		24	41.48
1990	1,153		698		26	44.30
1991	1,195		696		30	40.40
1992	1,359		733		34	39.99
1993	1,562		726		42	37.39
1994	1,782		675		52	33.97

[84] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	2,057		641		64	32.34
1996	2,350		668		72	32.49
1997	2,712		745		81	33.66
1998	3,107		852		86	36.20
1999	3,562		984		94	37.99
2000	4,264	4,278	1,183	1,187	103	41.40
2001	4,582	4,591	1,247	1,249	113	40.43
2002	5,200	5,213	1,429	1,432	124	41.82
2003	5,889	5,906	1,598	1,602	143	41.29
2004	6,697	6,726	1,746	1,753	168	39.92
2005	7,284	7,318	1,880	1,890	198	36.81
2006	8,077	8,112	2,050	2,059	227	35.57
2007	9,097	9,141	2,173	2,184	274	33.18
2008	10,301	10,359	2,290	2,304	333	30.90
2009	11,599	11,667	2,613	2,629	391	29.64

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure GZ-1.1 graphs real and nominal human capital for Guizhou reported in Table GZ-1.1 As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

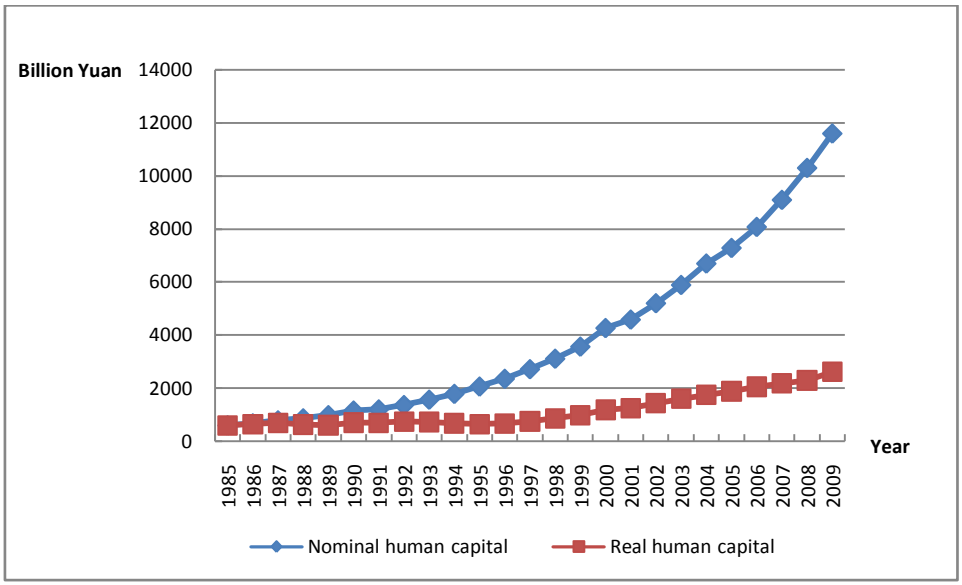


Figure GZ-1.1 Nominal and Real Human Capital for Guizhou

In order to get a sense of the magnitude of the human capital in Guizhou, we also present the ratio of nominal human capital to nominal GDP in Table GZ-1.1.[85] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure GZ-1.2, nominal human capital is substantially higher than nominal GDP for Guizhou. There are three stages in this series: Downward from 1985 through 1995, upward from 1996 through 2000, and finally downward from 2002 through 2009.

[85] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

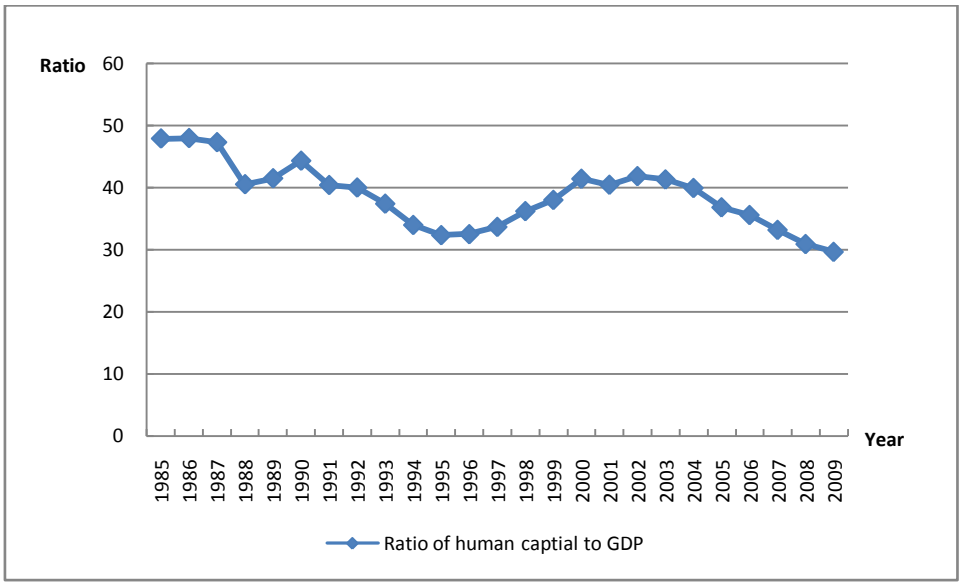


Figure GZ-1.2 Ratio of Human Capital to GDP for Guizhou

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table GZ-1.2 shows real human capital for Guizhou by gender and region. The results based on five education categories show that the human capital for Guizhou during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Guizhou increases from 0.59 trillion Yuan to 2.61 trillion Yuan (calculated by 1985 comparable price) by 3 times, and the annual growth rate of human capital over this period increases to 6.18%.[86]

From 1985 to 2009, male human capital in Guizhou increases from 0.368 trillion Yuan to 1.635 trillion Yuan, the human capital for female in Guizhou increases from 0.226 trillion Yuan to 0.979 trillion Yuan. During the same period, the annual growth rates of human capital are 6.21% and 6.11% for male and female respectively. The gender gap in the estimated

[86] In calculating annual average growth rate in this report, we calculate annual growth rate using the difference of logarithm for every year, and then take average across years.

human capital increases from 0.142 trillion Yuan in 1985 to 0.656 trillion Yuan in 2009. In 2009, the male human capital is about 1.7 times the amount of that for female in Guizhou.

From 1985 to 2009, rural human capital for Guizhou increases from 0.230 trillion Yuan to 0.638 trillion Yuan, the urban human capital in Guizhou increases from 0.363 trillion Yuan to 1.985 trillion Yuan. During the same period, the annual growth rates of human capital are 4.19% and 7.08% for rural and urban areas respectively. The region gap in the estimated human capital increases from 0.133 trillion Yuan in 1985 to 1.357 trillion Yuan in 2009. In 2009, the urban human capital is about 3 times the amount of that for rural in Guizhou. In a word, both gender and region gap of real human capital in Guizhou are expanding from 1985 to 2009.

Table GZ-1.2 Real Human Capital by Gender and Region for Guizhou[87]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	593	368	226	363	230
1986	633	393	241	388	245
1987	683	424	260	433	250
1988	627	388	239	374	252
1989	603	374	229	370	233
1990	698	434	263	446	252
1991	696	430	266	401	295
1992	733	455	278	425	308
1993	726	451	274	429	296
1994	675	422	253	407	267

[87] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1995	641	398	243	402	239
1996	668	416	252	422	246
1997	745	466	280	480	265
1998	852	535	317	557	295
1999	984	623	362	656	328
2000	1,183	742	441	818	365
2001	1,247	782	465	851	397
2002	1,429	896	532	991	437
2003	1,598	1,002	595	1,129	469
2004	1,746	1,095	652	1,259	487
2005	1,880	1,173	707	1,386	494
2006	2,050	1,285	765	1,512	538
2007	2,173	1,363	810	1,620	553
2008	2,290	1,435	855	1,727	563
2009	2,613	1,635	979	1,985	629

Figure GZ-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason male real human capital is higher than female real human capital is the earlier retirement for women (age 55 for women vs. age 60 for men based on China Labor Law). Accordingly, men have more time to generate income in the market. Another reason is more educational attainment for men. Moreover, the male-female income gap has been on expansion. The results based on six education categories show similar trends.

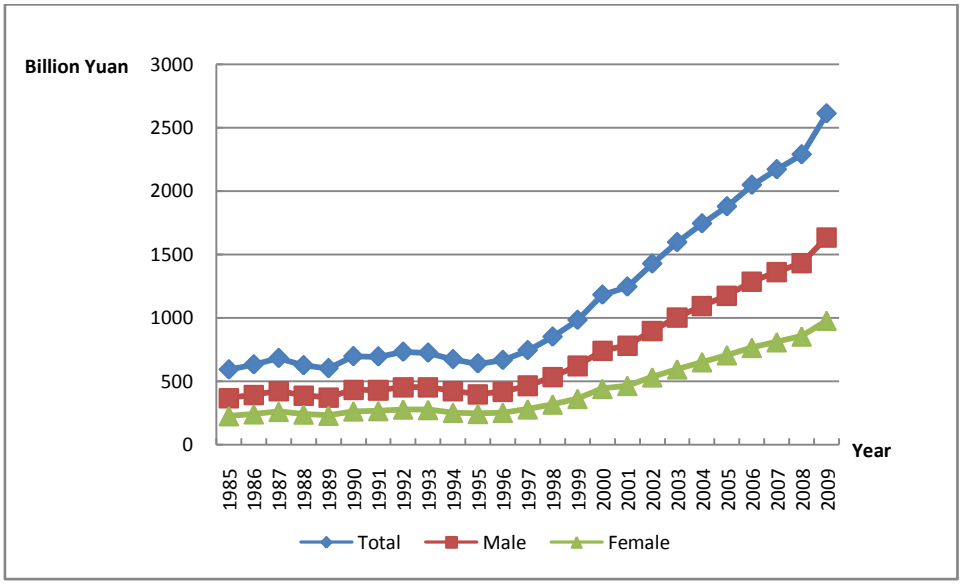


Figure GZ-1.3 Real Human Capital by Gender for Guizhou

Figure GZ-1.4 shows the real human capital for urban and rural separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1997, the urban human capital is about 1.5-2 times the amount of that for rural. Since 1997, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly, which results in a larger region gap.

This change is, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the education gap between the urban and rural population. Urban areas usually have a larger proportion of educated population than rural areas do.

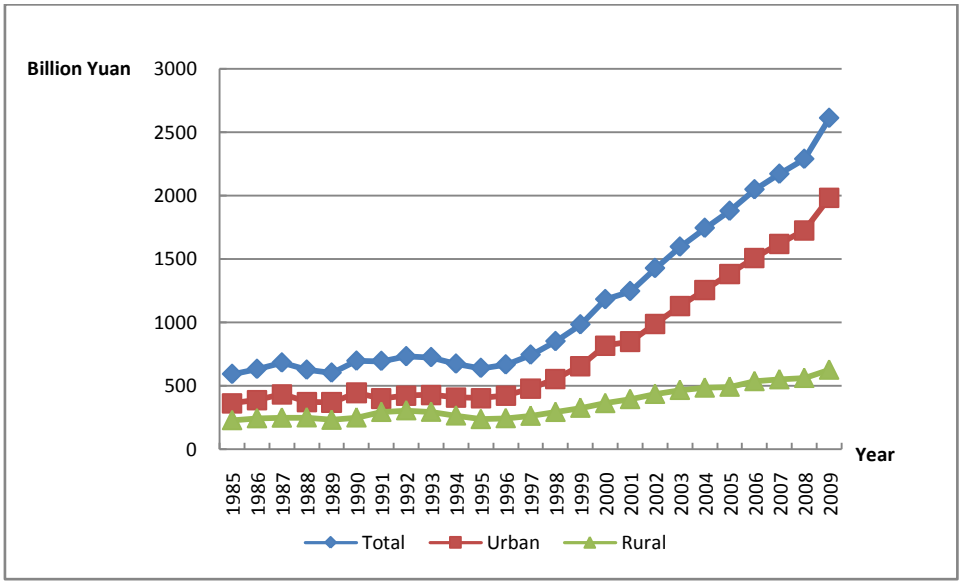


Figure GZ-1.4 Real Human Capital by Region for Guizhou

Finally we calculate real human capital indices using 1985 as the base year. The results for each group are reported in Table GZ-1.3.

Table GZ-1.3 Real Human Capital Index for Guizhou (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.71	106.77	106.64	106.80	106.56
1987	115.17	115.23	115.16	119.27	108.69
1988	105.63	105.49	105.89	103.08	109.65
1989	101.70	101.77	101.61	101.93	101.35
1990	117.58	118.14	116.71	122.82	109.30
1991	117.31	117.02	117.82	110.38	128.25
1992	123.53	123.66	123.40	117.02	133.81
1993	122.32	122.76	121.63	118.20	128.81
1994	113.69	114.74	112.01	112.17	116.08
1995	108.01	108.10	107.90	110.68	103.78
1996	112.61	113.08	111.87	116.27	106.82

1997	125.62	126.65	124.02	132.27	115.12
1998	143.62	145.39	140.74	153.36	128.25
1999	165.92	169.32	160.43	180.73	142.55
2000	199.43	201.88	195.50	225.33	158.54
2001	210.18	212.67	206.19	234.17	172.32
2002	240.81	243.79	235.99	272.94	190.09
2003	269.29	272.59	263.92	310.85	203.69
2004	294.29	297.69	289.07	346.64	211.65
2005	316.91	319.12	313.50	381.61	214.78
2006	345.53	349.58	339.17	416.30	233.81
2007	366.19	370.79	358.99	446.04	240.16
2008	386.04	390.29	379.04	475.50	244.85
2009	440.50	444.60	433.93	546.53	273.14

Figure GZ-1.5 shows the index of real total human capital for Guizhou. Before 1997 the index grows quite steadily; it accelerates after that year.

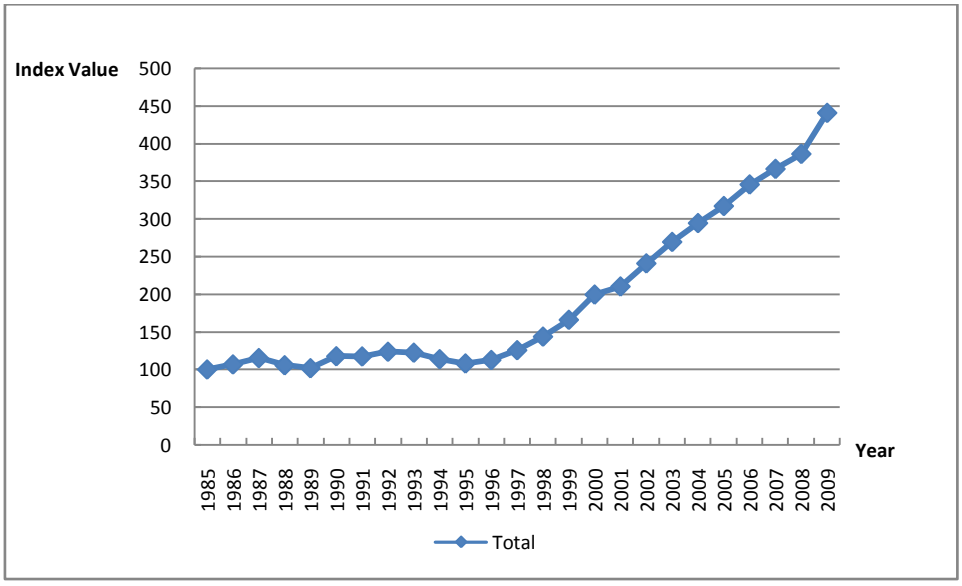


Figure GZ-1.5 Real Human Capital Index for Guizhou

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), more educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table GZ-2.1 shows the human capital per capita by gender for Guizhou. Based on the five education categories, real human capital per capita for male increases from 25,910 Yuan to 94,730 Yuan, by around 3 times; real human capital per capita for female increases from 17,260 Yuan to 65,450 Yuan, by around 3 times. From 1985 to 2009, the annual growth rate is 5.40% for male, and 5.55% for female.

Table GZ-2.1 Nominal and Real Human Capital Per Capita by Gender for Guizhou

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	21.77	25.91	17.26	21.77	25.91	17.26
1986	24.21	28.87	19.16	22.91	27.30	18.14
1987	27.93	33.39	22.04	24.39	29.12	19.29
1988	29.86	35.40	23.76	21.80	25.79	17.42
1989	33.68	39.78	26.90	20.77	24.48	16.65
1990	38.52	45.50	30.71	23.31	27.49	18.64
1991	39.39	46.17	31.79	22.93	26.84	18.56
1992	44.34	51.98	35.73	23.91	27.98	19.32

1993	50.48	59.19	40.61	23.45	27.46	18.91
1994	57.09	67.22	45.58	21.61	25.42	17.29
1995	64.90	75.87	52.46	20.21	23.63	16.35
1996	73.34	86.10	58.95	20.85	24.46	16.78
1997	83.63	98.24	67.02	22.98	26.97	18.44
1998	94.81	111.42	75.77	26.00	30.52	20.81
1999	107.58	126.79	85.29	29.73	35.01	23.60
2000	124.16	145.38	99.62	34.45	40.33	27.66
2001	135.51	159.03	108.48	36.88	43.25	29.56
2002	153.11	180.09	122.28	42.07	49.44	33.62
2003	173.10	203.81	138.01	46.96	55.27	37.47
2004	196.91	231.78	157.20	51.34	60.44	41.01
2005	223.17	261.85	179.23	57.61	67.60	46.26
2006	248.58	292.51	198.46	63.09	74.26	50.38
2007	281.43	330.28	225.34	67.21	78.92	53.80
2008	318.16	371.93	256.13	70.74	82.70	56.90
2009	360.13	420.24	290.74	81.14	94.73	65.45

Figure GZ-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for males and females. Real human capital per capita for male and female both exhibit an accelerating growth after 1996. The male-female gap has been widening.

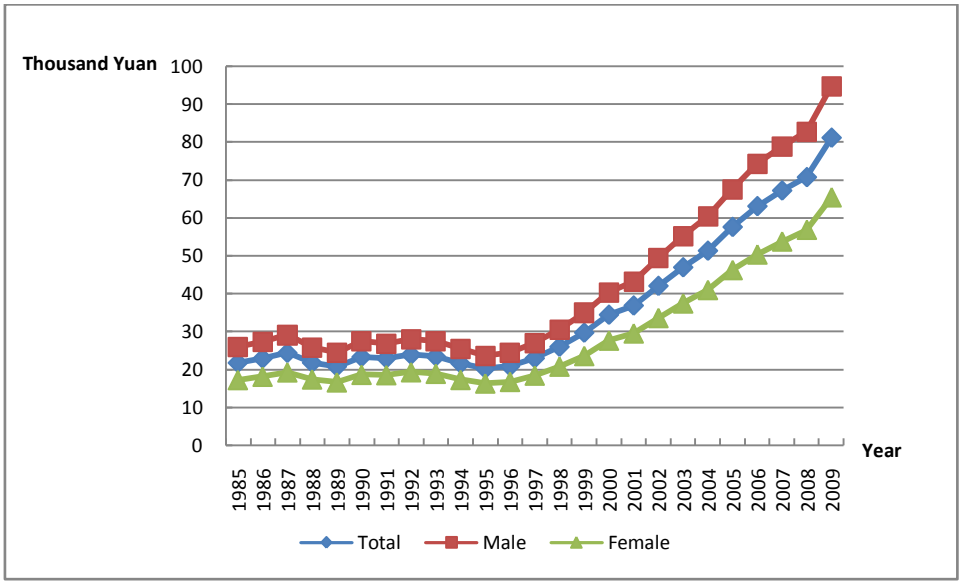


Figure GZ-2.1 Real Human Capital Per Capita by Gender for Guizhou

Table GZ-2.3 reports the results of human capital per capita measured in nominal and real terms for Guizhou by region separately. From 1985 to 2009, human capital per capita in urban areas is significantly larger than that in the rural. Per capita urban human capital increases from 44,630 Yuan to 193,620 Yuan, while per capita rural human capital increases from 12,040 Yuan to 28,620 Yuan. Human capital per capita in urban areas grows much faster than that in the rural.

Table GZ-2.2 Nominal and Real Human Capital Per Capita by Region for Guizhou

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	21.77	44.63	12.04	21.77	44.63	12.04
1986	24.21	49.39	13.30	22.91	46.41	12.71
1987	27.93	54.50	14.77	24.39	46.69	13.35

1988	29.86	61.23	16.30	21.80	43.17	12.57
1989	33.68	68.22	17.99	20.77	40.80	11.67
1990	38.52	76.32	19.88	23.31	45.15	12.55
1991	39.39	87.78	22.00	22.93	49.98	13.21
1992	44.34	99.15	24.38	23.91	51.93	13.70
1993	50.48	113.81	27.12	23.45	51.48	13.11
1994	57.09	129.30	30.06	21.61	47.94	11.76
1995	64.90	146.54	33.30	20.21	45.46	10.45
1996	73.34	167.37	36.66	20.85	46.95	10.67
1997	83.63	192.55	40.51	22.98	52.24	11.40
1998	94.81	219.91	44.64	26.00	59.36	12.62
1999	107.58	250.76	49.20	29.73	68.45	13.95
2000	124.16	278.51	54.50	34.45	76.63	15.42
2001	135.51	314.11	59.70	36.88	84.40	16.71
2002	153.11	357.16	65.37	42.07	97.04	18.42
2003	173.10	405.73	71.62	46.96	109.25	19.79
2004	196.91	464.35	78.71	51.34	120.81	20.65
2005	223.17	516.32	86.41	57.61	133.53	22.20
2006	248.58	582.52	95.79	63.09	148.28	24.13
2007	281.43	660.86	106.48	67.21	158.85	24.98
2008	318.16	747.90	118.26	70.74	168.01	25.50
2009	360.13	849.80	131.47	81.14	193.62	28.62

Figure GZ-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, real human capital per capita for urban and rural both exhibit an accelerating growth after 1996. Based on five education categories, the ratio of urban to rural increases from 3.71 in 1985 to 6.77 in 2009, the absolute size of region gap has been on the rise. From 1985 to 2009, the annual growth rate is 6.11% for the urban area, and 3.61% for the rural area.

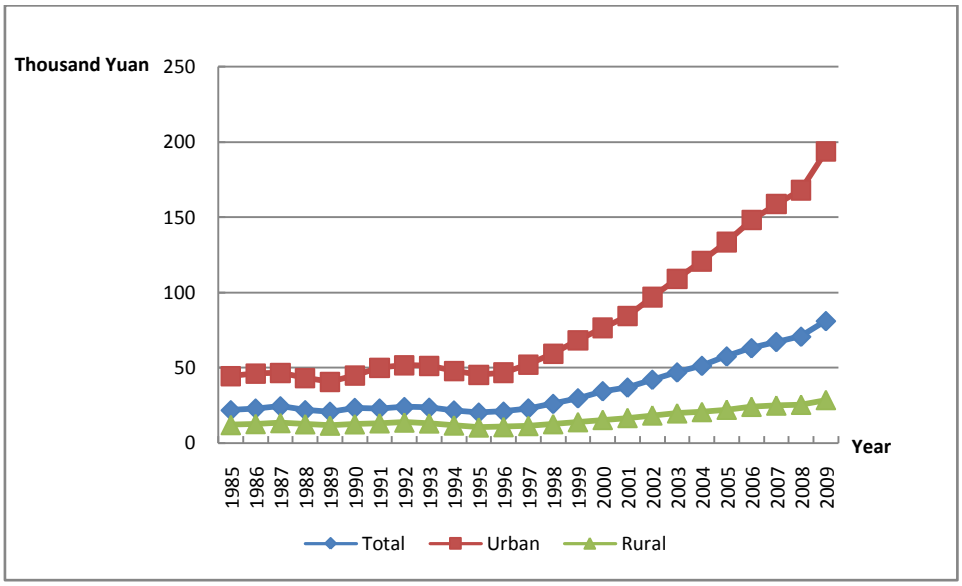


Figure GZ-2.2 Real Human Capital Per Capita by Region for Guizhou

Figure GZ-2.3 shows the real human capital per capita index for Guizhou. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

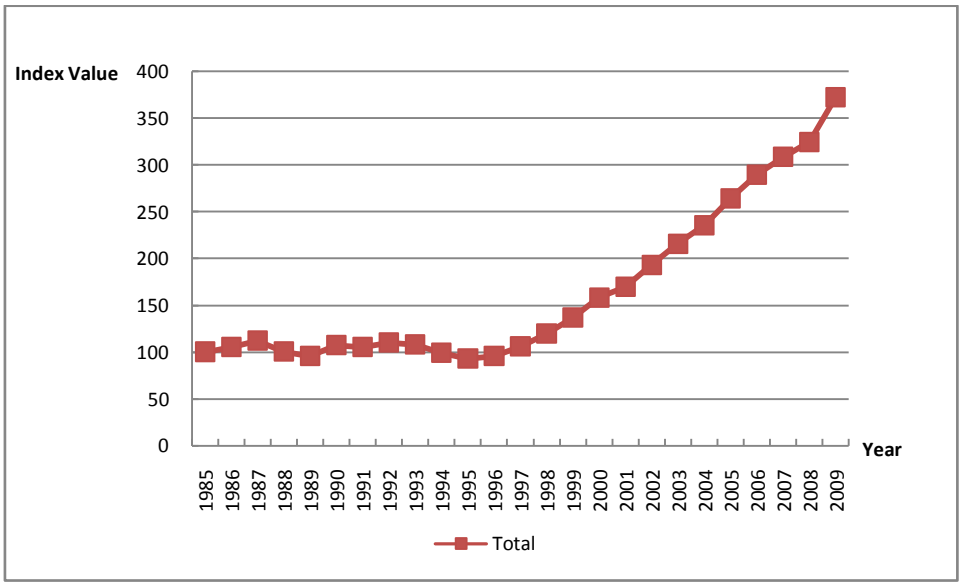


Figure GZ-2.3 Real Human Capital Per Capita Index for Guizhou

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table GZ-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table GZ-3.1 Labor Force Human Capital and Nominal GDP for Guizhou

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	251		251		12	20.21
1986	290		274		14	20.76
1987	348		304		17	21.00
1988	399		292		21	18.83
1989	475		293		24	20.16
1990	582		352		26	22.36
1991	603		352		30	20.39
1992	691		373		34	20.32
1993	787		366		42	18.83
1994	887		337		52	16.91
1995	1,008		314		64	15.84
1996	1,123		320		72	15.53
1997	1,270		350		81	15.76
1998	1,439		396		86	16.76

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1999	1,625		450		94	17.34
2000	1,963	1,385	546	392	103	19.06
2001	2,020	1,521	551	426	113	17.82
2002	2,201	1,661	607	468	124	17.70
2003	2,427	1,821	660	503	143	17.01
2004	2,645	1,952	690	512	168	15.77
2005	2,842	1,977	733	508	198	14.36
2006	3,137	2,242	795	565	227	13.81
2007	3,462	2,516	825	590	274	12.63
2008	3,894	2,840	862	612	333	11.68
2009	4,389	3,190	984	694	391	11.22

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure GZ-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keeps increasing.

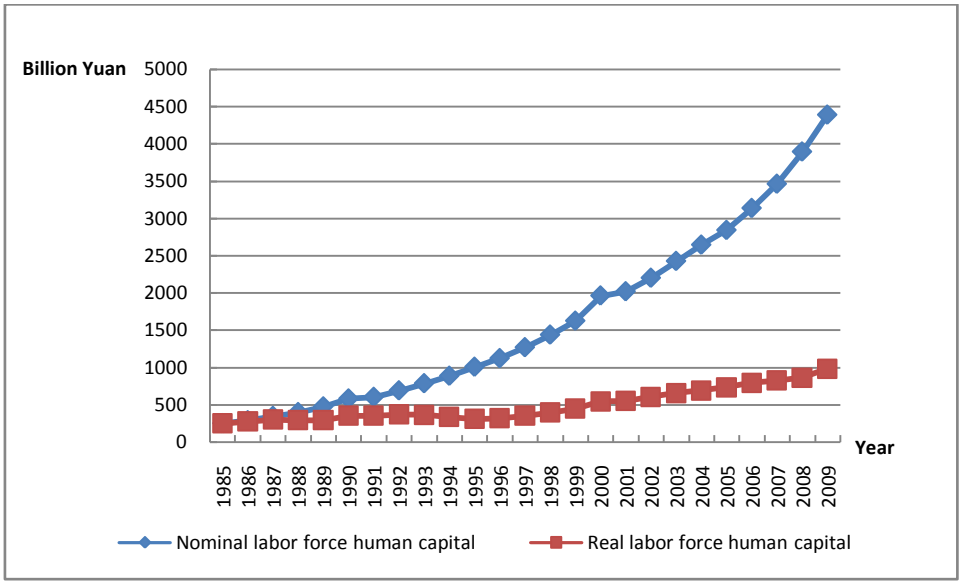


Figure GZ-3.1 Nominal and Real Labor Force Human Capital for Guizhou

We also calculate the ratio of labor force human capital to GDP. The results are reported in the last column of Table GZ-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure GZ-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. The ratio remains between 10 and 21 and generally shows a decreasing trend.

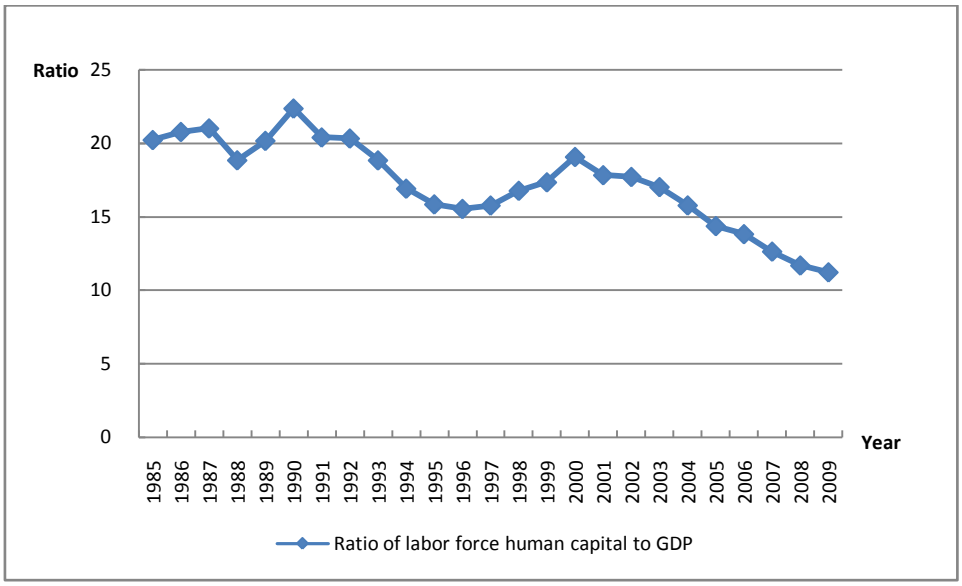


Figure GZ-3.2 Ratio of Labor Force Human Capital to GDP for Guizhou

Figure GZ-3.3 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table GZ-3.2 Real Labor Force Human Capital by Region for Guizhou

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	251	148	102	251	148	102
1986	290	172	117	274	162	112
1987	348	219	128	304	188	116
1988	399	242	157	292	170	121
1989	475	298	177	293	178	115
1990	582	381	200	352	226	126
1991	603	340	263	352	194	158

1992	691	391	299	373	205	168
1993	787	448	339	366	203	164
1994	887	507	380	337	188	149
1995	1,008	584	423	314	181	133
1996	1,123	653	470	320	183	137
1997	1,270	746	524	350	202	148
1998	1,439	858	581	396	232	164
1999	1,625	988	637	450	270	181
2000	1,963	1,265	698	546	348	198
2001	2,020	1,253	767	551	337	215
2002	2,201	1,363	838	607	370	236
2003	2,427	1,508	919	660	406	254
2004	2,645	1,660	985	690	432	259
2005	2,842	1,845	997	733	477	256
2006	3,137	2,004	1,133	795	510	285
2007	3,462	2,190	1,272	825	526	298
2008	3,894	2,459	1,435	862	552	309
2009	4,389	2,775	1,614	984	632	351

Figure GZ-3.3 shows real labor force human capital for urban and rural respectively. The pattern of labor force human capital is almost the same as that of real human capital. The rural labor force human capital grows relatively slower and is much less than the urban one.

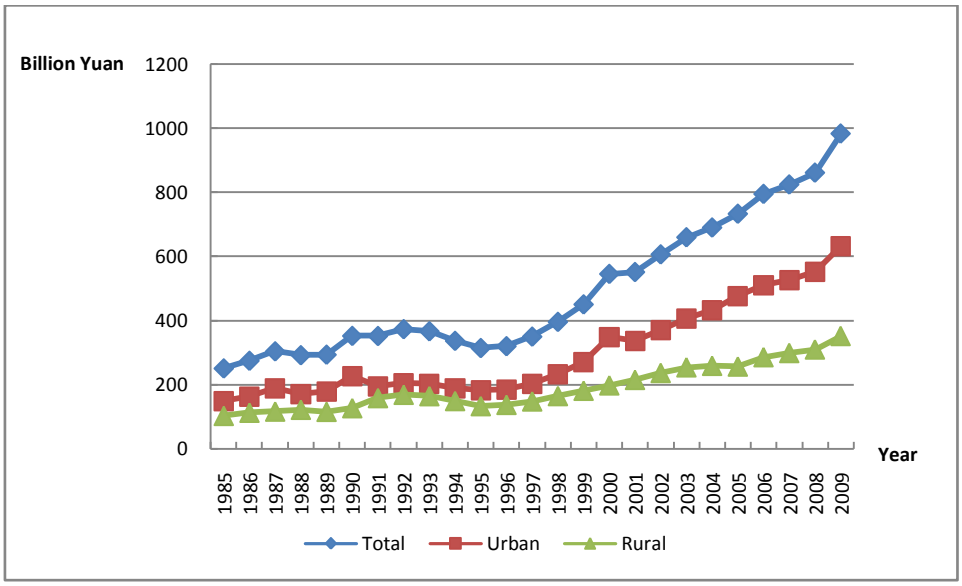


Figure GZ-3.3 Real Labor Force Human Capital by Region for Guizou

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of the population that are over 15 years old, non-retired and out of school.

Table GZ-3.3 reports the real average labor force human capital classified by gender. Average labor force human capital for female is smaller than that for male. More specifically, the number for male is about 1.5 times that for female in 2009.

Table GZ-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Guizhou

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	18.08	21.53	14.14	18.08	21.53	14.14
1986	20.13	23.93	15.86	19.05	22.65	15.02
1987	23.39	27.92	18.37	20.44	24.38	16.09
1988	25.34	30.04	20.05	18.53	21.92	14.71
1989	28.94	34.20	22.91	17.86	21.06	14.18
1990	33.38	39.37	26.42	20.20	23.80	16.03
1991	33.47	39.22	26.85	19.51	22.84	15.68
1992	37.38	43.86	29.91	20.19	23.66	16.20
1993	41.84	49.25	33.32	19.49	22.91	15.56
1994	46.45	54.75	36.92	17.63	20.76	14.04
1995	51.83	61.14	41.16	16.16	19.05	12.83
1996	57.44	67.86	45.45	16.36	19.32	12.97
1997	64.12	75.95	50.46	17.66	20.91	13.92
1998	71.81	85.47	55.96	19.75	23.49	15.42
1999	80.23	95.71	62.08	22.23	26.50	17.22
2000	93.11	111.69	71.27	25.88	31.02	19.83
2001	98.25	117.81	75.49	26.82	32.13	20.64
2002	106.94	128.64	82.06	29.47	35.42	22.64
2003	117.33	141.43	90.02	31.91	38.44	24.51
2004	128.69	155.39	98.58	33.59	40.55	25.74
2005	144.45	174.77	110.57	37.27	45.09	28.53
2006	158.85	192.15	121.36	40.28	48.73	30.76
2007	175.24	211.25	134.48	41.75	50.35	32.01
2008	195.48	234.43	150.93	43.26	51.91	33.36
2009	220.05	262.87	170.92	49.32	58.96	38.25

Table GZ-3.4 reports the real average labor force human capital by region. The real average labor force human capital is much smaller in rural

area than in urban area.

Table GZ-3.4 Nominal and Real Average Labor Force Human Capital by Region for Guizhou

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	18.08	32.23	11.06	18.08	32.23	11.06
1986	20.13	35.86	12.25	19.05	33.70	11.71
1987	23.39	40.28	13.62	20.44	34.51	12.31
1988	25.34	45.64	15.07	18.53	32.18	11.62
1989	28.94	51.70	16.62	17.86	30.92	10.79
1990	33.38	58.41	18.39	20.20	34.56	11.61
1991	33.47	65.18	20.54	19.51	37.11	12.34
1992	37.38	73.03	22.82	20.19	38.25	12.82
1993	41.84	82.20	25.38	19.49	37.18	12.27
1994	46.45	91.69	28.01	17.63	34.00	10.96
1995	51.83	102.20	30.85	16.16	31.71	9.68
1996	57.44	114.59	33.92	16.36	32.15	9.87
1997	64.12	129.35	37.33	17.66	35.09	10.51
1998	71.81	145.92	41.04	19.75	39.39	11.60
1999	80.23	163.66	44.82	22.23	44.67	12.70
2000	93.11	184.32	49.10	25.88	50.72	13.89
2001	98.25	202.02	53.42	26.82	54.28	14.95
2002	106.94	222.09	58.03	29.47	60.34	16.35
2003	117.33	245.81	63.16	31.91	66.19	17.45
2004	128.69	271.05	68.28	33.59	70.52	17.91
2005	144.45	300.36	73.69	37.27	77.68	18.93
2006	158.85	335.28	82.26	40.28	85.34	20.72
2007	175.24	372.38	91.70	41.75	89.51	21.51
2008	195.48	417.79	102.25	43.26	93.85	22.04
2009	220.05	475.51	114.40	49.32	108.34	24.91

Chapter 18 Human capital for Gansu

1. Total human capital

Human capital stocks of Gansu are calculated using estimated income parameters and a 4.58% discount rate. The results are reported in Table GS-1.1. Column 1 and column 2 contain the nominal human capital; column 3 and column 4 contain the real human capital deflated by CPI (in 1985 Yuan).[88]

Table GS-1.1 Nominal and Real Human Capital, Nominal GDP for Gansu

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	373		373		12	30.26
1986	425		399		14	30.20
1987	483		422		16	30.28
1988	545		403		19	28.42
1989	617		386		22	28.43
1990	705		428		24	29.04
1991	795		458		27	29.28
1992	894		482		32	28.12
1993	1,020		477		37	27.40
1994	1,163		438		45	25.63

[88] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal human capital (Billions of Yuan)		Real human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1995	1,320		416		56	23.67
1996	1,495		428		72	20.68
1997	1,713		477		79	21.59
1998	1,949		548		89	21.96
1999	2,241		645		96	23.44
2000	2,542	2,545	734	734	105	24.14
2001	2,899	2,908	803	806	113	25.76
2002	3,351	3,363	929	932	123	27.20
2003	3,855	3,871	1,057	1,062	140	27.54
2004	4,394	4,416	1,177	1,183	169	26.02
2005	4,949	4,970	1,303	1,309	193	25.59
2006	5,748	5,782	1,495	1,505	228	25.24
2007	6,491	6,538	1,601	1,614	270	24.01
2008	7,305	7,363	1,666	1,680	318	23.00
2009	8,409	8,484	1,896	1,914	339	24.82

Note: The ratio of human capital to GDP is based on the current values for that year.

Figure GS-1.1 graphs real and nominal human capital for Gansu reported in Table GS-1.1 As is seen from the figure, both the nominal and real human capital rise steadily and nominal human capital grows faster than real human capital.

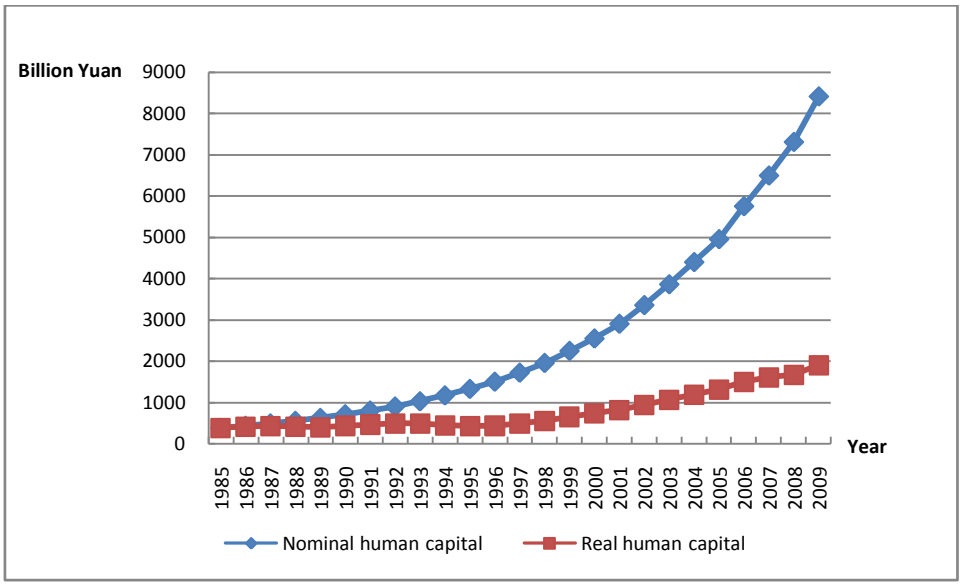


Figure GS-1.1 Nominal and Real Human Capital for Gansu

In order to get a sense of the magnitude of the human capital in Gansu, we also present the ratio of nominal human capital to nominal GDP in Table GS-1.1.[89] Similar to physical capital, human capital plays an important role in GDP growth, so the ratio can also reflect human capital's influence on sustainable growth of GDP. As is shown in Figure GS-1.2, nominal human capital is substantially higher than nominal GDP for Gansu. From 1985 to 1991, the ratio of human capital to GDP in Gansu almost remains the same except a slight drop in 1988 and 1989. The ratio decreases at a considerable rate after 1992 and then keeps growing steadily from 1996 to 2003. After a slow decrease between 2003 and 2008, the ratio of human capital to GDP measured in nominal terms rises to 24.82 by 2009.

[89] The reason for calculating the ratio at the nominal level is to avoid the differences between the real value of human capital and that of GDP caused by using different deflator indices.

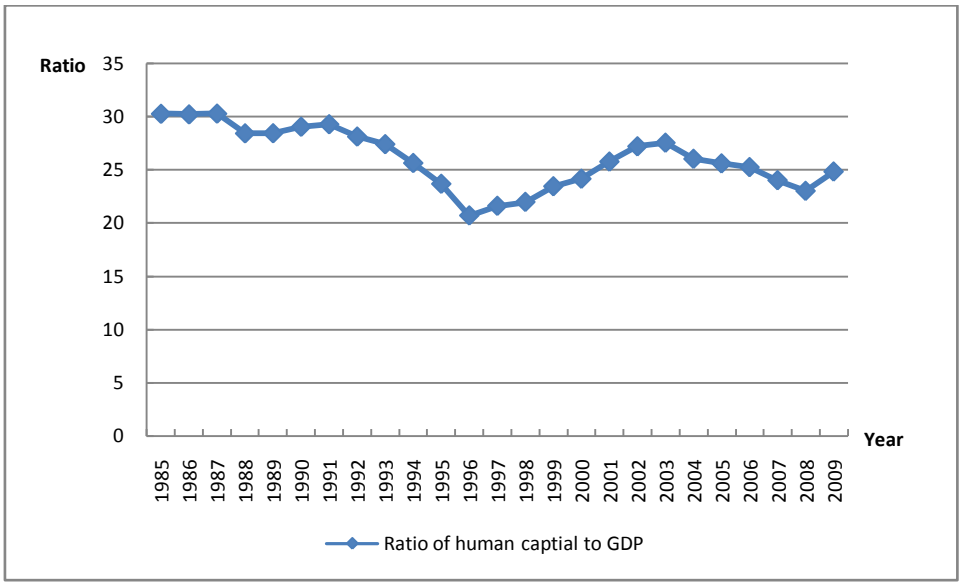


Figure GS-1.2 Ratio of Human Capital to GDP for Gansu

In order to discuss the trend of human capital, we calculate the real values here by CPI. Table GS-1.2 shows real human capital for Gansu by gender and region. The results based on five education categories show that the human capital for Gansu during 1985 to 2009 keeps growing rapidly. More specifically, the human capital for Gansu increases from 0.373 trillion Yuan to 1.8963 trillion Yuan (calculated by 1985 comparable price), by 4 times. The annual growth rate of human capital over this period increases to 6.78%.

From 1985 to 2009, male human capital in Gansu increases from 0.225 trillion Yuan to 1.1643 trillion Yuan, while the human capital for female in Gansu increases from 0.148 trillion Yuan to 0.7323 trillion Yuan. During the same period, the annual growth rates of human capital are 6.85% and 6.67% for male and female respectively. The gender gap in the estimated human capital increases from 0.077 trillion Yuan in 1985 to 0.432 trillion

Yuan in 2009. In 2009, the male human capital is about 1.6 times the amount of that for female in Gansu.

From 1985 to 2009, rural human capital in Gansu increases from 0.189 trillion Yuan to 0.531 trillion Yuan, the urban human capital in Gansu increases from 0.185 trillion Yuan to 1.365 trillion Yuan. During the same period, the annual growth rates of human capital are 4.30% and 8.32% for rural and urban areas respectively. The region gap in the estimated human capital increases from -0.004 trillion Yuan in 1985 to 0.8337 trillion Yuan in 2009. In 2009, the urban human capital is about 2.6 times the amount of that for rural in Gansu. In a word, both gender and region gap of real human capital in Gansu are expanding from 1985 to 2009.

Table GS-1.2 Real Human Capital by Gender and Region for Gansu[90]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	373	225	148	185	189
1986	399	242	157	202	197
1987	422	257	165	215	207
1988	403	247	156	202	201
1989	386	238	148	194	193
1990	428	264	164	217	210
1991	458	283	176	232	227
1992	482	298	185	244	239
1993	477	295	182	244	232
1994	438	271	167	225	213
1995	416	256	160	215	201

[90] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1996	428	264	163	222	206
1997	477	296	181	250	226
1998	548	339	209	290	258
1999	645	400	245	349	295
2000	734	455	279	403	331
2001	803	497	307	455	349
2002	929	577	352	551	378
2003	1,057	653	404	651	406
2004	1,177	727	450	753	423
2005	1,303	800	503	865	438
2006	1,495	919	577	1,022	473
2007	1,601	983	619	1,111	490
2008	1,666	1,023	644	1,170	496
2009	1,896	1,164	732	1,365	531

Figure GS-1.3 shows that real human capital by five education categories keeps growing, and it grows even faster during 1996-2009. One reason male real human capital is higher than female real human capital is the earlier retirement for women (age 55 vs. age 60 for men based on China Labor Law). Accordingly, men have more time to generate income in the market. Another reason is more educational attainment for men. Moreover, the male-female income gap has been expanding. The results based on six education categories show similar trends.

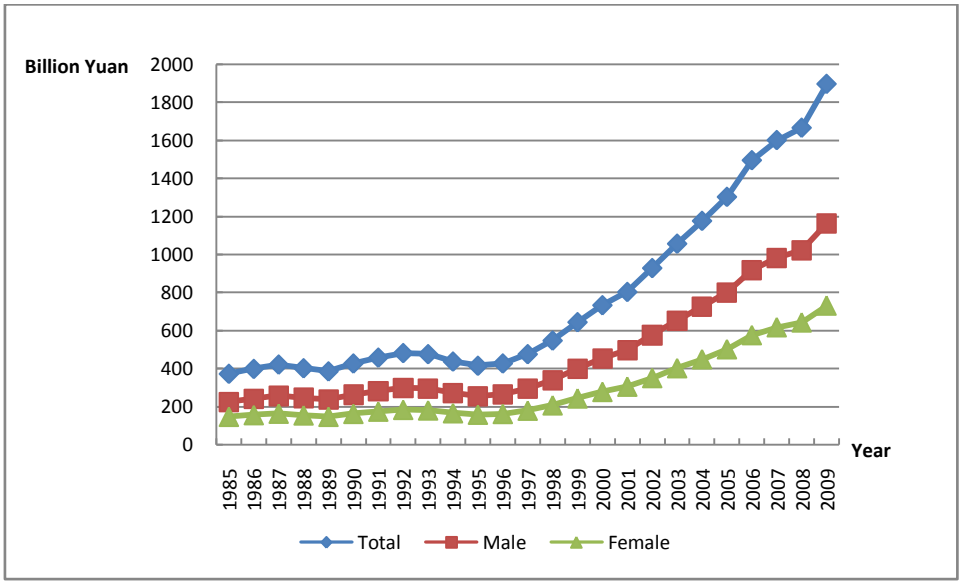


Figure GS-1.3 Real Human Capital by Gender for Gansu

Figure GS-1.4 shows the real human capital for urban and rural separately. Before 1997, the amount of real human capital in both areas is quite close. Since 1997, however, the real human capital in the urban area has been rising much more rapidly, while the real human capital in the rural area grows quite slowly, which results in a larger region gap.

This change is, to a large extent, a result of the rapid urbanization during the course of economic transition as well as a large scale rural-urban migration. Another reason is the education gap between the urban and rural population. Urban areas usually have a larger proportion of educated population than rural areas.

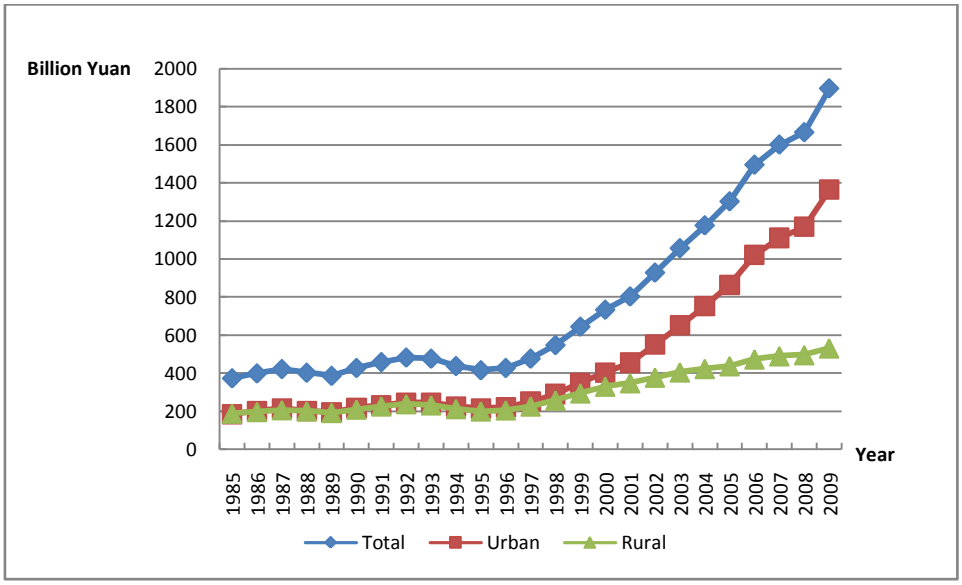


Figure GS-1.4 Real Human Capital by Region for Gansu

Finally we calculate real human capital indices using 1985 as the base year. The results for each group are reported in Table GS-1.3.

Table GS-1.3 Real Human Capital Index for Gansu (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.88	107.47	105.97	109.26	104.56
1987	112.99	114.22	111.17	116.41	109.64
1988	107.82	109.69	104.95	109.21	106.46
1989	103.40	105.64	100.03	104.88	101.96
1990	114.49	117.20	110.38	117.66	111.39
1991	122.76	125.64	118.41	125.57	120.02
1992	129.19	132.27	124.49	132.12	126.32
1993	127.64	130.98	122.58	132.29	123.09
1994	117.22	120.27	112.59	121.83	112.71
1995	111.30	113.78	107.55	116.52	106.20
1996	114.54	117.51	110.05	120.04	109.16

1997	127.64	131.51	121.78	135.59	119.86
1998	146.73	150.80	140.54	157.20	136.49
1999	172.63	177.64	164.93	189.27	156.36
2000	196.46	202.00	188.03	218.20	175.21
2001	215.16	220.80	206.63	246.42	184.59
2002	248.74	256.40	237.08	298.43	200.16
2003	283.05	290.36	271.91	352.87	214.78
2004	315.16	322.89	303.44	408.13	224.26
2005	348.93	355.51	338.88	468.58	231.94
2006	400.48	408.31	388.80	553.63	250.74
2007	428.82	436.76	416.69	601.84	259.64
2008	446.20	454.44	433.67	633.80	262.76
2009	507.85	517.47	493.36	739.44	281.41

Figure GS-1.5 shows the index of real total human capital for Gansu. Before 1997 the index grows quite steadily; it accelerates after that year.

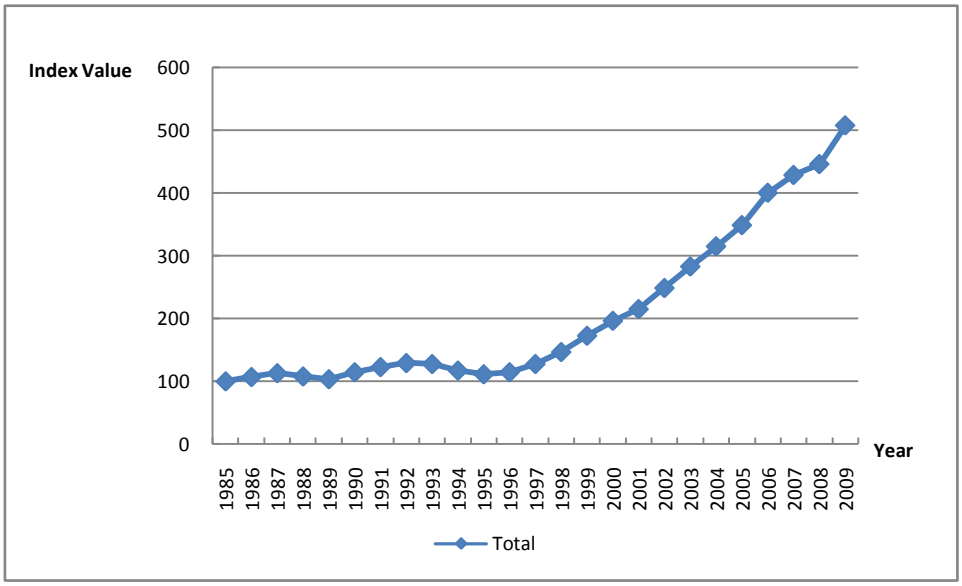


Figure GS-1.5 Real Human Capital Index for Gansu

2. Human capital per capita

An increase in real human capital can be caused by a number of factors, such as population growth, demographic changes (e.g., the size of retirement group), region migration or urbanization (e.g., an individual can achieve higher value of human capital by moving from rural to urban area), more educational attainment, higher rates of return to education, and higher rates of return to on-the-job training. In order to get further information on the dynamics of human capital, we calculate real human capital per capita, i.e., the ratio of real human capital to non-retired population.

Table GS-2.1 shows the human capital per capita by gender for Gansu. Based on the five education categories, real human capital per capita for male increases from 22,030 Yuan to 100,670 Yuan, by around 4 times; real human capital per capita for female increases from 15,460 Yuan to 65,130 Yuan, by around 3 times. From 1985 to 2009, the annual growth rate is 6.33% for male, and 5.99% for female.

Table GS-2.1 Nominal and Real Human Capital Per Capita by Gender for Gansu

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	18.85	22.03	15.46	18.85	22.03	15.46
1986	21.40	25.06	17.47	20.09	23.53	16.40
1987	24.16	28.40	19.60	21.10	24.80	17.14
1988	27.05	31.84	21.84	19.98	23.46	16.17
1989	30.28	35.56	24.44	18.96	22.24	15.35
1990	33.80	39.78	27.21	20.49	24.09	16.53

1991	37.63	44.28	30.29	21.71	25.51	17.51
1992	41.92	49.27	33.78	22.63	26.55	18.28
1993	47.34	55.75	38.01	22.12	26.02	17.80
1994	53.22	62.61	42.77	20.04	23.54	16.15
1995	59.42	69.79	47.94	18.71	21.95	15.12
1996	66.69	78.38	53.68	19.08	22.40	15.40
1997	75.76	89.23	60.72	21.07	24.79	16.93
1998	85.58	100.52	68.90	24.05	28.22	19.39
1999	97.78	114.45	78.97	28.12	32.89	22.73
2000	110.46	129.40	89.14	31.88	37.33	25.76
2001	125.61	148.08	100.81	34.81	41.02	27.96
2002	144.57	172.68	114.13	40.07	47.86	31.64
2003	166.13	199.17	130.94	45.55	54.62	35.90
2004	189.23	229.24	147.75	50.68	61.43	39.53
2005	216.25	262.62	168.94	56.93	69.22	44.40
2006	251.46	304.87	196.71	65.42	79.41	51.12
2007	284.09	344.00	222.58	70.08	84.96	54.82
2008	321.50	389.14	252.09	73.33	88.86	57.40
2009	368.67	445.82	289.31	83.14	100.67	65.13

Figure GS-2.1 shows the trend of real human capital per capita by gender. Real human capital per capita shows a similar trend for males and females. Real human capital per capita for male and female both exhibit an accelerating growth after 1996. The male-female gap has been widening.

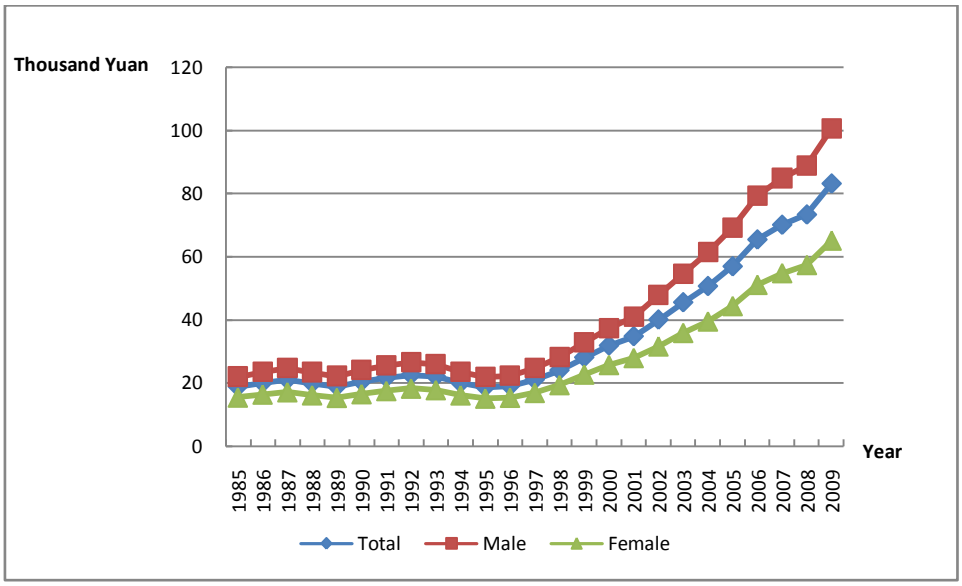


Figure GS-2.1 Real Human Capital Per Capita by Gender for Gansu

Table GS-2.2 reports the results of human capital per capita measured in nominal and real terms for Gansu by region. From 1985 to 2009, the human capital per capita in urban areas is much larger than that for rural. The per capita urban human capital increases from 46,820 Yuan to 178,920 Yuan, the per capita rural human capital increases from 11,900 Yuan to 35,000 Yuan. The human capital per capita in urban areas grows much faster than the one for rural.

Table GS-2.2 Nominal and Real Human Capital Per Capita by Region for Gansu

Year	Nominal human capital per capita (Thousands of Yuan)			Real human capital per capita (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	18.85	46.82	11.90	18.85	46.82	11.90
1986	21.40	51.81	13.33	20.09	48.42	12.57
1987	24.16	57.30	14.94	21.10	49.41	13.23
1988	27.05	63.73	16.74	19.98	45.56	12.78

1989	30.28	71.03	18.70	18.96	42.96	12.14
1990	33.80	79.50	20.86	20.49	47.19	12.94
1991	37.63	87.98	23.25	21.71	49.40	13.80
1992	41.92	97.48	25.86	22.63	51.01	14.42
1993	47.34	110.17	28.95	22.12	50.05	13.94
1994	53.22	124.08	32.33	20.04	45.24	12.61
1995	59.42	138.73	36.04	18.71	42.54	11.68
1996	66.69	155.50	40.35	19.08	43.23	11.92
1997	75.76	177.56	45.28	21.07	48.02	13.01
1998	85.58	200.60	50.76	24.05	54.80	14.74
1999	97.78	230.67	56.94	28.12	64.82	16.84
2000	110.46	259.33	63.87	31.88	73.47	18.87
2001	125.61	293.73	71.33	34.81	80.79	19.97
2002	144.57	331.11	79.30	40.07	91.71	22.01
2003	166.13	373.59	87.92	45.55	102.55	24.06
2004	189.23	417.78	97.41	50.68	113.21	25.56
2005	216.25	470.04	107.34	56.93	125.86	27.35
2006	251.46	541.21	119.86	65.42	143.21	30.12
2007	284.09	606.90	133.20	70.08	152.65	31.48
2008	321.50	690.11	147.73	73.33	160.72	32.12
2009	368.67	774.88	164.46	83.14	178.92	35.00

Figure GS-2.2 shows trends in real human capital per capita in urban and rural areas. During the period of 1985-2009, real human capital per capita for urban and rural both exhibit an accelerating growth after 1996. Based on five education categories, the ratio of urban to rural increases from 3.93 in 1985 to 5.11 in 2009, the absolute size of region gap has been on the rise. From 1985 to 2009, the annual growth rate is 5.59% for the urban area, and 4.50% for the rural area.

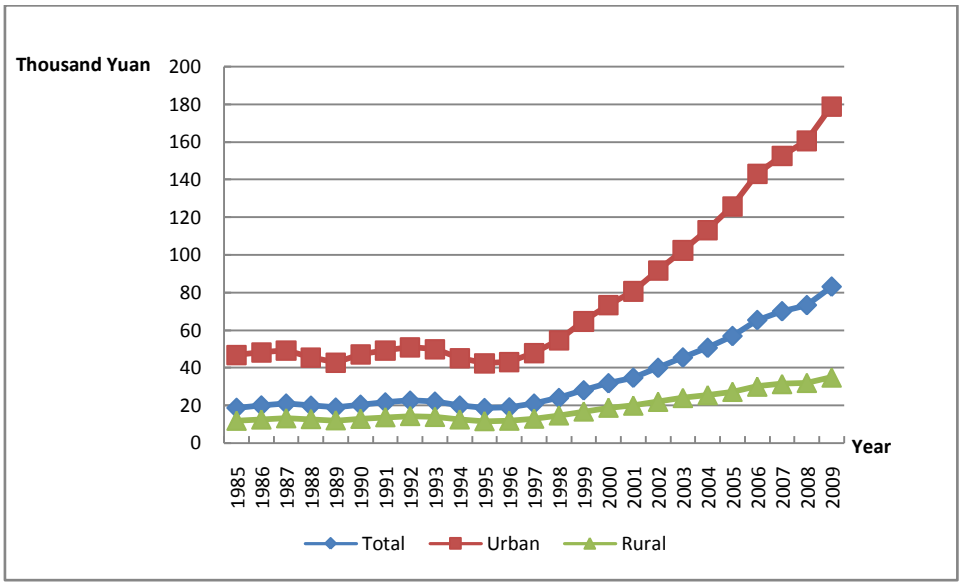


Figure GS-2.2 Real Human Capital Per Capita by Region for Gansu

Figure GS-2.3 shows the real human capital per capita index for Gansu. As is seen from the graph below, real human capital per capita is essentially stable before 1996, but significant growth occurs after 1996.

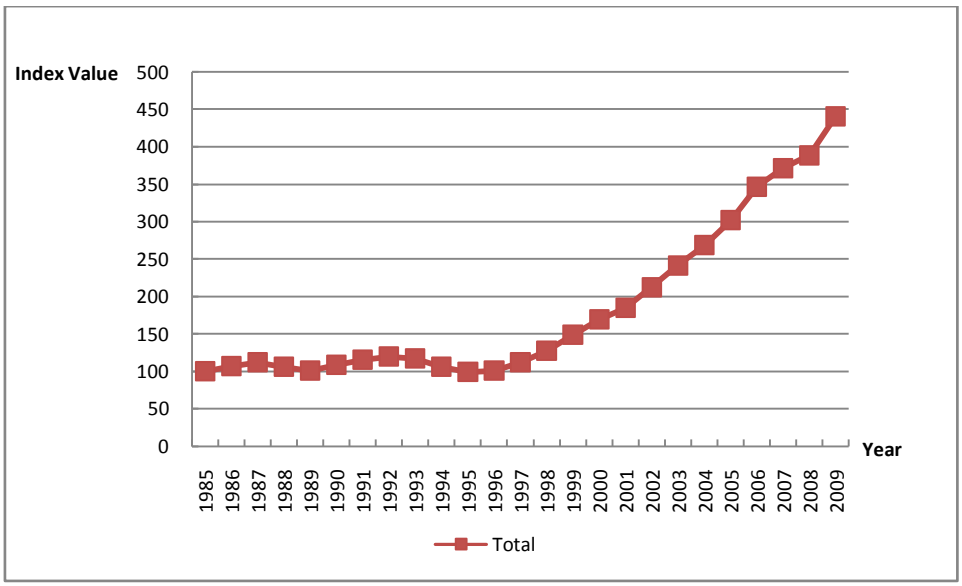


Figure GS-2.3 Real Human Capital Per Capita Index for Gansu

3. Labor force human capital

3.1 Total labor force human capital

Labor force human capital represents the human capital of the population that is over 15 years old, non-retired and out-of-school. Labor force human capital is estimated in the same way as human capital. The labor force human capital is reported in Table GS-3.1. The real values in this table are calculated by deflating the nominal values with the CPI.

Table GS-3.1 Labor Force Human Capital and Nominal GDP for Gansu

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1985	182		182		12	14.75
1986	207		195		14	14.73
1987	238		208		16	14.91
1988	280		207		19	14.59
1989	330		207		22	15.21
1990	387		235		24	15.95
1991	442		255		27	16.30
1992	496		268		32	15.61
1993	561		262		37	15.08
1994	624		235		45	13.76
1995	697		220		56	12.50
1996	777		223		72	10.75
1997	878		245		79	11.06
1998	993		280		89	11.18

Year	Nominal labor force human capital (Billions of Yuan)		Real labor force human capital (Billions of 1985 Yuan)		Nominal GDP (Billions of Yuan)	Ratio of labor force human capital to GDP
	By five education categories	By six education categories	By five education categories	By six education categories		
1999	1,113		321		96	11.64
2000	1,284	1,261	371	365	105	12.20
2001	1,452	1,432	403	397	113	12.90
2002	1,640	1,623	455	450	123	13.31
2003	1,888	1,876	518	514	140	13.49
2004	2,118	2,115	566	565	169	12.55
2005	2,368	2,363	622	620	193	12.25
2006	2,652	2,649	688	687	228	11.65
2007	2,929	2,927	719	718	270	10.83
2008	3,231	3,229	732	731	318	10.17
2009	3,557	3,554	794	794	339	10.50

Note: The ratio of labor force human capital to GDP is based on the current values for that year.

The trends in nominal and real labor force human capital are presented in Figure GS-3.1. Similar to the trend of human capital, from 1985 to 2009, labor force human capital both in nominal and real terms keep increasing.

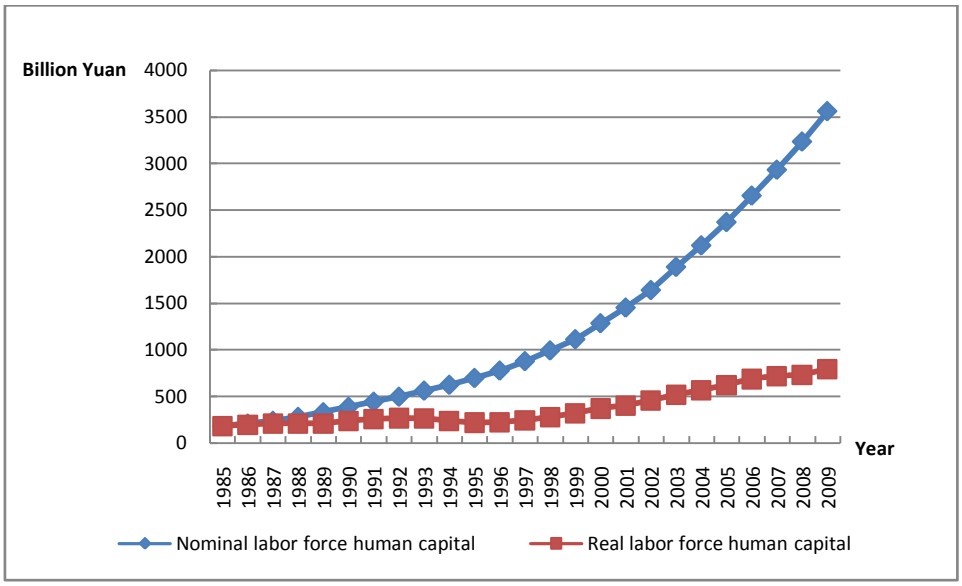


Figure GS-3.1 Nominal and Real Labor Force Human Capital for Gansu

We also calculate the ratio of labor force human capital to GDP. The results are reported in the last column of Table GS-3.1. As before, the ratio can reflect human capital's influence on sustainable growth of GDP, and may also reflect changes in human capital productivity and efficiency. Figure GS-3.2 shows the trend for the ratio. The pattern of the ratio for labor force human capital is almost the same as that for human capital. The level of nominal labor force human capital is much higher than that of nominal GDP. After a slight increase during 1985 to 1991, the ratio of labor force human capital to GDP in Gansu decreases at a considerable rate from 1991 to 1996. From 1996 to 2003 the ratio rises slowly in a small scale and then it goes down again.

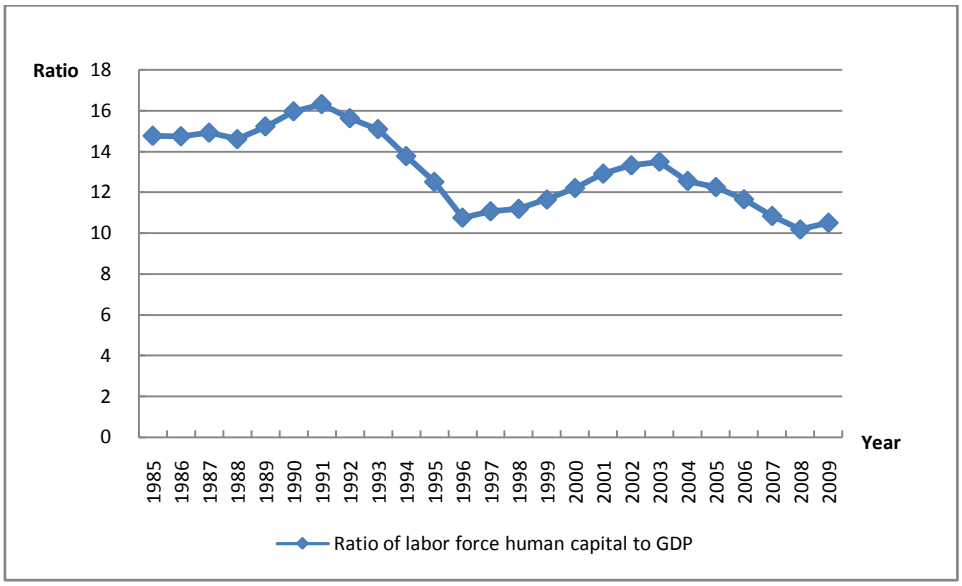


Figure GS-3.2 Ratio of Labor Force Human Capital to GDP for Gansu

Figure GS-3.2 shows the nominal and real labor force human capital for urban and rural respectively. The pattern of real labor force human capital is almost the same as that of the real human capital. Urban real labor force human capital surpasses its rural counterpart for the first time in 1999.

Table GS-3.2 Nominal and Real Labor Force Human Capital by Region for Gansu

Year	Nominal labor force human capital (Billions of Yuan)			Real labor force human capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	182	83	99	182	83	99
1986	207	97	110	195	91	104
1987	238	114	124	208	98	110
1988	280	136	144	207	97	110
1989	330	165	165	207	100	107
1990	387	196	192	235	116	119
1991	442	224	218	255	126	129

1992	496	253	243	268	132	136
1993	561	290	271	262	132	131
1994	624	321	303	235	117	118
1995	697	357	340	220	110	110
1996	777	395	382	223	110	113
1997	878	449	429	245	121	123
1998	993	510	483	280	139	140
1999	1,113	575	538	321	162	159
2000	1,284	684	601	371	194	178
2001	1,452	769	682	403	212	191
2002	1,640	887	752	455	246	209
2003	1,888	1,053	835	518	289	229
2004	2,118	1,209	909	566	328	239
2005	2,368	1,394	974	622	373	248
2006	2,652	1,583	1,069	688	419	269
2007	2,929	1,732	1,197	719	436	283
2008	3,231	1,884	1,347	732	439	293
2009	3,557	2,061	1,496	794	476	318

Figure GS-3.3 shows real labor force human capital for urban and rural respectively. The pattern of labor force human capital is almost the same as that of real human capital. The urban labor force human capital surpassed the rural one in 1999 and has grown much faster ever since.

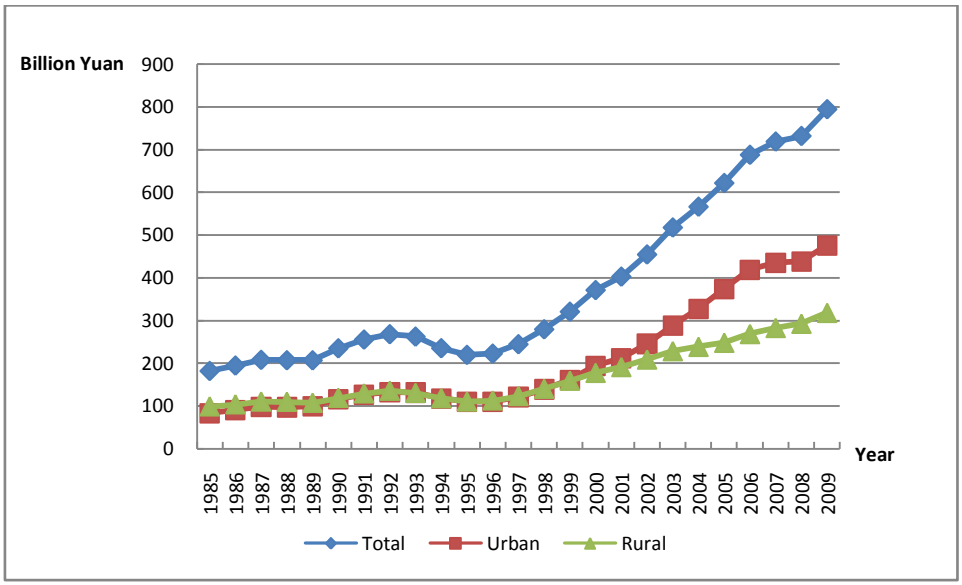


Figure GS-3.3 Real Labor Force Human Capital by Region for Gansu

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. Here the average labor force human capital means labor force human capital divided by the number of people who are over 15 years old, non-retired and out of school.

Table GS-3.3 reports the real average labor force human capital by gender. Additionally, the table shows that the real average labor force human capital for female is smaller than that for male.

Table GS-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Gansu

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	15.52	18.18	12.57	15.52	18.18	12.57
1986	17.62	20.72	14.17	16.55	19.46	13.31
1987	19.92	23.51	15.88	17.42	20.55	13.90
1988	22.68	26.82	18.01	16.78	19.82	13.36
1989	25.89	30.61	20.53	16.24	19.16	12.90
1990	29.29	34.69	23.08	17.78	21.02	14.03
1991	32.60	38.64	25.70	18.82	22.27	14.87
1992	36.13	42.84	28.51	19.52	23.11	15.44
1993	40.56	48.25	31.85	18.96	22.53	14.93
1994	44.62	53.06	35.12	16.82	19.97	13.28
1995	49.12	58.30	38.83	15.48	18.35	12.26
1996	54.35	64.64	42.79	15.58	18.50	12.29
1997	60.99	72.91	47.46	16.99	20.29	13.26
1998	68.10	81.20	53.30	19.18	22.84	15.04
1999	75.76	90.63	58.86	21.83	26.08	16.99
2000	86.69	103.93	66.97	25.06	30.01	19.38
2001	96.38	116.44	74.18	26.73	32.28	20.59
2002	108.33	132.30	82.59	30.03	36.68	22.90
2003	123.02	151.91	92.93	33.73	41.65	25.47
2004	137.21	171.38	102.47	36.67	45.86	27.34
2005	153.48	194.14	113.37	40.28	51.04	29.66
2006	171.71	218.07	125.88	44.52	56.62	32.52
2007	188.64	239.38	138.24	46.28	58.87	33.78
2008	208.14	264.19	152.51	47.14	59.97	34.38
2009	228.20	289.51	167.23	50.95	64.85	37.15

Table GS-3.4 reports the real average labor force human capital by region. The real average labor force human capital is much smaller in rural

area than in urban area.

Table GS-3.4 Nominal and Real Average Labor Force Human Capital by Region for Gansu

Year	Nominal average labor force human capital (Thousands of Yuan)			Real average labor force human capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	15.52	35.18	10.55	15.52	35.18	10.55
1986	17.62	39.00	11.86	16.55	36.45	11.19
1987	19.92	43.12	13.36	17.42	37.18	11.83
1988	22.68	48.79	15.05	16.78	34.88	11.49
1989	25.89	55.55	16.90	16.24	33.60	10.97
1990	29.29	62.73	18.97	17.78	37.23	11.77
1991	32.60	69.38	21.09	18.82	38.96	12.52
1992	36.13	76.36	23.34	19.52	39.96	13.02
1993	40.56	85.85	25.91	18.96	39.00	12.48
1994	44.62	94.09	28.65	16.82	34.30	11.17
1995	49.12	103.03	31.69	15.48	31.59	10.27
1996	54.35	114.18	35.24	15.58	31.74	10.41
1997	60.99	129.15	39.30	16.99	34.92	11.29
1998	68.10	143.89	43.76	19.18	39.31	12.71
1999	75.76	159.93	48.50	21.83	44.95	14.34
2000	86.69	183.97	54.13	25.06	52.12	15.99
2001	96.38	205.31	60.30	26.73	56.47	16.89
2002	108.33	228.08	66.91	30.03	63.17	18.57
2003	123.02	255.94	74.33	33.73	70.26	20.34
2004	137.21	282.95	81.43	36.67	76.68	21.37
2005	153.48	311.19	88.97	40.28	83.33	22.67
2006	171.71	341.12	98.97	44.52	90.26	24.87
2007	188.64	370.88	110.26	46.28	93.28	26.06
2008	208.14	412.57	122.92	47.14	96.08	26.73
2009	228.20	439.50	137.26	50.95	101.48	29.21

Chapter 19 Human Capital for Tianjin

1. Total human capital

Human capital stocks of Tianjin are calculated based on estimated income parameters and a 4.58% discount rate. The results are reported in Table TJ-1.1. Column 1 and 2 contain the nominal human capital; column 3 and 4 contain the real human capital deflated by CPI (in 1985 Yuan).[91]

Table TJ-1.1 Nominal and Real Human Capital for Tianjin

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	469		469	
1986	528		494	
1987	598		524	
1988	686		514	
1989	783		512	
1990	888		564	
1991	997		574	
1992	1,118		578	
1993	1,267		557	
1994	1,424		505	
1995	1,651		508	
1996	1,877		530	
1997	2,131		583	
1998	2,426		667	

[91] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1999	2,797		778	
2000	3,429	3,474	957	970
2001	3,850	3,927	1,062	1,083
2002	4,335	4,429	1,201	1,227
2003	4,929	5,018	1,352	1,376
2004	5,610	5,730	1,505	1,536
2005	6,548	6,734	1,730	1,779
2006	7,392	7,713	1,924	2,007
2007	8,438	8,832	2,107	2,206
2008	9,639	10,107	2,284	2,395
2009	11,098	11,663	2,656	2,792

Figure TJ-1.1 graphs real and nominal human capital for Tianjin. As shown, both the nominal and real human capital rise steadily but the former grows faster than the latter.

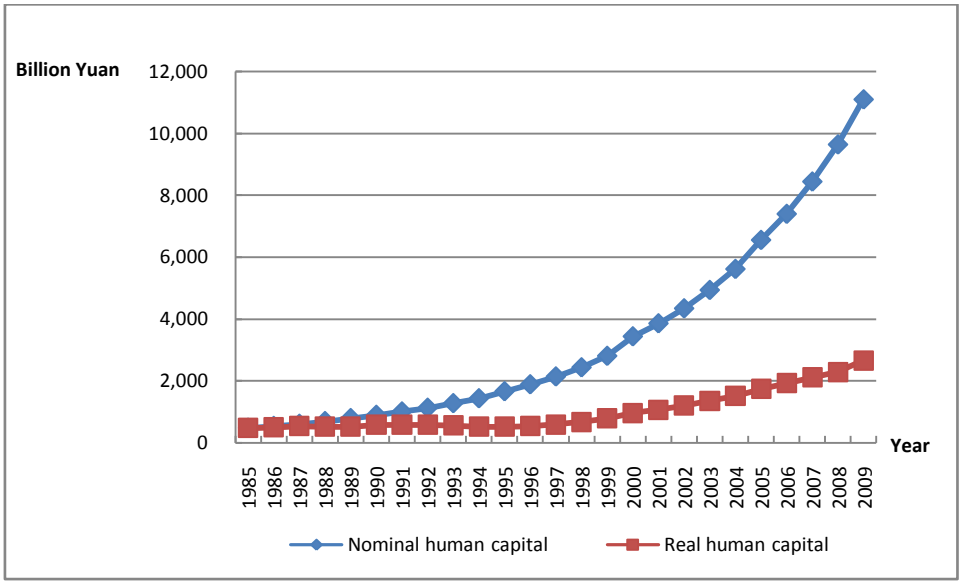


Figure TJ-1.1 Nominal and Real Human Capital for Tianjin

Table TJ-1.2 reports the real human capital for Tianjin by gender and region. Overall, the results based on five-education categories show that human capital for Tianjin during the years 1985-2009 keeps growing rapidly. More specifically, total real human capital for Tianjin increases from 0.469 trillion Yuan to 2.656 trillion Yuan, and the average annual growth rate is about 7.44%. However, the total real human capital for male is apparently much larger than that of female. It increases from 0.303 trillion Yuan to 1.726 trillion Yuan for male, and from 0.166 trillion Yuan to 0.93 trillion Yuan for female. At the same time, the real human capital for urban and rural also increase a lot, from 0.367 trillion Yuan to 2.261 trillion Yuan for urban area and from 0.102 trillion Yuan to 0.395 trillion Yuan for rural area. The average annual growth rate is 7.57% and 5.64% for urban and rural area respectively. In 2009, the total real human capital for urban is almost 5 times the amount of that for rural in Tianjin.

Table TJ-1.2 Real Human Capital by Gender and Region for Tianjin[92]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	469	303	166	367	102
1986	494	319	174	385	109
1987	524	339	185	404	120
1988	514	335	179	399	116
1989	512	335	177	397	115
1990	564	371	193	436	128
1991	574	378	196	442	133
1992	578	381	198	444	134
1993	557	367	190	429	128
1994	505	333	172	391	114
1995	508	333	175	394	115

[92] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1996	530	349	181	411	118
1997	583	385	198	455	128
1998	667	442	225	525	142
1999	778	515	263	619	159
2000	957	633	324	779	179
2001	1,062	702	360	866	197
2002	1,201	793	408	983	218
2003	1,352	890	462	1,114	238
2004	1,505	987	518	1,248	257
2005	1,730	1,131	599	1,474	256
2006	1,924	1,261	663	1,624	300
2007	2,107	1,376	731	1,782	325
2008	2,284	1,487	797	1,938	346
2009	2,656	1,726	930	2,261	395

In Figure TJ-1.2, the real human capital of male and female for Tianjin exhibit a rising trend from 1985 to 2009. Starting from 1996, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

The pattern that the human capital of male is higher than that of female is consistent with that at the national level. One reason behind this pattern is that men have a higher retirement age than women, and thus end up with a higher lifetime income relative to women.[93] In addition, the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[93] To ensure the consistency of urban and rural, we define the working age of male and female in rural area as 60 and 55.

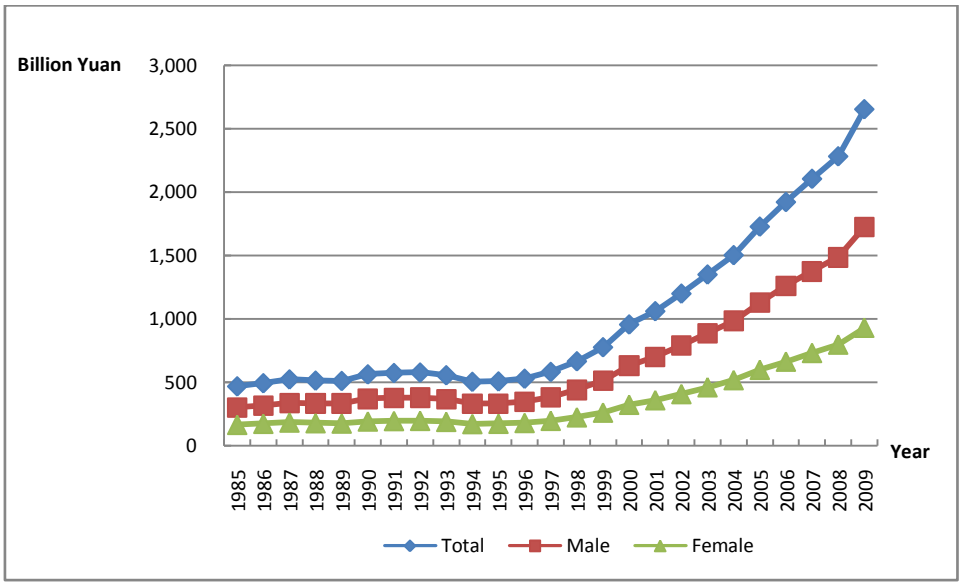


Figure TJ-1.2 Real Human Capital by Gender for Tianjin

Figure TJ-1.3 shows the real human capital for urban and rural separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1996, the growth rate for urban and rural does not show much difference. Starting from 1996, however, the urban human capital is rising much more rapidly than the rural human capital, leading to an increasingly larger gap between rural and urban.

The gap between rural and urban can be partially explained by the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another possible contributing factor could be the education gap between the rural and urban population.

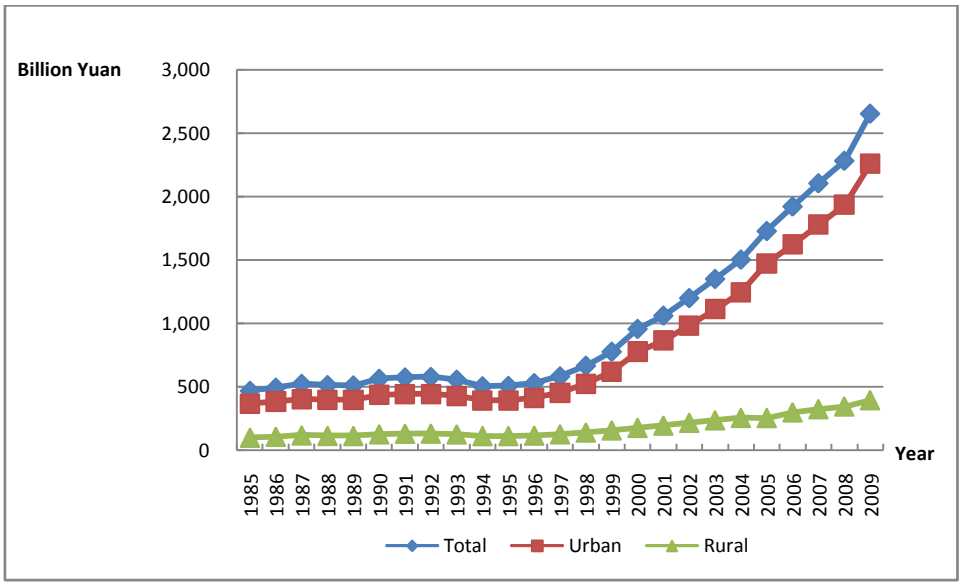


Figure TJ-1.3 Real Human Capital by Region for Tianjin

Human capital index could reflect the trend of human capital directly. Table TJ-1.3 reports a set of indices of real human capital classified by gender and region for Tianjin from 1985 to 2009. We calculate them using year 1985 as the base year.

Table TJ-1.3 Real Human Capital Index for Tianjin (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.26	105.39	104.95	104.76	107.07
1987	111.61	111.93	111.02	110.02	117.37
1988	109.61	110.61	107.76	108.55	113.44
1989	109.03	110.60	106.18	108.06	112.56
1990	120.14	122.49	115.84	118.56	125.81
1991	122.40	124.86	117.89	120.17	130.42
1992	123.18	125.58	118.79	120.93	131.31
1993	118.67	121.15	114.15	116.88	125.12
1994	107.61	109.76	103.66	106.34	112.17

1995	108.25	109.98	105.06	107.10	112.37
1996	112.83	115.02	108.83	111.98	115.90
1997	124.27	127.12	119.05	123.82	125.91
1998	142.15	145.81	135.54	142.81	139.74
1999	165.76	170.03	157.93	168.56	155.64
2000	204.01	208.97	194.98	211.98	175.27
2001	226.34	231.74	216.42	235.60	192.93
2002	255.91	261.66	245.40	267.47	214.23
2003	288.00	293.80	277.64	303.21	233.17
2004	320.58	325.51	311.36	339.68	251.72
2005	368.57	373.09	360.21	401.20	250.93
2006	409.87	415.92	398.83	442.03	293.92
2007	448.92	453.94	439.79	485.03	318.74
2008	486.68	490.69	479.49	527.49	339.55
2009	565.91	569.56	559.18	615.41	387.44

Figure TJ-1.4 shows the index of real human capital. It is obvious that the human capital has been rising much more rapidly since 1996.

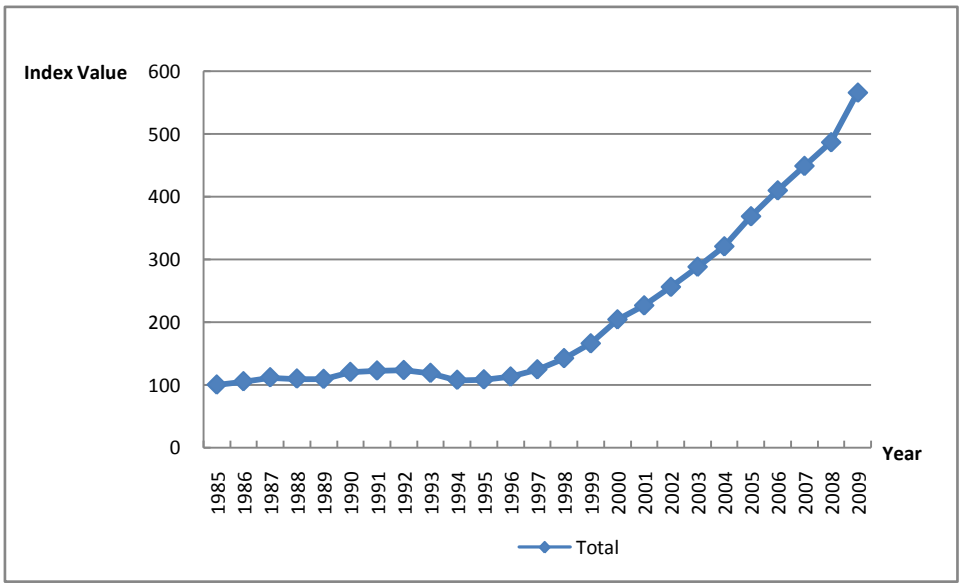


Figure TJ-1.4 Human Capital Index for Tianjin

2. Human capital per capita

The increase in human capital can be caused by changes in demographic structure, education, migration and urbanization etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital to non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it could exclude the influence of population factor to a large extent. Thus it could serve as a better indicator of the average human capital.

Table TJ-2.1 presents the trend of human capital per capita for Tianjin by gender in both nominal and real terms. Human capital per capita of male remains larger than that of female. Real human capital per capita for male increases 3.67 times from 79,870 Yuan to 373,400 Yuan. For female, it increases 3.56 times from 48,060 Yuan to 219,390 Yuan. From 1985 to 2009, the annual growth rate is 6.42% for male, and 6.32% for female.

Table TJ-2.1 Nominal and Real Human Capital Per Capita by Gender for Tianjin

Year	Nominal Human Capital Per Capita (Thousands of Yuan)			Real Human Capital Per Capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	64.69	79.87	48.06	64.69	79.87	48.06
1986	72.33	89.48	53.54	67.73	83.78	50.12
1987	80.70	100.20	59.43	70.74	87.85	52.11
1988	91.03	113.50	66.42	68.27	85.11	49.82
1989	102.27	127.66	74.23	66.87	83.48	48.54
1990	114.65	143.54	82.62	72.77	91.11	52.43
1991	128.12	160.51	92.20	73.80	92.46	53.10
1992	143.29	180.17	102.77	74.10	93.15	53.14
1993	162.05	204.57	115.59	71.26	89.95	50.83
1994	182.41	230.99	129.70	64.67	81.91	46.00

1995	204.78	259.21	146.28	63.00	79.72	44.99
1996	230.80	293.03	163.82	65.12	82.69	46.21
1997	262.10	333.01	185.37	71.74	91.14	50.72
1998	296.61	377.04	209.05	81.57	103.74	57.51
1999	339.56	430.49	240.10	94.44	119.70	66.77
2000	397.33	498.59	284.50	110.94	139.22	79.44
2001	446.15	560.92	318.85	123.10	154.77	87.96
2002	501.52	632.97	357.33	138.95	175.37	98.99
2003	567.89	717.91	404.73	155.72	196.90	111.02
2004	645.74	816.37	462.01	173.19	218.88	123.84
2005	750.71	947.91	539.03	198.31	250.40	142.36
2006	842.46	1,063.97	603.73	219.22	276.83	157.10
2007	956.82	1,201.67	691.54	238.90	300.04	172.71
2008	1,086.31	1,358.88	790.51	257.41	322.03	187.34
2009	1,252.54	1,560.36	916.86	299.74	373.40	219.39

Figure TJ-2.1 shows that the real human capital per capita of male is larger than that of female for Tianjin from 1985 to 2009. Starting from 1997, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

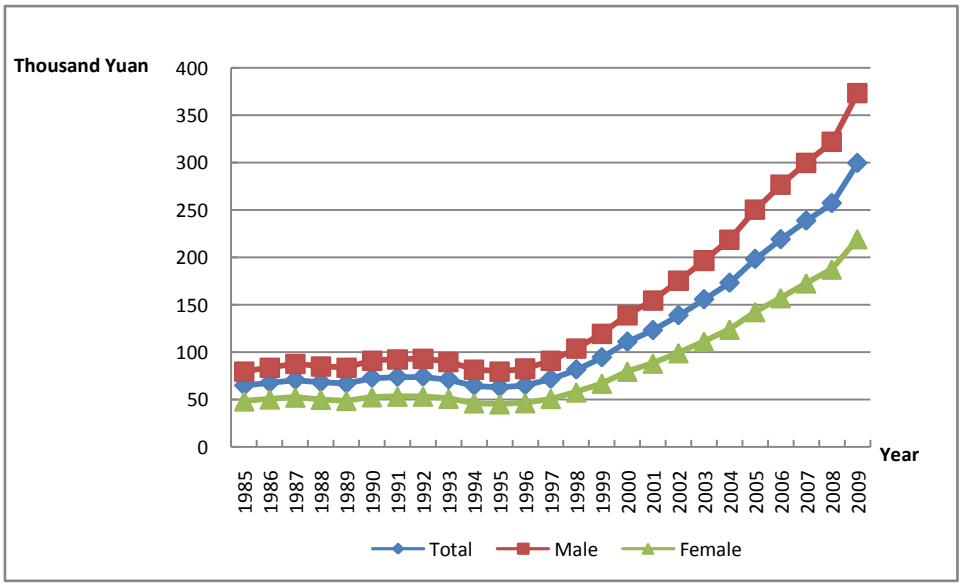


Figure TJ-2.1 Human Capital Per Capita by Gender for Tianjin

Table TJ-2.2 reports the results of human capital per capita by region for Tianjin in both nominal and real terms. From 1986 to 2009, the human capital per capita in urban area is significantly larger than that for rural. The real human capital per capita for urban increases from 72,180 Yuan to 340,610 Yuan, the per capita rural human capital increases from 47,110 Yuan to 177,620 Yuan. The human capital per capita in urban area grows much faster than the one for rural area.

Table TJ-2.2 Nominal and Real Human Capital Per Capita by Region for Tianjin

Year	Nominal Human Capital Per Capita (Thousands of Yuan)			Real Human Capital Per Capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	64.69	72.18	47.11	64.69	72.18	47.11
1986	72.33	80.83	52.77	67.73	75.68	49.41
1987	80.70	90.62	58.90	70.74	79.45	51.64
1988	91.03	101.64	66.92	68.27	76.23	50.19
1989	102.27	113.90	75.57	66.87	74.48	49.41
1990	114.65	127.98	84.66	72.77	81.24	53.74
1991	128.12	142.42	96.04	73.80	82.04	55.33
1992	143.29	159.27	107.49	74.10	82.36	55.58
1993	162.05	180.58	120.44	71.26	79.40	52.96
1994	182.41	203.73	134.26	64.67	72.25	47.61
1995	204.78	230.63	147.94	63.00	70.93	45.50
1996	230.80	259.63	166.44	65.12	73.26	46.96
1997	262.10	295.32	187.48	71.74	80.82	51.31
1998	296.61	335.18	208.26	81.57	92.19	57.28
1999	339.56	385.50	231.69	94.44	107.21	64.44
2000	397.33	453.24	258.44	110.94	126.55	72.16
2001	446.15	509.09	288.94	123.10	140.46	79.72
2002	501.52	572.38	322.12	138.95	158.56	89.23
2003	567.89	649.06	357.95	155.72	178.02	98.18

2004	645.74	739.97	398.87	173.19	198.39	106.94
2005	750.71	847.83	452.04	198.31	223.95	119.41
2006	842.46	955.18	513.81	219.22	248.58	133.72
2007	956.82	1,084.27	581.38	238.90	270.80	145.20
2008	1,086.31	1,232.62	652.51	257.41	292.08	154.62
2009	1,252.54	1,423.42	742.27	299.74	340.61	177.62

Figure TJ-2.2 reflects the trend of real human capital per capita by region. As is shown, the gap between urban and rural expanded rapidly after 1997. This is partly due to the long-term stagnant status in the rural area before 1997. Based on five education categories, the ratio of urban to rural increases from 1.53 in 1985 to 1.92 in 2009, which indicates an increasing region gap. From 1985 to 2009, the annual growth rate is 6.46% for the urban area, and 5.52% for the rural area.

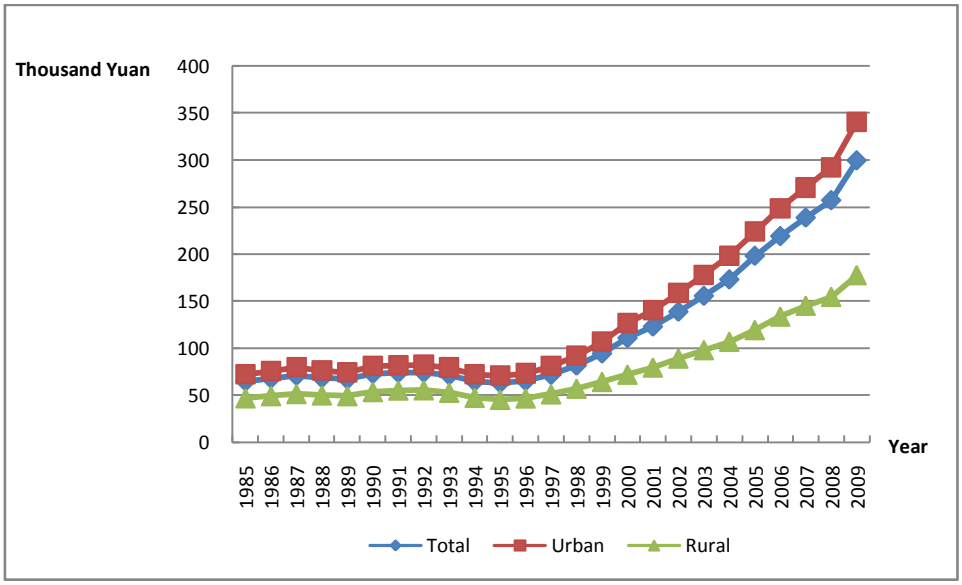


Figure TJ-2.2 Real Human Capital Per Capita by Region for Tianjin

Figure TJ-2.3 shows the human capital per capita index for Tianjin. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

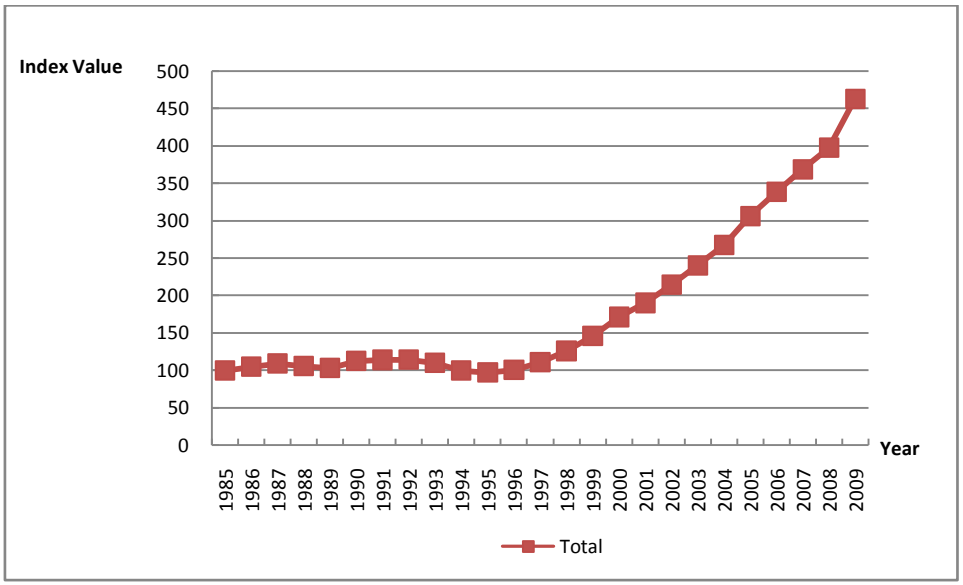


Figure TJ-2.3 Real Human Capital Per Capita Index for Tianjin

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimation method is the same as before. The labor force human capital for Tianjin is reported in Table TJ-3.1. The real values in this table are calculated by using CPI as the deflator.

Table TJ-3.1 Nominal and Real Labor Force Human Capital and GDP for Tianjin

Year	Nominal Labor Force Human Capital (Billions of Yuan)		Real Labor Force Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	211		211	
1986	239		224	
1987	274		240	
1988	314		236	
1989	359		234	
1990	405		257	
1991	453		261	
1992	506		262	
1993	563		248	
1994	624		221	
1995	716		220	
1996	804		227	
1997	917		251	
1998	1,071		294	
1999	1,238		345	
2000	1,614	1,554	451	434
2001	1,789	1,743	493	481
2002	1,997	1,963	553	544
2003	2,247	2,234	616	613
2004	2,483	2,503	666	671
2005	2,868	2,896	758	765
2006	3,254	3,289	847	856
2007	3,738	3,782	934	945
2008	4,300	4,355	1,019	1,032
2009	5,004	5,078	1,198	1,215

The trends of labor force human capital in both real and nominal terms for Tianjin are presented in Figure TJ-3.1. From 1985 to 2009, the nominal labor force human capital keeps rising, while the real labor force human capital rises not so dramatically.

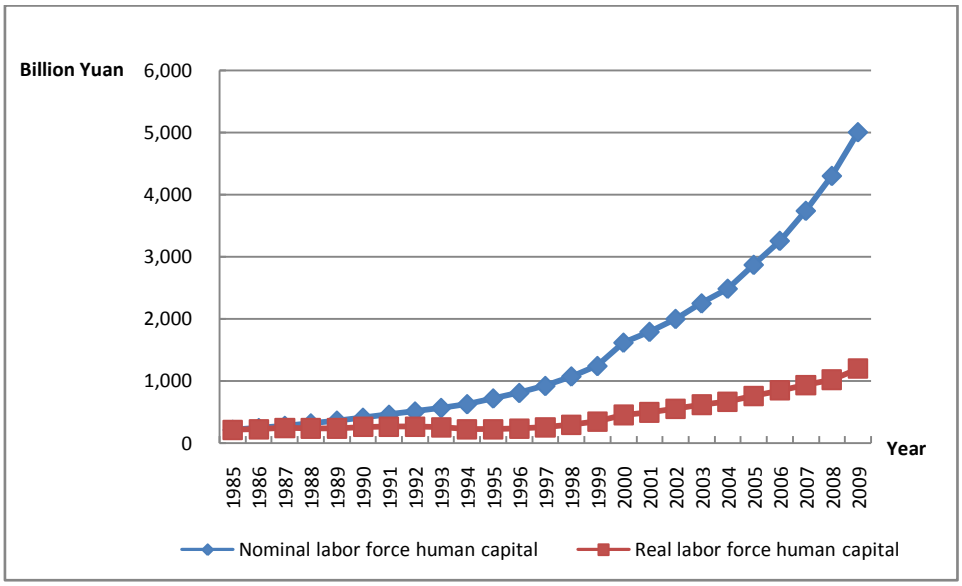


Figure TJ-3.1 Nominal and Real Labor Force Human Capital for Tianjin

Table TJ-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table TJ-3.2 Nominal and Real Labor Force Human Capital by Region for Tianjin

Year	Nominal Labor Force Human Capital (Billions of Yuan)			Real Labor Force Human Capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	211	173	38	211	173	38
1986	239	195	44	224	182	41

1987	274	221	53	240	194	47
1988	314	257	57	236	193	43
1989	359	295	63	234	193	41
1990	405	332	73	257	211	46
1991	453	374	79	261	215	46
1992	506	415	91	262	215	47
1993	563	460	103	248	202	45
1994	624	507	117	221	180	41
1995	716	575	141	220	177	43
1996	804	649	155	227	183	44
1997	917	744	173	251	204	47
1998	1,071	873	197	294	240	54
1999	1,238	1,016	222	345	283	62
2000	1,614	1,354	260	451	378	73
2001	1,789	1,499	290	493	414	80
2002	1,997	1,665	332	553	461	92
2003	2,247	1,858	389	616	510	107
2004	2,483	2,036	447	666	546	120
2005	2,868	2,415	453	758	638	120
2006	3,254	2,704	550	847	704	143
2007	3,738	3,100	638	934	774	159
2008	4,300	3,568	732	1,019	846	174
2009	5,004	4,183	821	1,198	1,001	197

Figure TJ-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The rural labor force human capital grows quite slowly and much less than the one for urban.

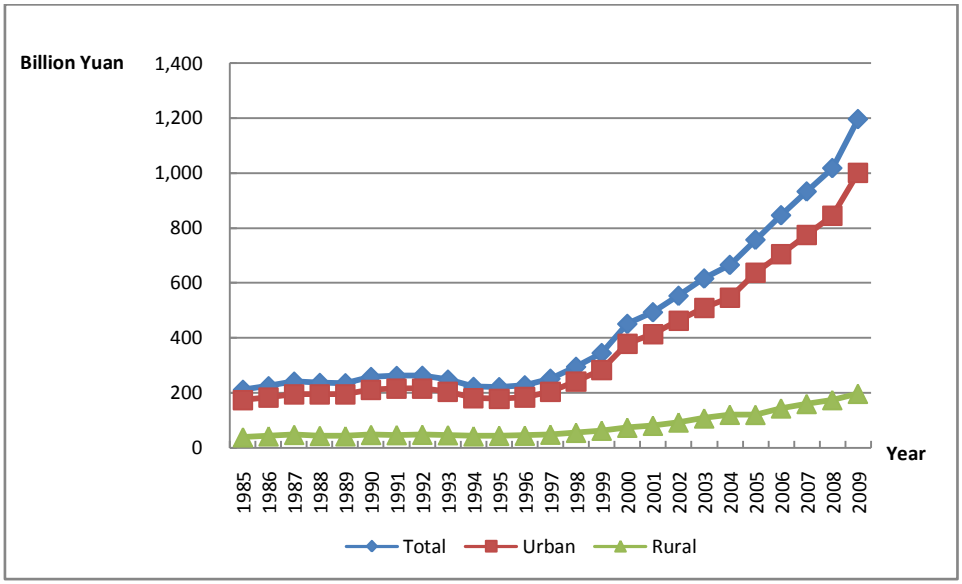


Figure TJ-3.2 Real Labor Force Human Capital by Region for Tianjin

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. The average labor force human capital means the labor force human capital divided by the population that are over 15 years old, non-retired and out of school.

Table TJ-3.3 reports the real average labor force human capital by gender. The average labor force human capital for female is smaller than that for male. More specifically, the number for male is about 1.81 times that for female in 2009.

Table TJ-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Tianjin

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	44.57	54.41	33.90	44.57	54.41	33.90
1986	50.01	61.34	37.73	46.83	57.45	35.33
1987	56.11	69.18	41.96	49.18	60.67	36.79
1988	63.26	78.57	46.72	47.44	58.94	35.04
1989	71.02	88.57	51.93	46.43	57.92	33.97
1990	79.26	99.49	57.14	50.32	63.14	36.27
1991	88.92	112.01	63.70	51.23	64.52	36.69
1992	98.45	124.38	70.29	50.90	64.30	36.35
1993	109.41	139.09	77.49	48.11	61.15	34.08
1994	120.68	153.78	85.39	42.78	54.54	30.29
1995	133.15	169.98	94.31	40.94	52.27	29.00
1996	148.88	191.13	104.12	42.00	53.92	29.38
1997	168.92	217.97	116.48	46.22	59.64	31.88
1998	192.69	249.73	131.27	52.99	68.68	36.11
1999	217.40	282.22	147.28	60.49	78.48	40.95
2000	262.46	337.20	179.46	73.29	94.14	50.11
2001	293.10	376.84	200.93	80.86	104.00	55.45
2002	323.32	416.90	221.88	89.59	115.49	61.47
2003	358.08	462.61	246.16	98.22	126.85	67.53
2004	394.30	510.92	270.87	105.74	136.96	72.62
2005	448.27	579.38	310.00	118.42	153.04	81.90
2006	502.04	649.36	345.71	130.67	168.97	89.99
2007	568.56	731.25	394.27	142.00	182.65	98.44
2008	648.60	829.46	453.58	153.70	196.59	107.46
2009	753.70	959.15	529.56	180.36	229.55	126.71

Table TJ-3.4 reports the real average Labor force human capital by region. The average labor force human capital is much smaller in rural area

than in urban area. The number for urban is about 1.54 times that for rural in 2009.

Table TJ-3.4 Nominal and Real Average Labor Force Human Capital by Region for Tianjin

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	44.57	48.16	33.24	44.57	48.16	33.24
1986	50.01	54.17	37.35	46.83	50.72	34.97
1987	56.11	61.11	41.83	49.18	53.58	36.67
1988	63.26	68.84	46.35	47.44	51.63	34.76
1989	71.02	77.30	51.53	46.43	50.54	33.69
1990	79.26	86.54	57.28	50.32	54.94	36.36
1991	88.92	96.90	64.07	51.23	55.82	36.91
1992	98.45	107.33	71.39	50.90	55.50	36.91
1993	109.41	119.26	79.99	48.11	52.44	35.17
1994	120.68	131.82	88.28	42.78	46.74	31.30
1995	133.15	146.03	97.82	40.94	44.91	30.09
1996	148.88	163.32	108.59	42.00	46.08	30.64
1997	168.92	185.66	121.75	46.22	50.81	33.32
1998	192.69	212.22	136.85	52.99	58.37	37.64
1999	217.40	240.03	152.12	60.49	66.75	42.31
2000	262.46	292.19	171.65	73.29	81.59	47.93
2001	293.10	326.20	192.09	80.86	90.00	53.00
2002	323.32	358.87	216.12	89.59	99.41	59.87
2003	358.08	396.03	245.68	98.22	108.62	67.39
2004	394.30	435.13	276.41	105.74	116.66	74.11
2005	448.27	488.25	312.18	118.42	128.97	82.46
2006	502.04	546.15	359.56	130.67	142.13	93.57
2007	568.56	616.23	413.27	142.00	153.91	103.22
2008	648.60	703.50	469.84	153.70	166.70	111.33
2009	753.70	820.28	533.33	180.36	196.29	127.62

4. Relative trend in human capital

Figure TJ-4.1 illustrates the ratio of labor force human capital to human capital based on five-education categories[94], and the ratio of total population in labor force to total non-retired population. After 1990, the two ratios showed different trends. One potential explanation is that the student population, especially tertiary education students, increases a lot.

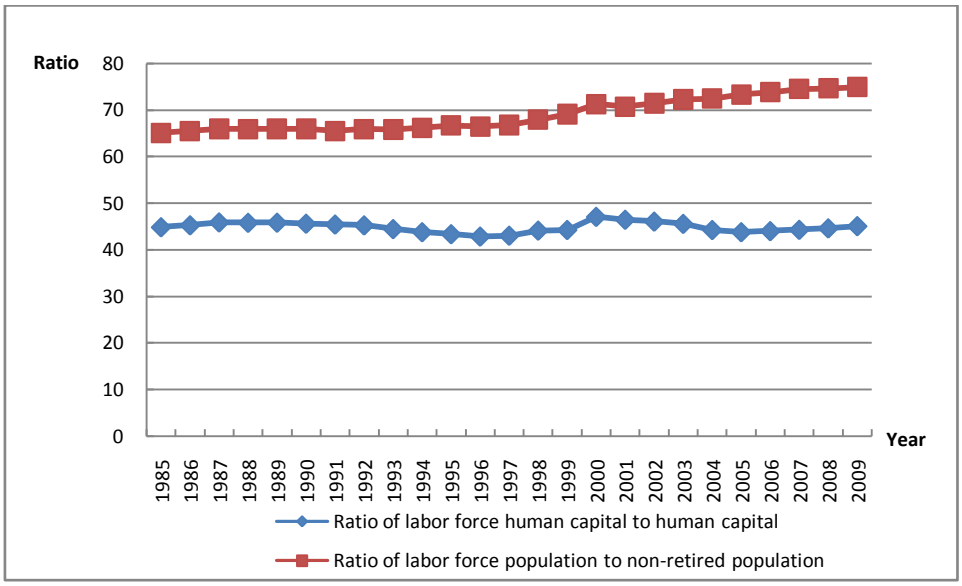


Figure TJ-4.1 Ratio of Labor Force Human Capital to Human Capital and Ratio of Labor Force Population to Non-retired Population for Tianjin

Figure TJ-4.2 reports the ratio of human capital to fixed assets for Tianjin. We can see that human capital is always larger than fixed assets. From 1985 to 1995, it shows an obviously downward trend, and the ratio remains relatively stable through 1995 to 2007.

[94] Unless otherwise stated, all human capitals refer to nominal ones and based on five-education categories.

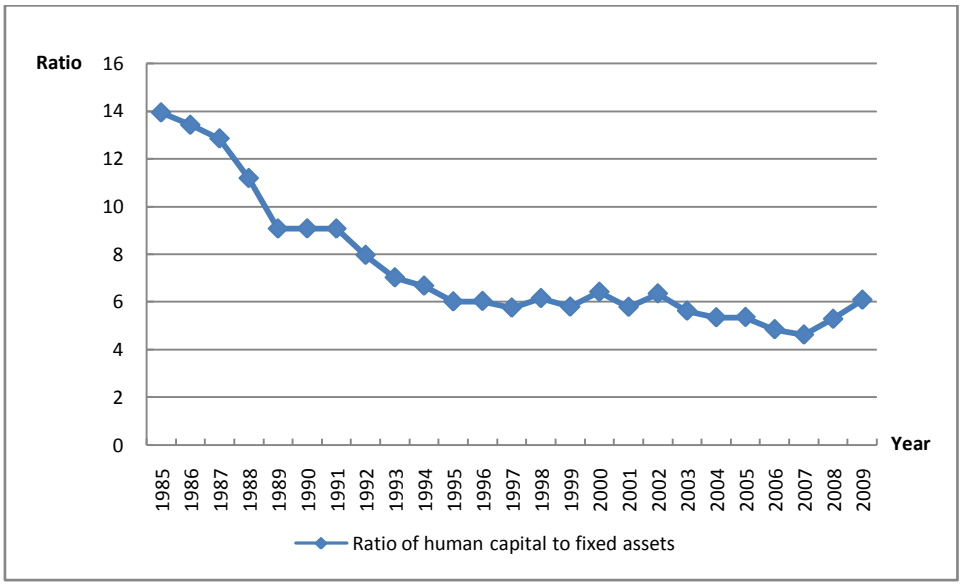


Figure TJ-4.2 Ratio of Human Capital to Fixed Assets for Tianjin

Figure TJ-4.3 reports the ratio of human capital to GDP and ratio of labor force human capital to GDP for Tianjin. Both experience same fluctuations before 2008.

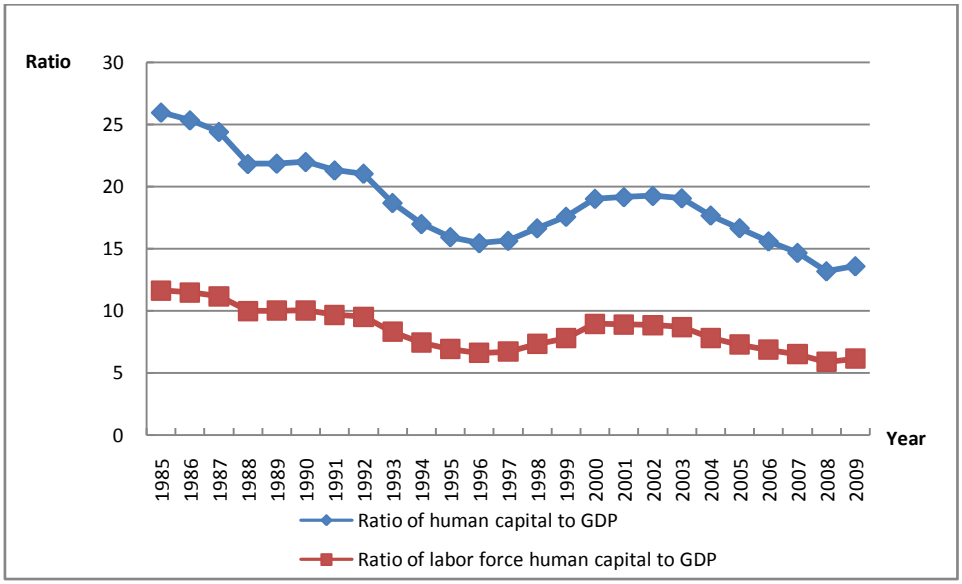


Figure TJ-4.3 Ratio of Human Capital to GDP and Ratio of Labor Force Human Capital to GDP for Tianjin

Figure TJ-4.4 reports the ratio of fixed assets to GDP for Tianjin. The ratio itself reveals the rate of output of fixed assets. Before 2003, there is a general upward trend. But it starts to decline after 2003.

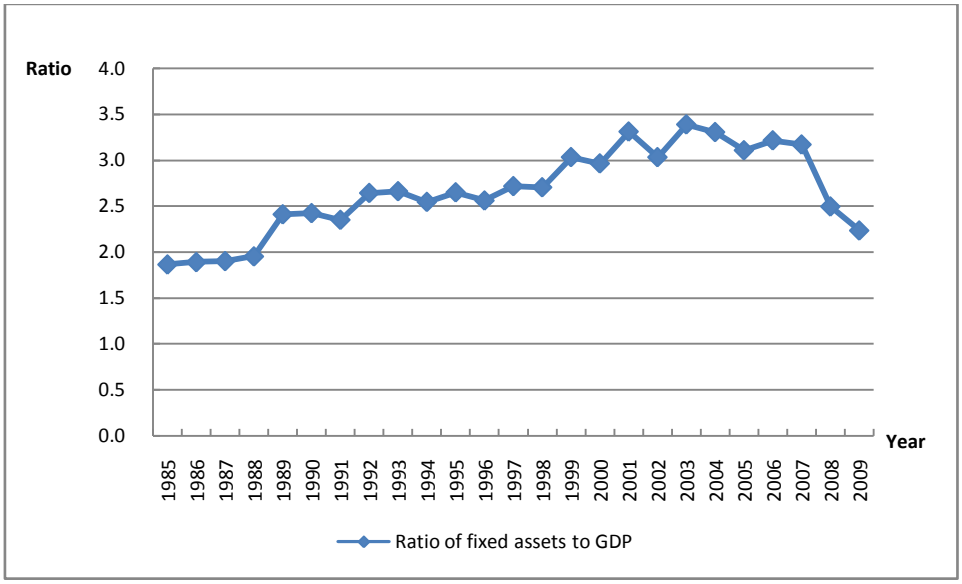


Figure TJ-4.4 Ratio of Fixed Assets to GDP for Tianjin

5. Conclusion

1. The nominal and real human capital for Tianjin in 2009 is 11.098 trillion Yuan and 2.656 trillion Yuan. Urban and rural human capital in real values are 2.261 trillion Yuan and 0.395 trillion Yuan, accounting for 85.13% and 14.87% of the total human capital respectively. Male and Female human capital in real values are 1.726 trillion Yuan and 0.93 trillion Yuan, accounting for 64.98% and 35.02%.

2. The nominal and real human capital per capita for Tianjin increase from 64,690 Yuan to 1,252,540 Yuan and 64,690 Yuan to 299,740 Yuan respectively from 1985 to 2009. In 2009, the real human capital per capita is

340,610 Yuan for urban, 177,620 Yuan for rural, 373,400 Yuan for male and 219,400 Yuan for female.

3. The average annual growth rate of real human capital is 7.57% for urban and 5.64% for rural. The real human capital per capita for urban area is larger than that for rural area. After 1997, their average annual growth rates become even larger.

4. In 2009, the nominal and real labor force human capital for Tianjin reach 5.004 trillion Yuan and 1.198 trillion Yuan. And the real labor force human capital is 1.001 trillion Yuan for urban and 0.197 trillion Yuan for rural, accounting for 83.56% and 16.44% of the total labor force human capital.

5. The ratio of real human capital per capita of male to real human capital per capita of female increases from 1.60 to 1.81 from 1985 to 2009. At the same time, the same ratio between urban and rural area increases from 1.45 to 1.54.

Chapter 20 Human Capital for Heilongjiang

1. Total human capital

Human capital stocks of Heilongjiang are calculated based on estimated income parameters and a 4.58% discount rate. The results are reported in Table HLJ-1.1. Column 1 and 2 contain the nominal human capital; column 3 and 4 contain the real human capital deflated by CPI (in 1985 Yuan).[95]

Table HLJ-1.1 Nominal and Real Human Capital for Heilongjiang

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	824		824	
1986	931		873	
1987	1,058		915	
1988	1,205		885	
1989	1,370		878	
1990	1,559		944	
1991	1,763		995	
1992	1,997		1,039	
1993	2,273		1,030	
1994	2,568		955	
1995	2,903		929	
1996	3,279		980	
1997	3,698		1,059	
1998	4,171		1,187	

[95] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1999	4,768		1,401	
2000	5,291	5,303	1,586	1,589
2001	5,886	5,906	1,751	1,756
2002	6,545	6,576	1,958	1,966
2003	7,313	7,358	2,166	2,178
2004	8,058	8,115	2,294	2,309
2005	9,073	9,178	2,549	2,577
2006	10,094	10,201	2,780	2,807
2007	11,289	11,421	2,947	2,979
2008	12,767	12,935	3,151	3,191
2009	14,347	14,544	3,534	3,580

Figure HLJ-1.1 graphs real and nominal human capital for Heilongjiang. As shown, both the nominal and real human capital rise steadily but the former grows faster than the latter.

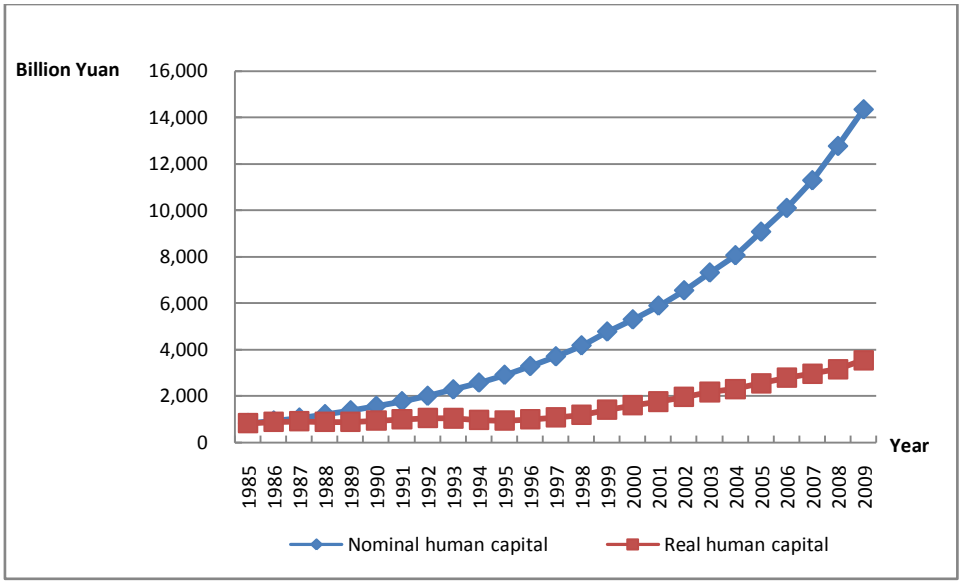


Figure HLJ-1.1 Nominal and Real Human Capital for Heilongjiang

Table HLJ-1.2 reports the real human capital for Heilongjiang by gender and region. Overall, the results based on five-education categories show that human capital for Heilongjiang during the years 1985-2009 grow rapidly. More specifically, total real human capital for Heilongjiang increases from 0.824 trillion Yuan to 3.534 trillion Yuan, and the average annual growth rate is about 6.25%. However, the total real human capital for male is apparently much larger than that of female. It increases from 0.523 trillion Yuan to 2.260 trillion Yuan for male, and from 0.300 trillion Yuan to 1.274 trillion Yuan for female. At the same time, the real human capital for urban and rural also increase a lot, from 0.502 trillion Yuan to 2.677 trillion Yuan for urban area and from 0.322 trillion Yuan to 0.857 trillion Yuan for rural area. The average annual growth rate is 7.22% and 4.16% for urban and rural area respectively. In 2009, the total real human capital for urban is almost 3 times the amount of that for rural in Heilongjiang.

Table HLJ-1.2 Real Human Capital by Gender and Region for Heilongjiang[96]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	824	523	300	502	322
1986	873	556	317	543	330
1987	915	584	331	568	347
1988	885	567	319	554	331
1989	878	563	315	560	319
1990	944	607	337	614	330
1991	995	641	354	650	345
1992	1,039	670	369	682	357
1993	1,030	666	364	685	345
1994	955	619	336	644	310

[96] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1995	929	602	327	639	290
1996	980	635	345	677	303
1997	1,059	686	373	735	324
1998	1,187	769	418	827	360
1999	1,401	904	497	988	413
2000	1,586	1,025	561	1,086	500
2001	1,751	1,130	621	1,208	543
2002	1,958	1,266	692	1,361	597
2003	2,166	1,398	768	1,519	647
2004	2,294	1,477	816	1,624	670
2005	2,549	1,640	909	1,830	719
2006	2,780	1,792	988	2,009	771
2007	2,947	1,893	1,054	2,151	796
2008	3,151	2,017	1,134	2,363	788
2009	3,534	2,260	1,274	2,677	857

In Figure HLJ-1.2, the real human capital of male and female for Heilongjiang exhibit a rising trend from 1985 to 2009. Starting from 1996, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

The pattern that the human capital of male is higher than that of female is consistent with that at the national level. One reason behind this pattern is that men have a higher retirement age than women, and thus end up with a higher lifetime income relative to women.[97] In addition, the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[97] To ensure the consistency of urban and rural, we define the working age of male and female in rural area as 60 and 55.

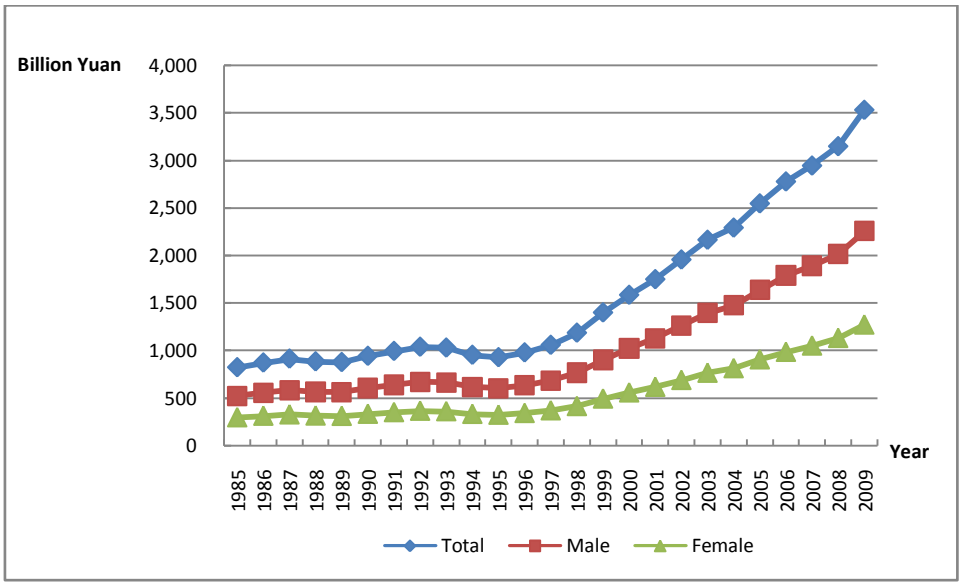


Figure HLJ-1.2 Real Human Capital by Gender for Heilongjiang

Figure HLJ-1.3 shows the real human capital for urban and rural separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1996, the growth rate for urban and rural does not show much difference. Starting from 1996, however, the urban human capital is rising much more rapidly than the rural human capital, leading to an increasingly large gap between rural and urban.

The gap between rural and urban can be partially explained by the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another possible contributing factor could be the education gap between the rural and urban population.

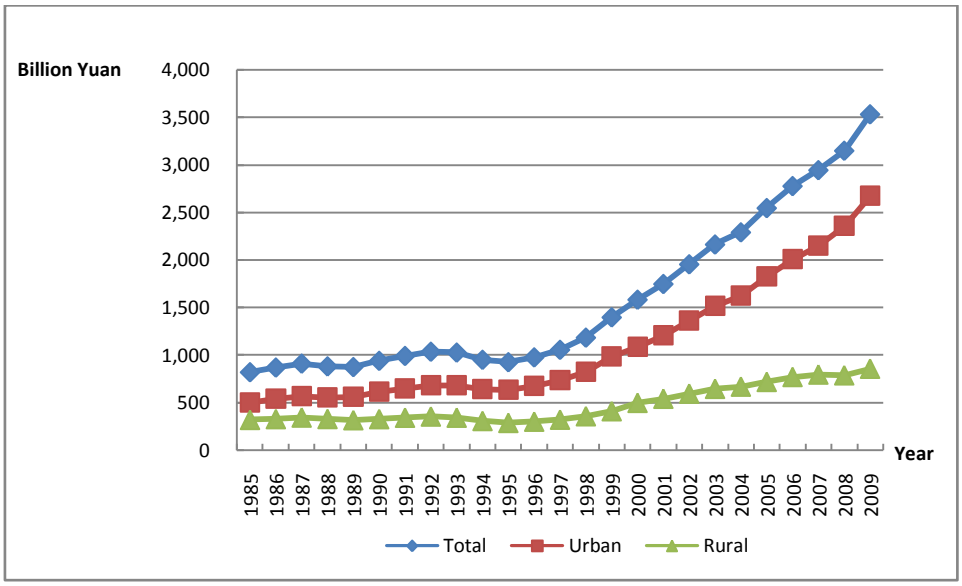


Figure HLJ-1.3 Real Human Capital by Region for Heilongjiang

Human capital index could reflect the trend of human capital directly. Table HLJ-1.3 reports a set of indices of real human capital classified by gender for Heilongjiang from 1985 to 2009. We calculate them using year 1985 as the base year.

Table HLJ-1.3 Real Human Capital Index for Heilongjiang (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.98	106.28	105.45	108.17	102.56
1987	111.00	111.50	110.12	113.14	107.66
1988	107.47	108.25	106.10	110.39	102.90
1989	106.59	107.59	104.84	111.46	99.00
1990	114.53	115.87	112.20	122.25	102.50
1991	120.78	122.41	117.95	129.56	107.10
1992	126.15	128.05	122.84	135.91	110.93
1993	125.07	127.29	121.19	136.52	107.20
1994	115.87	118.17	111.87	128.37	96.38

1995	112.78	114.98	108.94	127.29	90.16
1996	118.93	121.22	114.93	134.78	94.22
1997	128.57	131.07	124.22	146.44	100.70
1998	144.12	146.93	139.21	164.78	111.89
1999	169.98	172.63	165.37	196.79	128.18
2000	192.50	195.77	186.80	216.32	155.36
2001	212.51	215.95	206.52	240.60	168.71
2002	237.63	241.79	230.38	271.16	185.34
2003	262.88	267.02	255.67	302.59	200.95
2004	278.37	282.24	271.64	323.42	208.12
2005	309.35	313.27	302.52	364.44	223.43
2006	337.38	342.31	328.78	400.19	239.41
2007	357.68	361.68	350.69	428.39	247.40
2008	382.45	385.40	377.31	470.66	244.90
2009	428.91	431.66	424.13	533.16	266.34

Figure HLJ-1.4 shows the index of real human capital. It is obvious that the human capital has been rising much more rapidly since 1996.

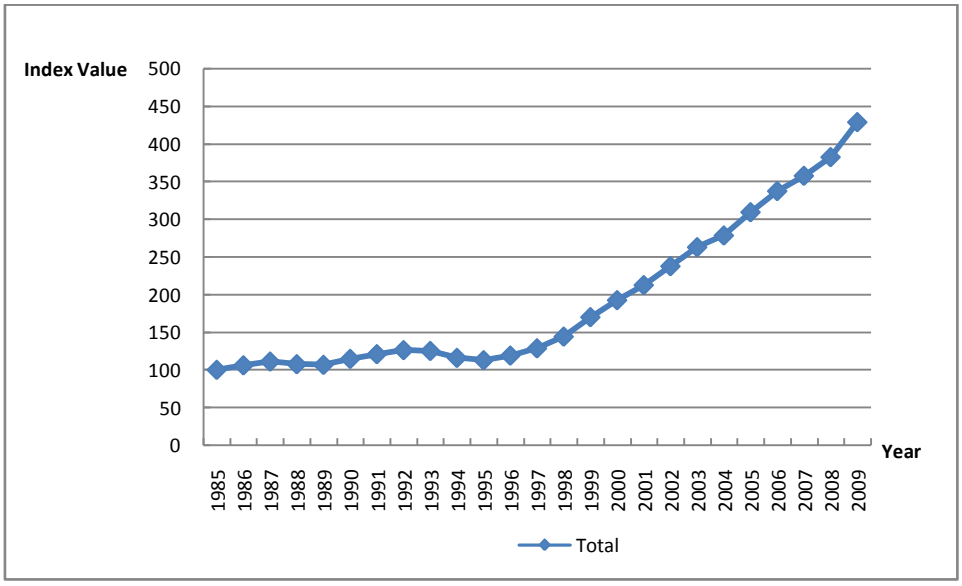


Figure HLJ-1.4 Human Capital Index for Heilongjiang

2. Human capital per capita

The increase in human capital can be caused by changes in demographic structure, education, migration and urbanization etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital to non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it could exclude the influence of population factor to a large extent. Thus it could serve as a better indicator of the average human capital.

Table HLJ-2.1 presents the trend of human capital per capita for Heilongjiang by gender in both nominal and real terms. Human capital per capita of male remains larger than that of female. Real human capital per capita for male increases over 3 times from, 32,190 Yuan to 133,490 Yuan. For female, it increases 3.3 times from 20,060 Yuan to 84,790 Yuan.

Table HLJ-2.1 Nominal and Real Human Capital Per Capita by Gender for Heilongjiang

Year	Nominal Human capital per capita (Thousands of Yuan)			Real Human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	26.38	32.19	20.06	26.38	32.19	20.06
1986	29.66	36.27	22.48	27.84	34.03	21.09
1987	33.24	40.73	25.10	28.74	35.22	21.71
1988	37.45	45.96	28.17	27.52	33.77	20.71
1989	42.15	51.69	31.69	27.01	33.13	20.31
1990	47.56	58.40	35.64	28.79	35.35	21.58
1991	53.43	65.79	39.88	30.16	37.14	22.52
1992	60.12	74.11	44.76	31.29	38.56	23.31
1993	68.10	84.19	50.45	30.87	38.16	22.88
1994	76.64	94.79	56.66	28.50	35.24	21.07
1995	86.40	106.84	63.91	27.66	34.20	20.47

1996	97.49	120.67	72.05	29.14	36.05	21.54
1997	109.79	135.87	81.13	31.45	38.90	23.25
1998	123.63	152.98	91.37	35.20	43.54	26.03
1999	141.28	174.09	105.20	41.49	51.13	30.90
2000	155.27	191.70	115.27	46.55	57.47	34.56
2001	173.46	213.97	128.98	51.60	63.65	38.37
2002	193.93	239.62	143.79	58.01	71.67	43.02
2003	218.00	268.63	162.32	64.56	79.56	48.08
2004	242.33	297.49	181.43	68.98	84.67	51.64
2005	274.90	336.39	206.72	77.23	94.50	58.08
2006	308.01	376.80	231.38	84.82	103.76	63.72
2007	347.25	422.66	262.95	90.64	110.33	68.64
2008	396.06	479.58	302.37	97.76	118.38	74.62
2009	448.95	541.90	344.26	110.58	133.49	84.79

Figure HLJ-2.1 shows that the real human capital per capita of male is larger than that of female for Heilongjiang from 1985 to 2009. Starting from 1997, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

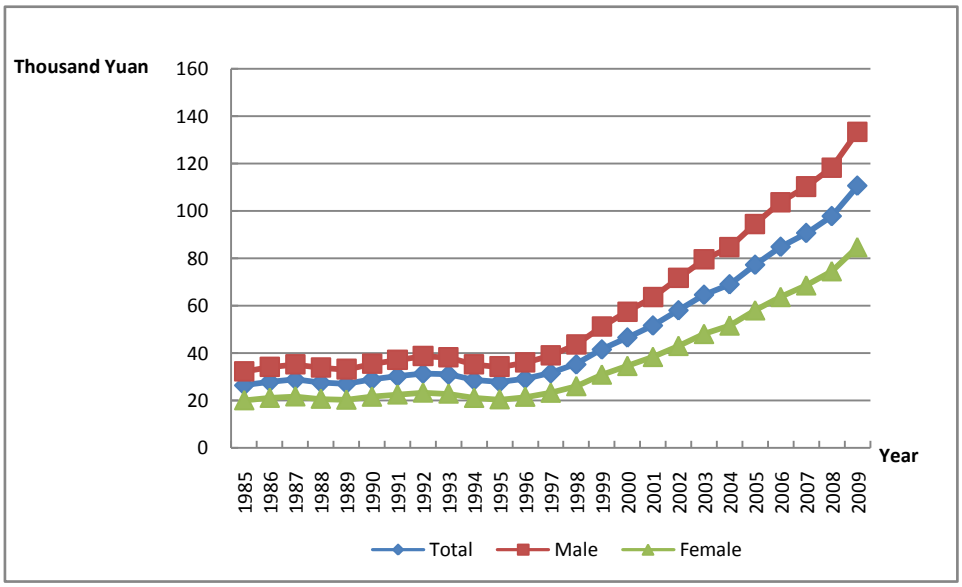


Figure HLJ-2.1 Human Capital Per Capita by Gender for Heilongjiang

Table HLJ-2.2 reports the results of human capital per capita by region for Heilongjiang in both nominal and real terms. From 1986 to 2009, the human capital per capita in urban area is significantly larger than that for rural. The real human capital per capita for urban increases from 37,330 Yuan to 154,140 Yuan, the per capita rural human capital increases from 18,090 Yuan to 58,750 Yuan. The human capital per capita in urban area grows much faster than the one for rural.

Table HLJ-2.2 Nominal and Real Human Capital Per Capita by Region for Heilongjiang

Year	Nominal Human capital per capita (Thousands of Yuan)			Real Human capital per capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	26.38	37.33	18.09	26.38	37.33	18.09
1986	29.66	41.81	20.16	27.84	39.45	18.76
1987	33.24	46.76	22.45	28.74	40.21	19.59
1988	37.45	52.30	25.09	27.52	37.92	18.86
1989	42.15	58.53	27.92	27.01	37.03	18.31
1990	47.56	65.72	31.09	28.79	39.38	19.18
1991	53.43	73.29	34.67	30.16	40.59	20.32
1992	60.12	82.03	38.55	31.29	41.41	21.33
1993	68.10	92.43	43.09	30.87	40.50	20.97
1994	76.64	103.43	47.87	28.50	37.15	19.20
1995	86.40	115.96	53.16	27.66	35.94	18.35
1996	97.49	131.48	58.97	29.14	37.87	19.24
1997	109.79	148.95	65.35	31.45	41.05	20.54
1998	123.63	168.62	72.41	35.20	46.06	22.83
1999	141.28	194.45	80.22	41.49	54.76	26.27
2000	155.27	218.61	89.09	46.55	62.37	30.01
2001	173.46	244.24	98.33	51.60	69.13	32.99
2002	193.93	274.00	108.42	58.01	78.10	36.56
2003	218.00	310.33	119.57	64.56	87.75	39.84
2004	242.33	345.48	131.78	68.98	94.39	41.74

2005	274.90	394.21	146.27	77.23	106.85	45.29
2006	308.01	440.44	162.95	84.82	117.27	49.27
2007	347.25	497.14	180.43	90.64	125.58	51.76
2008	396.06	561.59	199.76	97.76	135.11	53.46
2009	448.95	639.48	222.23	110.58	154.14	58.75

Figure HLJ-2.2 reflects the trend of real human capital per capita by region. As is shown, the gap between urban and rural expands rapidly after 1997. This is partly due to the long-term stagnant status in the rural area before 2002. From 1985 to 2009, the annual growth rate is 5.14% for the urban area, and 4.54% for the rural area.

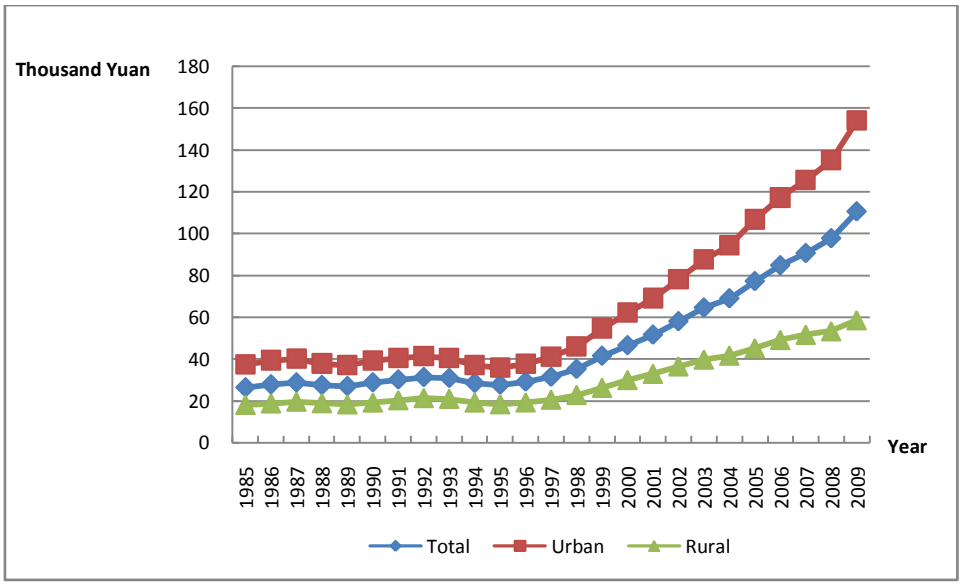


Figure HLJ-2.2 Real Human Capital Per Capita by Region for Heilongjiang

Figure HLJ-2.3 shows the human capital per capita index for Heilongjiang. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

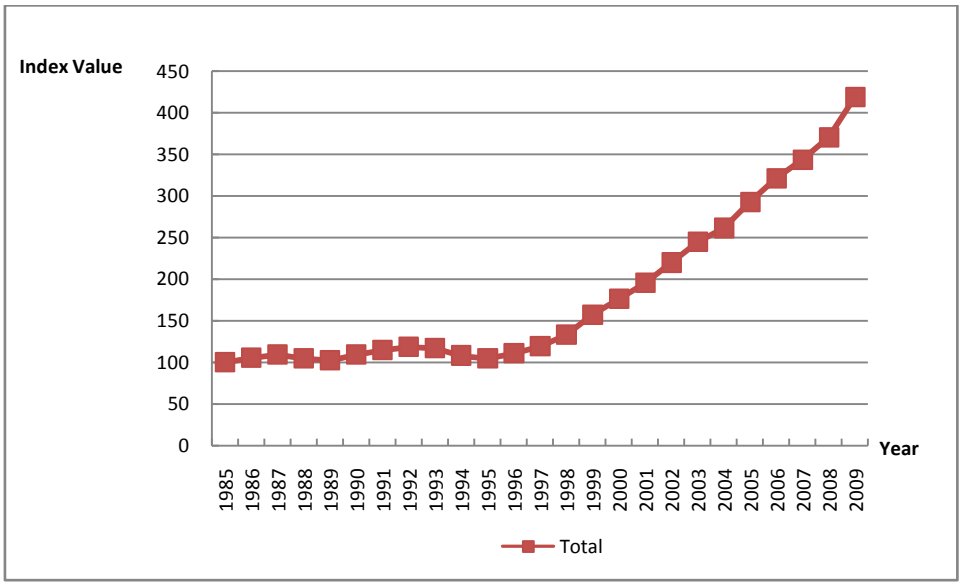


Figure HLJ-2.3 Real Human Capital Per Capita Index for Heilongjiang

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimation method is the same as before. The labor force human capital for Heilongjiang is reported in Table HLJ-3.1. The real values in this table are calculated by using CPI as the deflator.

Table HLJ-3.1 Nominal and Real Labor Force Human Capital and GDP for Heilongjiang

Year	Nominal Labor Force Human Capital (Billions of Yuan)		Real Labor Force Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	390		390	
1986	452		424	
1987	526		455	
1988	621		456	
1989	733		469	
1990	854		517	
1991	992		560	
1992	1,140		593	
1993	1,310		593	
1994	1,491		554	
1995	1,699		544	
1996	1,926		576	
1997	2,172		622	
1998	2,472		704	
1999	2,783		818	
2000	3,097	3,046	931	916
2001	3,416	3,371	1,020	1,007
2002	3,787	3,752	1,139	1,129
2003	4,227	4,209	1,261	1,255
2004	4,600	4,602	1,319	1,319
2005	5,065	5,067	1,433	1,433
2006	5,646	5,649	1,566	1,566
2007	6,223	6,224	1,637	1,637
2008	6,914	6,919	1,718	1,719
2009	7,655	7,657	1,898	1,897

The trends of labor force human capital in both real and nominal terms for Heilongjiang are presented in Figure HLJ-3.1. From 1985 to 2009, labor force human capital keeps rising.

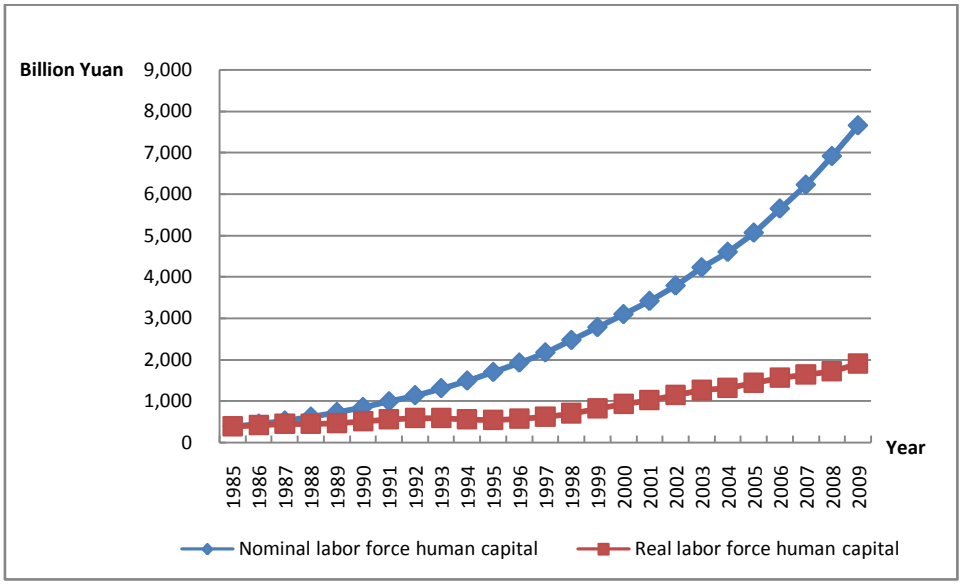


Figure HLJ-3.1 Nominal and Real Labor Force Human Capital for Heilongjiang

Table HLJ-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table HLJ-3.2 Nominal and Real Labor Force Human Capital by Region for Heilongjiang

Year	Nominal Labor Force Human Capital (Billions of Yuan)			Real Labor Force Human Capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	390	235	156	390	235	156
1986	452	278	174	424	262	162
1987	526	331	196	455	285	171
1988	621	399	222	456	289	167

1989	733	482	251	469	305	165
1990	854	572	282	517	343	174
1991	992	672	320	560	372	188
1992	1,140	783	357	593	395	197
1993	1,310	912	398	593	400	194
1994	1,491	1,053	438	554	378	176
1995	1,699	1,218	481	544	378	166
1996	1,926	1,384	542	576	399	177
1997	2,172	1,569	603	622	433	190
1998	2,472	1,798	674	704	491	213
1999	2,783	2,035	748	818	573	245
2000	3,097	2,179	918	931	622	309
2001	3,416	2,398	1,018	1,020	679	342
2002	3,787	2,644	1,143	1,139	754	386
2003	4,227	2,932	1,295	1,261	829	431
2004	4,600	3,181	1,419	1,319	869	450
2005	5,065	3,505	1,560	1,433	950	483
2006	5,646	3,921	1,725	1,566	1,044	522
2007	6,223	4,313	1,910	1,637	1,089	548
2008	6,914	4,873	2,041	1,718	1,172	546
2009	7,655	5,398	2,257	1,898	1,301	597

Figure HLJ-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The rural labor force human capital grows quite slowly and much less than the one for urban.

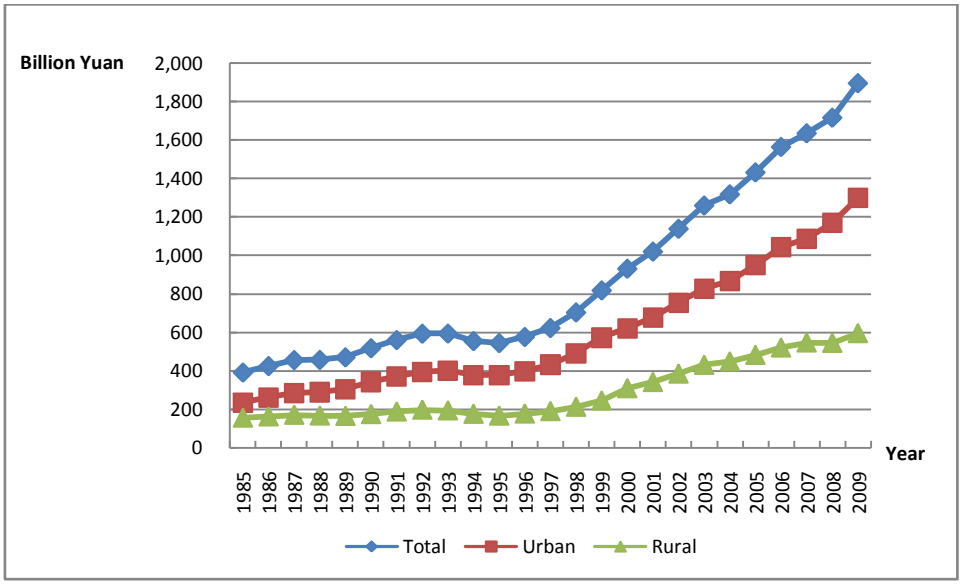


Figure HLJ-3.2 Real Labor Force Human Capital by Region for Heilongjiang

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. The average labor force human capital means the labor force human capital divided by the population that are over 15 years old, non-retired and out of school.

Table HLJ-3.3 reports the real average labor force human capital by gender. The average labor force human capital for female is smaller than that for male. More specifically, the number for male is about 1.75 times that for female in 2009.

Table HLJ-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Heilongjiang

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	21.86	26.65	16.80	21.86	26.65	16.80
1986	24.74	30.32	18.84	23.22	28.45	17.68
1987	28.00	34.46	21.16	24.21	29.80	18.30
1988	31.82	39.23	23.94	23.37	28.81	17.59
1989	36.17	44.57	27.15	23.17	28.54	17.40
1990	40.98	50.53	30.63	24.79	30.57	18.53
1991	46.13	57.04	34.30	26.03	32.18	19.36
1992	51.89	64.29	38.42	26.98	33.42	19.98
1993	58.52	72.69	43.07	26.50	32.91	19.51
1994	65.62	81.64	48.14	24.38	30.33	17.89
1995	73.70	91.80	53.96	23.58	29.37	17.27
1996	82.20	102.56	59.90	24.56	30.64	17.90
1997	91.86	114.94	66.63	26.31	32.90	19.09
1998	103.01	129.14	74.35	29.31	36.76	21.18
1999	114.59	143.76	82.65	33.68	42.25	24.30
2000	124.51	156.41	89.48	37.43	47.01	26.91
2001	136.83	172.18	98.09	40.87	51.42	29.32
2002	150.41	189.71	107.35	45.24	57.05	32.31
2003	166.00	209.47	118.31	49.50	62.43	35.31
2004	182.07	229.80	129.45	52.19	65.83	37.16
2005	200.77	253.06	142.73	56.80	71.55	40.44
2006	223.80	282.32	158.43	62.06	78.23	44.01
2007	247.69	311.41	175.87	65.15	81.88	46.35
2008	277.19	347.36	197.60	68.88	86.27	49.18
2009	309.54	387.27	220.81	76.74	95.95	54.81

Table HLJ-3.4 reports the real average Labor force human capital by region. The average labor force human capital is much smaller in rural area

than in urban area. The number for urban is about 1.90 times that for rural in 2009.

Table HLJ-3.4 Nominal and Real Average Labor Force Human Capital by Region for Heilongjiang

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	21.86	28.36	16.24	21.86	28.36	16.24
1986	24.74	32.13	18.11	23.22	30.31	16.84
1987	28.00	36.40	20.14	24.21	31.30	17.58
1988	31.82	41.25	22.54	23.37	29.91	16.94
1989	36.17	46.85	25.16	23.17	29.65	16.50
1990	40.98	52.99	28.07	24.79	31.75	17.32
1991	46.13	59.60	31.29	26.03	33.00	18.34
1992	51.89	66.86	34.79	26.98	33.75	19.25
1993	58.52	75.29	38.73	26.50	32.99	18.85
1994	65.62	84.18	42.91	24.38	30.24	17.21
1995	73.70	94.24	47.51	23.58	29.20	16.40
1996	82.20	105.48	52.57	24.56	30.38	17.15
1997	91.86	118.47	58.01	26.31	32.65	18.24
1998	103.01	133.30	64.11	29.31	36.41	20.22
1999	114.59	148.71	70.54	33.68	41.88	23.10
2000	124.51	166.39	77.96	37.43	47.47	26.26
2001	136.83	182.64	86.01	40.87	51.70	28.86
2002	150.41	201.03	95.06	45.24	57.30	32.06
2003	166.00	222.40	105.43	49.50	62.89	35.13
2004	182.07	243.81	116.16	52.19	66.61	36.79
2005	200.77	268.72	128.02	56.80	72.84	39.64
2006	223.80	298.28	142.81	62.06	79.42	43.18
2007	247.69	329.01	158.92	65.15	83.11	45.59
2008	277.19	364.84	176.10	68.88	87.77	47.13
2009	309.54	408.92	195.74	76.74	98.57	51.75

4. Relative trend in human capital

Figure HLJ-4.1 illustrates the ratio of labor force human capital to human capital based on five-education categories[98], and the ratio of total population in labor force to total non-retired population. After 1990, the two ratios show different trends. One potential explanation is that the student population, especially tertiary education students, increases a lot.

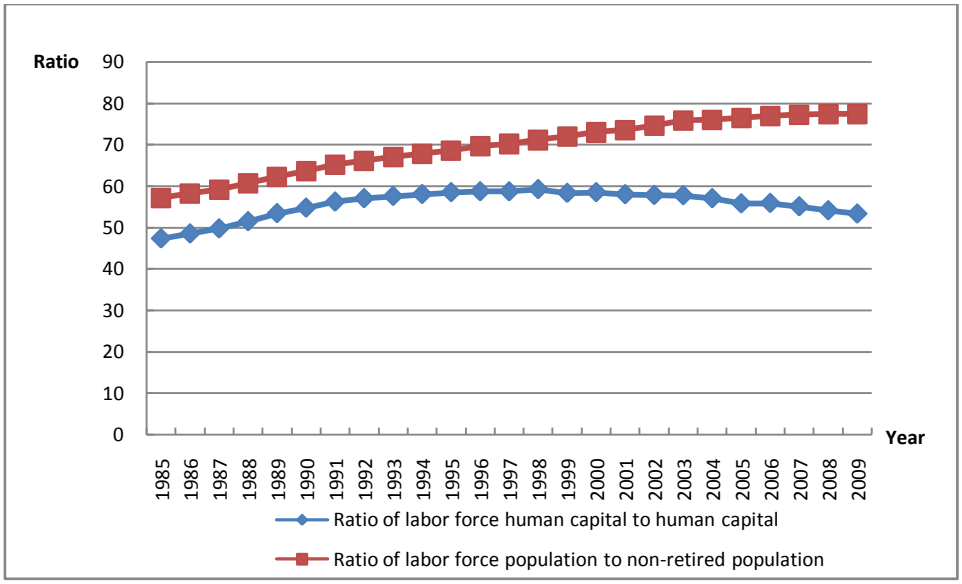


Figure HLJ-4.1 Ratio of Labor Force Human Capital to Human Capital and Ratio of Labor Force Population to Non-retired Population for Heilongjiang

Figure HLJ-4.2 reports the ratio of human capital to fixed assets for Heilongjiang. We can see that human capital is always larger than fixed assets. From 1985 to 2007, it shows an obvious downward trend. After 2007, however, the trend is reversed.

[98] Unless otherwise stated, all human capitals refer to nominal ones and based on five-education categories.

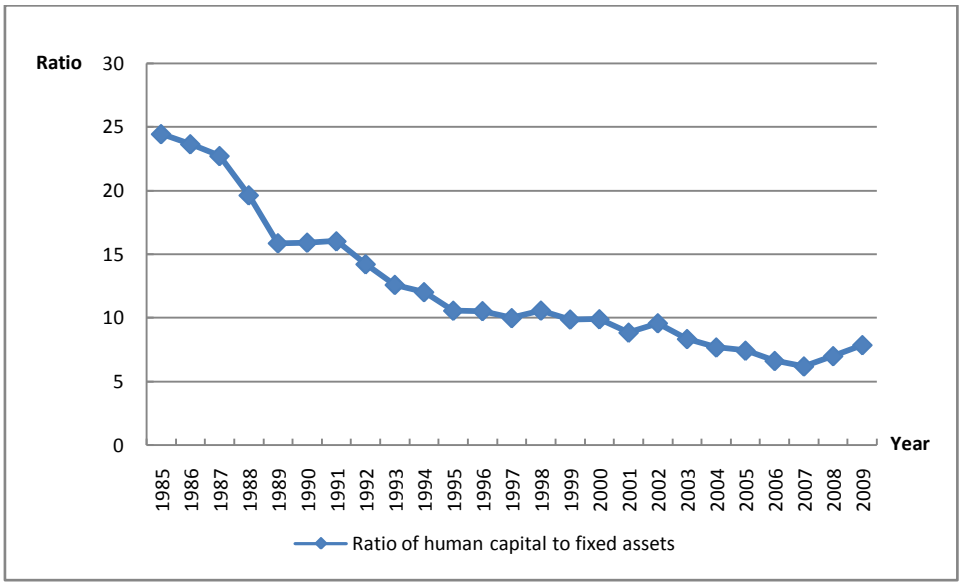


Figure HLJ-4.2 Ratio of Human Capital to Fixed Assets for Heilongjiang

Figure HLJ-4.3 reports the ratio of human capital to GDP and ratio of labor force human capital to GDP for Heilongjiang. The two ratios display similar patterns. Both experience some fluctuation before 2003 and roughly show a downward trend throughout.

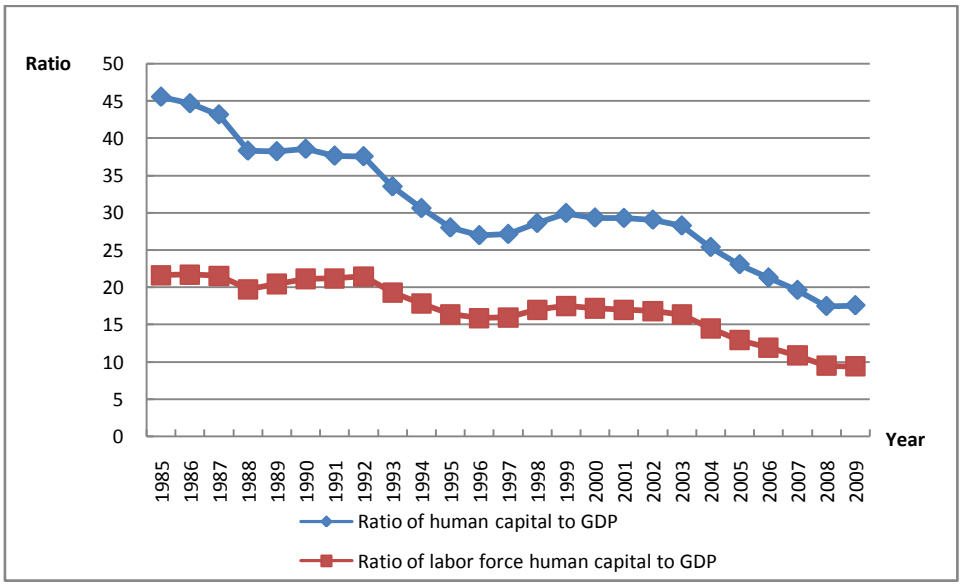


Figure HLJ-4.3 Ratio of Human Capital to GDP and Ratio of Labor Force Human Capital to GDP for Heilongjiang

Figure HLJ-4.4 reports the ratio of fixed assets to GDP for Heilongjiang. The ratio itself reveals the rate of output of fixed assets. Before 2003, there is a general upward trend. But it starts to decline after 2003.

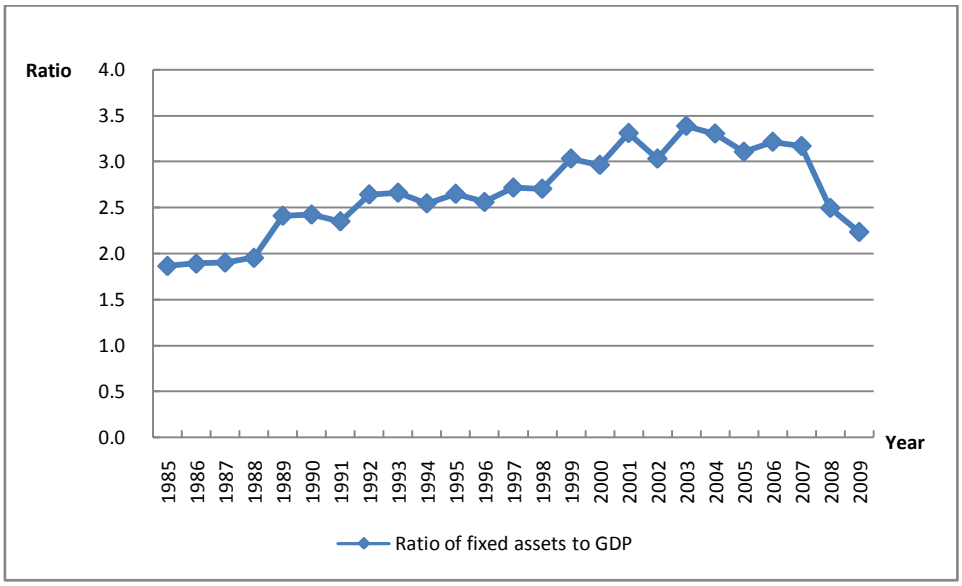


Figure HLJ-4.4 Ratio of Fixed Assets to GDP for Heilongjiang

5. Conclusion

1. The nominal and real human capital for Heilongjiang in 2009 is 14.347 trillion Yuan and 3.534 trillion Yuan. Urban and rural human capital in real values are 2.677 trillion Yuan and 0.857 trillion Yuan, accounting for 75.75% and 24.25% of the total human capital respectively. Male and Female human capital in real values are 2.260 trillion Yuan and 1.274 trillion Yuan, accounting for 63.95% and 36.05%.

2. The nominal and real human capital per capita for Heilongjiang increases from 26,380 Yuan to 448,950 Yuan and 26,380 Yuan to 110,580 Yuan respectively from 1985 to 2009. In 2009, the real human capital per

capita is 154,140 Yuan for urban, 58,750 Yuan for rural, 133,490 Yuan for male and 84,790 Yuan for female.

3. The average annual growth rate of real human capital is 7.22% for urban and 4.16% for rural. The real human capital per capita for urban is larger than that for rural. After 1997, their average annual growth rate becomes even larger and reaches 11.37% for urban and 8.44% for rural respectively.

4. In 2009, the nominal and real labor force human capital for Heilongjiang reaches 7.655 trillion Yuan and 1.898 trillion Yuan. And the real labor force human capital is 1.301 trillion Yuan for urban and 0.597 trillion Yuan for rural, accounting for 68.55% and 31.45% of the total labor force human capital.

Chapter 21 Human Capital for Zhejiang

1. Total human capital

Human capital stocks of Zhejiang are calculated based on estimated income parameters and a 4.58% discount rate. The results are reported in Table ZJ-1.1. Column 1 and 2 contain the nominal human capital; column 3 and 4 contain the real human capital deflated by CPI (in 1985 Yuan).[99]

Table ZJ-1.1 Nominal and Real Human Capital for Zhejiang

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	2,101		2,101	
1986	2,357		2,219	
1987	2,661		2,315	
1988	3,061		2,191	
1989	3,474		2,099	
1990	3,959		2,342	
1991	4,447		2,541	
1992	4,999		2,665	
1993	5,670		2,525	
1994	6,329		2,254	
1995	7,033		2,141	
1996	8,139		2,272	
1997	9,415		2,534	
1998	10,871		2,913	
1999	12,475		3,355	

[99] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
2000	15,169	15,251	4,021	4,039
2001	17,340	17,466	4,582	4,609
2002	19,490	19,646	5,188	5,226
2003	22,093	22,298	5,793	5,840
2004	25,251	25,529	6,391	6,454
2005	29,310	29,691	7,286	7,373
2006	33,434	33,910	8,219	8,326
2007	38,945	39,578	9,184	9,321
2008	44,849	45,638	10,068	10,232
2009	51,890	52,900	11,799	12,012

Figure ZJ-1.1 graphs real and nominal human capital for Zhejiang. As shown, both the nominal and real human capital rise steadily but the former grows faster than the latter.

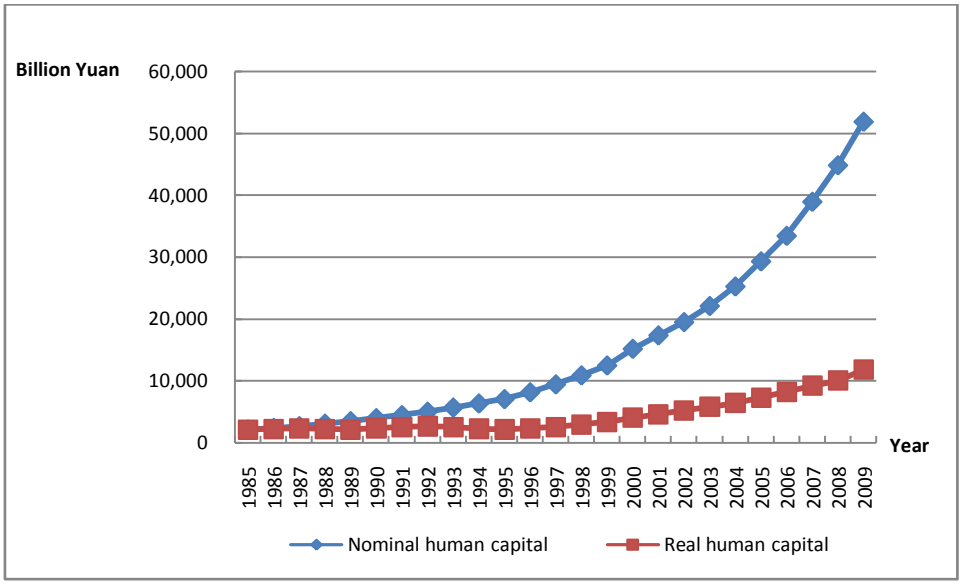


Figure ZJ-1.1 Nominal and Real Human Capital for Zhejiang

Table ZJ-1.2 reports the real human capital for Zhejiang by gender and region. Overall, the results based on five-education categories show that human capital for Zhejiang during the years 1985-2009 generally grows steadily. More specifically, total real human capital for Zhejiang increases from 2.101 trillion Yuan to 11.799 trillion Yuan, and the average annual growth rate is about 7.19%. However, the total real human capital for male is apparently much larger than that of female. It increases from 1.293 trillion Yuan to 7.814 trillion Yuan for male, and from 0.808 trillion Yuan to 3.986 trillion Yuan for female. At the same time, the real human capital for urban and rural also increase a lot, from 0.846 trillion Yuan to 8.961 trillion Yuan for urban area and from 1.255 trillion Yuan to 2.838 trillion Yuan for rural area. The average annual growth rate is 9.83% and 3.40% for urban and rural area respectively. In 2009, the total real human capital for urban is almost 3.2 times the amount of that for rural in Zhejiang.

Table ZJ-1.2 Real Human Capital by Gender and Region for Zhejiang[100]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	2,101	1,293	808	846	1,255
1986	2,219	1,373	847	929	1,290
1987	2,315	1,438	876	976	1,339
1988	2,191	1,374	817	950	1,241
1989	2,099	1,326	774	959	1,140
1990	2,342	1,488	854	1,115	1,227
1991	2,541	1,620	920	1,231	1,310
1992	2,665	1,705	960	1,311	1,354
1993	2,525	1,623	903	1,268	1,257
1994	2,254	1,455	799	1,165	1,089

[100] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1995	2,141	1,384	757	1,132	1,009
1996	2,272	1,478	795	1,248	1,024
1997	2,534	1,653	882	1,440	1,094
1998	2,913	1,906	1,006	1,714	1,199
1999	3,355	2,198	1,157	2,044	1,311
2000	4,021	2,645	1,376	2,541	1,480
2001	4,582	3,010	1,572	3,015	1,567
2002	5,188	3,423	1,767	3,483	1,705
2003	5,793	3,821	1,971	4,005	1,788
2004	6,391	4,212	2,179	4,529	1,862
2005	7,286	4,798	2,488	5,309	1,977
2006	8,219	5,423	2,795	6,017	2,202
2007	9,184	6,064	3,120	6,839	2,345
2008	10,068	6,656	3,412	7,589	2,479
2009	11,799	7,814	3,986	8,961	2,838

In Figure ZJ-1.2, the real human capital of male and female for Zhejiang exhibits a rising trend from 1985 to 2009. Starting from 1996, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

The pattern that the human capital of male is higher than that of female is consistent with that at the national level. One reason behind this pattern is that men have a higher retirement age than women, and thus ends up with a higher lifetime income relative to women.[101] In addition, the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[101] To ensure the consistency of urban and rural, we define the working age of male and female in rural area as 60 and 55.

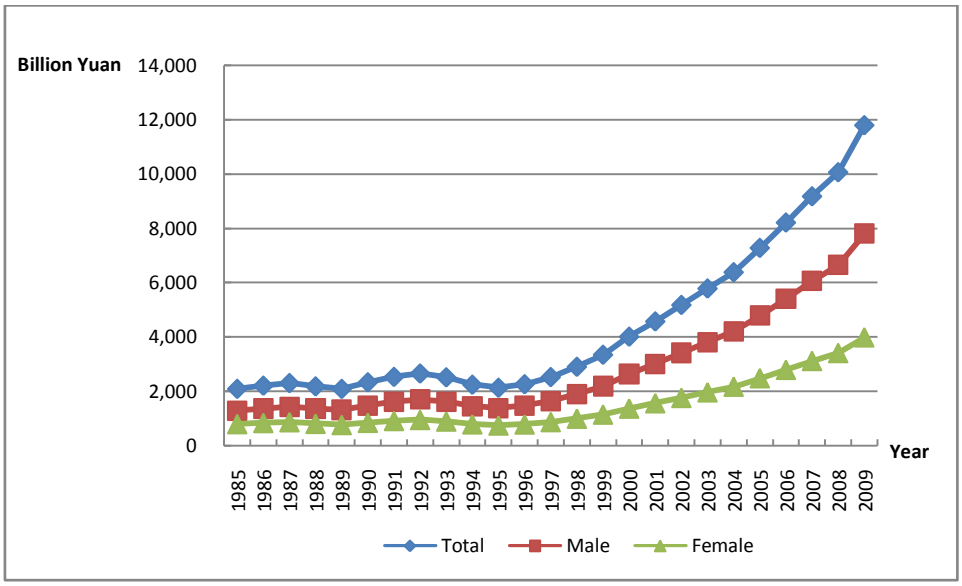


Figure ZJ-1.2 Real Human Capital by Gender for Zhejiang

Figure ZJ-1.3 shows the real human capital for urban and rural separately. The urban human capital stock is lower than that for rural from 1985-1992, but it begins to exceed the rural human capital after 1993. Before 1997, the growth rate for urban and rural does not show much difference. Starting from 1997, however, the urban human capital is rising much more rapidly than the rural human capital, leading to an increasingly larger gap between rural and urban.

The gap between rural and urban can be partially explained by the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another possible contributing factor can be the education gap between the rural and urban population. In addition, the graph shows that the pattern for urban real human capital is quite similar to that for the whole province, which indicates that changes of the provincial real human capital are determined by that for urban, to some extent.

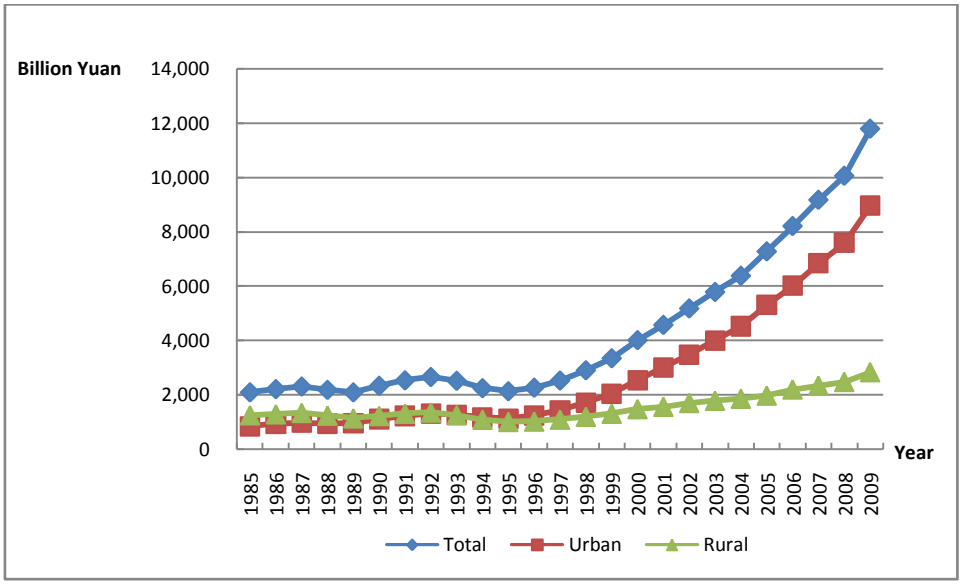


Figure ZJ-1.3 Real Human Capital by Region for Zhejiang

Human capital index can reflect the trend of human capital directly. Table ZJ-1.3 reports a set of indices of real human capital classified by gender and region for Zhejiang from 1985 to 2009. We calculate them using year 1985 as the base year.

Table ZJ-1.3 Real Human Capital Index for Zhejiang (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	105.63	106.16	104.83	109.85	102.79
1987	110.17	111.21	108.48	115.33	106.69
1988	104.31	106.28	101.16	112.37	98.88
1989	99.93	102.54	95.78	113.43	90.84
1990	111.48	115.08	105.73	131.83	97.77
1991	120.95	125.27	113.94	145.54	104.38
1992	126.86	131.89	118.84	155.00	107.89
1993	120.19	125.50	111.72	149.92	100.16
1994	107.29	112.51	98.86	137.74	86.77

1995	101.91	107.06	93.66	133.84	80.40
1996	108.15	114.28	98.40	147.55	81.59
1997	120.62	127.84	109.19	170.25	87.17
1998	138.66	147.39	124.57	202.65	95.54
1999	159.70	169.99	143.22	241.66	104.46
2000	191.40	204.56	170.35	300.43	117.93
2001	218.11	232.79	194.60	356.47	124.86
2002	246.95	264.73	218.71	411.80	135.86
2003	275.75	295.51	243.98	473.52	142.47
2004	304.22	325.75	269.78	535.47	148.37
2005	346.82	371.08	308.03	627.69	157.53
2006	391.23	419.41	346.05	711.40	175.46
2007	437.17	468.99	386.21	808.58	186.85
2008	479.25	514.77	422.32	897.26	197.53
2009	561.64	604.33	493.39	1,059.47	226.14

Figure ZJ-1.4 shows the index of real human capital. It is obvious that the human capital has been rising much more rapidly since 1996.

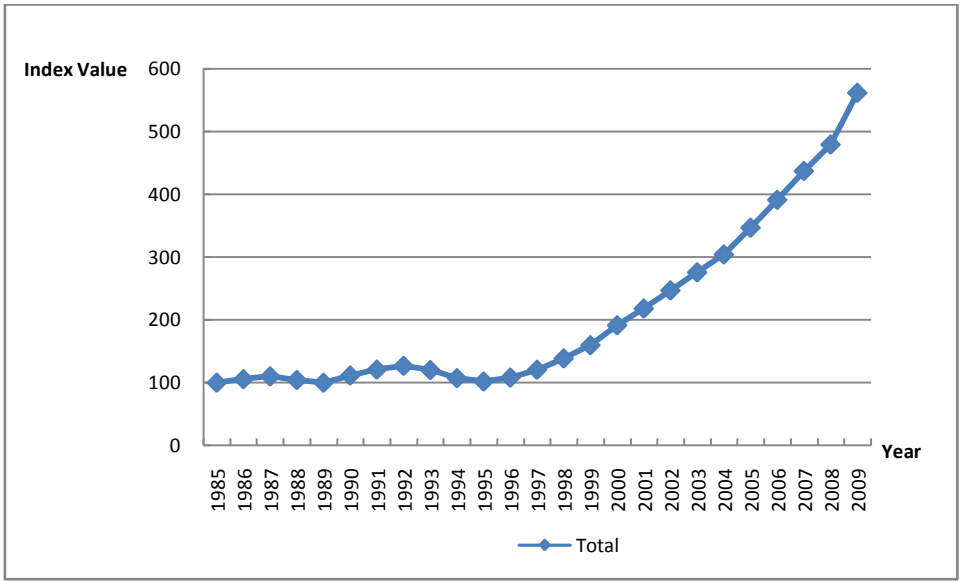


Figure ZJ-1.4 Human Capital Index for Zhejiang

2. Human capital per capita

The increase in human capital can be caused by changes in demographic structure, education, migration and urbanization etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital to non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it can exclude the influence of population factor to a large extent. Thus it can serve as a better indicator of the average human capital.

Table ZJ-2.1 presents the trend of human capital per capita for Zhejiang by gender in both nominal and real terms. Human capital per capita of male remains larger than that of female. Nominal human capital per capita for male increases 21 times, from 69,130 Yuan to 1,527,530 Yuan, while for female, it increases 17.6 times, from 47,420 Yuan to 880,190 Yuan. Real human capital per capita for male increases 4 times, from 69,130 Yuan to 348,140 Yuan. For female, it increases 3.2 times, from 47,420 Yuan to 199,240 Yuan.

Table ZJ-2.1 Nominal and Real Human Capital Per Capita by Gender for Zhejiang

Year	Nominal Human capital per capita (Thousands of Yuan)			Real Human capital per capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	58.78	69.13	47.42	58.78	69.13	47.42
1986	65.53	77.77	52.21	61.70	73.24	49.17
1987	73.11	87.56	57.53	63.59	76.09	50.07
1988	83.16	99.96	64.81	59.54	71.49	46.47
1989	93.65	112.71	72.61	56.59	68.05	43.93
1990	106.05	127.79	81.77	62.74	75.55	48.44
1991	118.77	143.89	90.82	67.86	82.09	51.97
1992	133.09	162.16	100.90	70.95	86.34	53.90
1993	150.89	185.06	113.21	67.19	82.32	50.52

1994	168.48	208.23	124.91	60.00	74.06	44.55
1995	187.32	232.80	137.92	57.03	70.81	42.04
1996	215.09	268.46	156.94	60.04	74.89	43.90
1997	247.75	309.74	180.16	66.68	83.36	48.53
1998	285.06	357.21	206.18	76.39	95.68	55.24
1999	326.94	409.02	236.79	87.93	110.05	63.62
2000	375.49	469.18	271.66	99.54	124.43	71.89
2001	429.33	536.05	311.16	113.45	141.84	82.02
2002	482.27	604.92	346.52	128.37	161.31	92.05
2003	546.79	686.59	392.80	143.37	180.16	102.67
2004	624.84	783.20	449.90	158.15	198.55	113.52
2005	716.28	896.67	516.81	178.06	223.32	128.03
2006	806.49	1,008.92	581.36	198.26	248.54	142.36
2007	928.55	1,161.24	669.32	218.97	274.36	157.25
2008	1,062.22	1,327.54	765.55	238.45	298.63	171.15
2009	1,222.43	1,527.53	880.19	277.96	348.14	199.24

Figure ZJ-2.1 shows that the real human capital per capita of male is larger than that of female for Zhejiang from 1985 to 2009. Starting from 1997, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

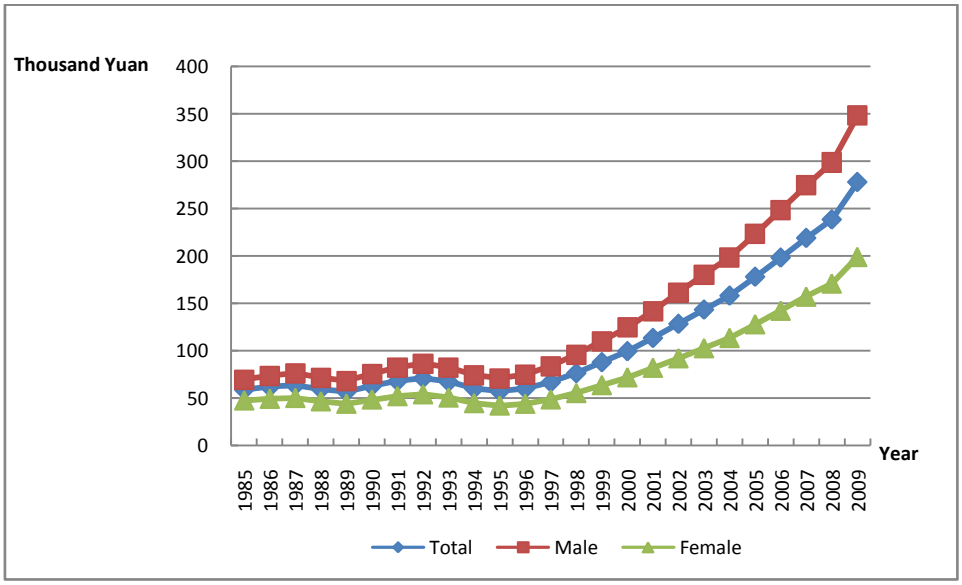


Figure ZJ-2.1 Human Capital Per Capita by Gender for Zhejiang

Table ZJ-2.2 reports the results of human capital per capita by region for Zhejiang in both nominal and real terms. From 1985 to 2009, the human capital per capita in urban area is significantly larger than that for rural. The nominal human capital per capita for urban increases from 78,250 Yuan to 1,634,660 Yuan. For rural it increases from 50,330 Yuan to 625,000 Yuan. The real human capital per capita for urban increases from 78,250 Yuan to 356,740 Yuan, the per capita rural human capital increases from 50,330 Yuan to 163,780 Yuan. The human capital per capita in urban area grows much faster than the one for rural.

Table ZJ-2.2 Nominal and Real Human Capital Per Capita by Region for Zhejiang

Year	Nominal Human capital per capita (Thousands of Yuan)			Real Human capital per capita (Thousands of 1985 Yuan)		
	Total	**Urban**	**Rural**	**Total**	**Urban**	**Rural**
1985	58.78	78.25	50.33	58.78	78.25	50.33
1986	65.53	86.88	55.66	61.70	81.73	52.46
1987	73.11	96.34	61.79	63.59	81.72	54.73
1988	83.16	110.24	69.16	59.54	75.78	51.14
1989	93.65	124.61	76.80	56.59	73.34	47.48
1990	106.05	141.93	85.43	62.74	81.81	51.78
1991	118.77	158.81	94.33	67.86	86.69	56.33
1992	133.09	178.08	104.10	70.95	89.02	59.31
1993	150.89	202.62	115.74	67.19	83.43	56.18
1994	168.48	225.35	127.84	60.00	74.41	49.68
1995	187.32	249.51	140.79	57.03	70.42	47.00
1996	215.09	289.58	155.82	60.04	74.43	48.61
1997	247.75	336.63	173.25	66.68	83.12	52.94
1998	285.06	389.55	192.58	76.39	95.71	59.26
1999	326.94	448.91	212.86	87.93	110.84	66.50
2000	375.49	515.55	236.45	99.54	126.16	73.07

2001	429.33	582.93	262.15	113.45	143.22	81.01
2002	482.27	651.12	289.93	128.37	161.92	90.23
2003	546.79	736.57	320.79	143.37	182.26	97.02
2004	624.84	839.67	357.70	158.15	202.11	103.42
2005	716.28	952.12	397.57	178.06	225.79	113.59
2006	806.49	1,069.76	445.35	198.26	250.93	125.98
2007	928.55	1,234.31	497.43	218.97	278.66	134.78
2008	1,062.22	1,416.60	554.66	238.45	305.24	142.79
2009	1,222.43	1,634.66	625.00	277.96	356.74	163.78

Figure ZJ-2.2 reflects the trend of real human capital per capita by region. As is shown, the gap between urban and rural expands rapidly after 1997. The real human capital per capita for urban area grows much faster than that for rural after 1997; although both urban and rural ones are growing faster after then.

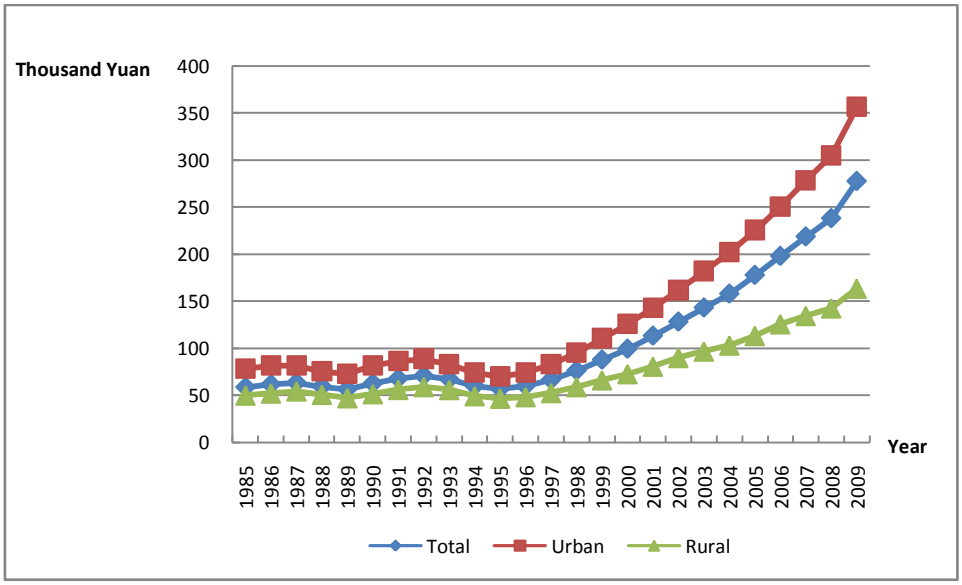


Figure ZJ-2.2 Real Human Capital Per Capita by Region for Zhejiang

Figure ZJ-2.3 shows the human capital per capita index for Zhejiang. It's obvious that the human capital per capita has been rising much more rapidly since 1997.

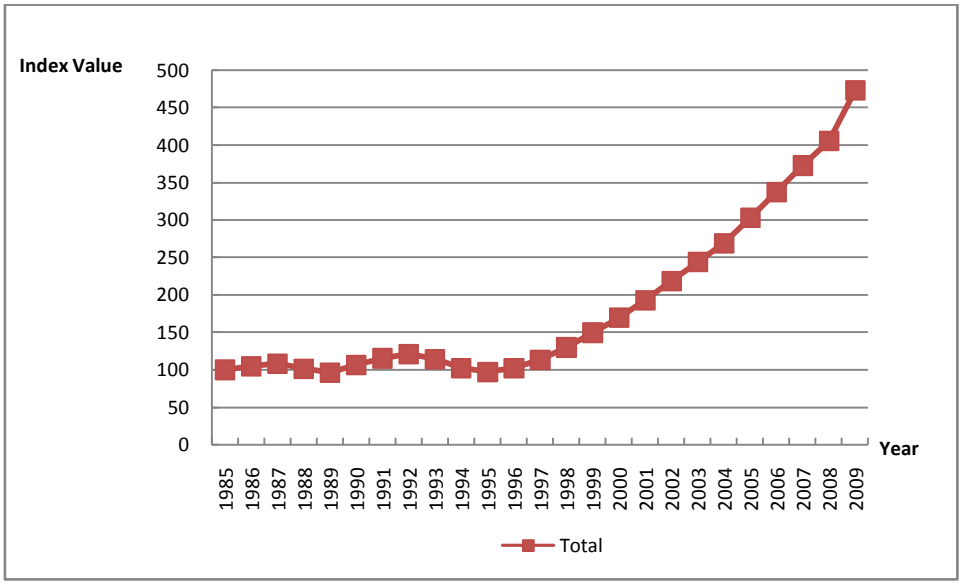


Figure ZJ-2.3 Real Human Capital Per Capita Index for Zhejiang

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimation method is the same as before. The labor force human capital for Zhejiang is reported in Table ZJ-3.1. The real values in this table are calculated by using CPI as the deflator.

Based on the five education categories, from 1985 to 2009, the total labor force human capital keeps increasing for both nominal and real terms. In detail, the nominal labor force human capital increases 19 times and the real one increases 3.6 times at the same time.

Table ZJ-3.1 Nominal and Real Labor Force Human Capital and GDP for Zhejiang

Year	Nominal Labor Force Human Capital (Billions of Yuan)		Real Labor Force Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	1,012		1,012	
1986	1,152		1,085	
1987	1,308		1,138	
1988	1,505		1,079	
1989	1,739		1,052	
1990	1,980		1,172	
1991	2,198		1,258	
1992	2,448		1,310	
1993	2,724		1,221	
1994	2,988		1,071	
1995	3,260		1,000	
1996	3,719		1,048	
1997	4,318		1,174	
1998	5,071		1,370	
1999	5,858		1,589	
2000	7,323	7,192	1,952	1,919
2001	8,003	7,880	2,131	2,099
2002	8,800	8,699	2,363	2,336
2003	9,944	9,882	2,630	2,613
2004	10,990	10,995	2,806	2,805
2005	12,555	12,569	3,150	3,152
2006	14,128	14,152	3,506	3,510
2007	15,996	16,029	3,812	3,816
2008	17,989	18,038	4,083	4,091
2009	20,327	20,403	4,677	4,690

The trends of labor force human capital in both real and nominal terms for Zhejiang are presented in Figure ZJ-3.1. From 1985 to 2009, labor force human capital keeps rising.

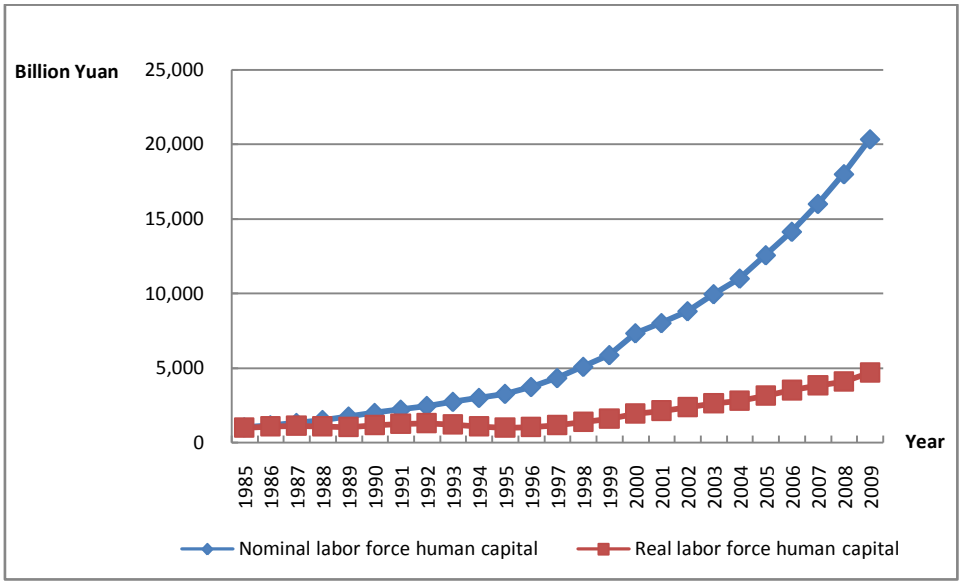


Figure ZJ-3.1 Nominal and Real Labor Force Human Capital for Zhejiang

Table ZJ-3.2 shows the nominal and real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital.

Table ZJ-3.2 Nominal and Real Labor Force Human Capital by Region for Zhejiang

Year	Nominal Labor Force Human Capital (Billions of Yuan)			Real Labor Force Human Capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	1,012	384	628	1,012	384	628
1986	1,152	457	694	1,085	430	655
1987	1,308	538	770	1,138	456	682
1988	1,505	649	856	1,079	446	633
1989	1,739	785	954	1,052	462	590

1990	1,980	930	1,050	1,172	536	636
1991	2,198	1,059	1,139	1,258	578	680
1992	2,448	1,210	1,238	1,310	605	705
1993	2,724	1,378	1,346	1,221	567	653
1994	2,988	1,543	1,445	1,071	509	562
1995	3,260	1,709	1,551	1,000	482	518
1996	3,719	2,043	1,676	1,048	525	523
1997	4,318	2,486	1,832	1,174	614	560
1998	5,071	3,063	2,008	1,370	753	618
1999	5,858	3,684	2,174	1,589	910	679
2000	7,323	4,830	2,493	1,952	1,182	770
2001	8,003	5,412	2,591	2,131	1,330	801
2002	8,800	6,007	2,793	2,363	1,494	869
2003	9,944	6,870	3,074	2,630	1,700	930
2004	10,990	7,674	3,316	2,806	1,847	959
2005	12,555	8,983	3,572	3,150	2,130	1,020
2006	14,128	10,140	3,988	3,506	2,378	1,128
2007	15,996	11,560	4,436	3,812	2,610	1,202
2008	17,989	13,040	4,949	4,083	2,809	1,274
2009	20,327	14,810	5,517	4,677	3,231	1,446

Figure ZJ-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is similar to that for human capital. Before 1996, the real labor force human capital for urban is lower than that for rural, but it begins to exceed the rural one after 1996. Also, after 1996, it grows very fast while the rural one grows quite slowly and much less than the one for urban.

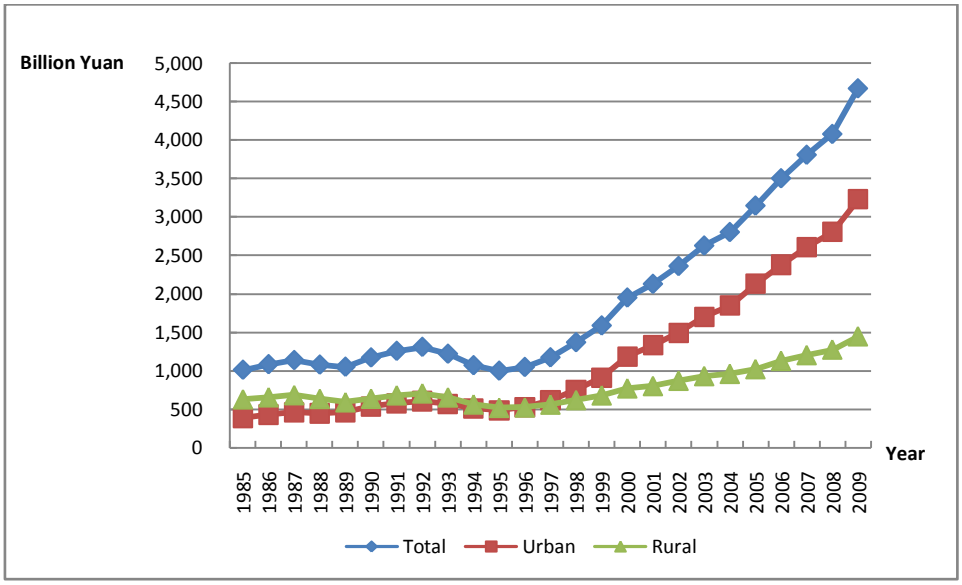


Figure ZJ-3.2 Real Labor Force Human Capital by Region for Zhejiang

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. The average labor force human capital is the ratio of labor force human capital to the population that are over 15 years old, non-retired and out of school.

Table ZJ-3.3 reports the nominal and real average labor force human capital by gender. The average labor force human capital is increasing apparently from 1985 to 2009, for both male and female. But the average labor force human capital for male remains larger than that for female. And the real average labor force human capital is almost 2 times for male that for female in 2009.

Table ZJ-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Zhejiang

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	42.46	49.77	34.60	42.46	49.77	34.60
1986	47.47	56.17	38.22	44.71	52.91	36.00
1987	52.88	63.17	42.09	46.02	54.95	36.66
1988	59.95	71.88	47.20	42.98	51.49	33.88
1989	68.12	81.88	53.12	41.20	49.49	32.17
1990	77.05	92.77	59.60	45.61	54.89	35.34
1991	84.82	102.73	65.03	48.55	58.75	37.30
1992	93.55	114.13	70.94	50.07	61.00	38.07
1993	103.64	127.57	77.54	46.44	57.08	34.85
1994	113.37	140.69	83.83	40.64	50.37	30.13
1995	123.53	154.39	90.48	37.89	47.30	27.81
1996	140.34	176.92	101.04	39.55	49.77	28.54
1997	161.04	204.40	114.22	43.78	55.49	31.12
1998	185.75	237.21	129.99	50.20	64.05	35.20
1999	211.51	270.34	147.47	57.37	73.30	40.03
2000	245.43	313.52	170.26	65.43	83.56	45.41
2001	270.42	346.57	186.68	71.99	92.27	49.68
2002	297.82	382.88	204.43	79.98	102.88	54.83
2003	333.90	430.08	228.31	88.30	113.83	60.29
2004	369.59	477.10	251.67	94.35	121.91	64.15
2005	414.63	535.58	282.14	104.03	134.55	70.65
2006	463.21	600.97	311.48	114.95	149.35	77.13
2007	522.56	678.91	349.24	124.53	161.97	83.03
2008	588.84	766.90	389.91	133.65	174.30	88.31
2009	667.27	871.31	437.37	153.53	200.72	100.37

Table ZJ-3.4 reports the average Labor force human capital by region. The average labor force human capital is much smaller in rural area than in urban area, for both nominal and real terms. The real average labor force

human capital for urban is about 1.51 times that for rural in 2009.

Table ZJ-3.4 Nominal and Real Average Labor Force Human Capital by Region for Zhejiang

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	42.46	50.63	38.64	42.46	50.63	38.64
1986	47.47	56.66	42.89	44.71	53.30	40.42
1987	52.88	62.98	47.55	46.02	53.42	42.12
1988	59.95	72.23	53.10	42.98	49.66	39.26
1989	68.12	83.19	59.28	41.20	48.96	36.65
1990	77.05	94.99	65.98	45.61	54.76	39.99
1991	84.82	103.89	72.43	48.55	56.71	43.25
1992	93.55	114.17	79.49	50.07	57.07	45.30
1993	103.64	126.11	87.64	46.44	51.93	42.54
1994	113.37	137.38	95.55	40.64	45.36	37.13
1995	123.53	148.91	103.97	37.89	42.03	34.71
1996	140.34	171.92	114.68	39.55	44.19	35.78
1997	161.04	200.50	127.12	43.78	49.51	38.85
1998	185.75	233.99	141.29	50.20	57.49	43.48
1999	211.51	268.50	155.57	57.37	66.30	48.60
2000	245.43	316.00	171.29	65.43	77.33	52.93
2001	270.42	343.55	187.20	71.99	84.41	57.85
2002	297.82	375.90	205.84	79.98	93.48	64.06
2003	333.90	419.23	229.50	88.30	103.74	69.41
2004	369.59	461.73	252.81	94.35	111.14	73.10
2005	414.63	512.96	279.75	104.03	121.65	79.93
2006	463.21	567.33	315.81	114.95	133.08	89.34
2007	522.56	638.29	354.92	124.53	144.10	96.17
2008	588.84	719.18	398.43	133.65	154.97	102.57
2009	667.27	815.47	448.31	153.53	177.97	117.48

4. Relative trend in human capital

Figure ZJ-4.1 illustrates the ratio of labor force human capital to human capital based on five-education categories[102], and the ratio of total population in labor force to total non-retired population. Before 1990, the two ratios are increasing slowly, but after 1990, they began to decrease with different levels. They are increasing slowly and reached the peak in 2000. The changing pattern can be explained by the variation of labor force population before 2000. After 2000, one potential explanation is that the student population, especially tertiary education students, increases a lot.

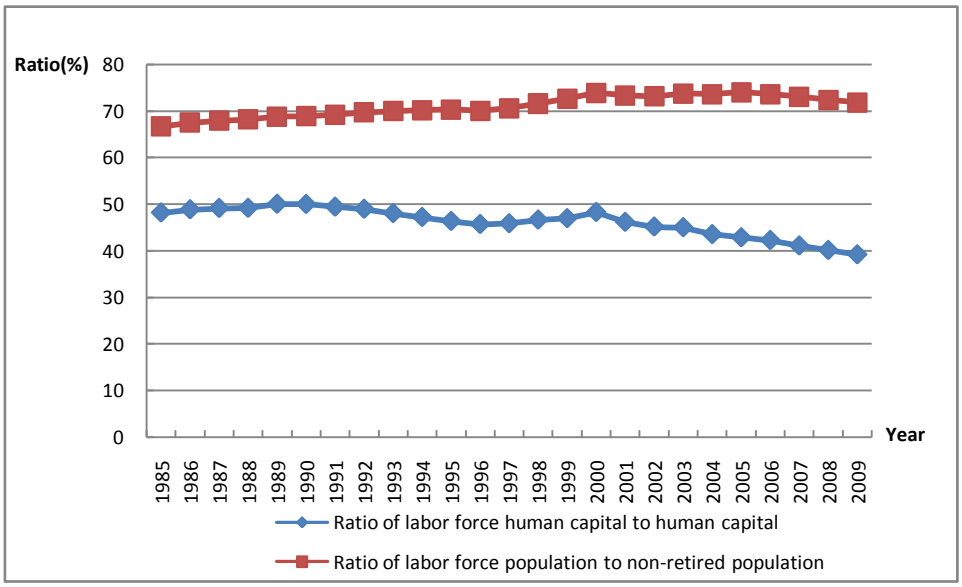


Figure ZJ-4.1 Ratio of Labor Force Human Capital to Human Capital and Ratio of Labor Force Population to Non-retired Population for Zhejiang

Figure ZJ-4.2 reports the ratio of human capital to fixed assets for Zhejiang. We can see that human capital is always larger than fixed assets.

[102] Unless otherwise stated, all human capital terms refer to nominal ones and based on five-education categories.

From 1985 to 1995, it shows an obvious downward trend, and the ratio remains relatively stable through 2000 to 2007. After 2007, however, the trend is reversed.

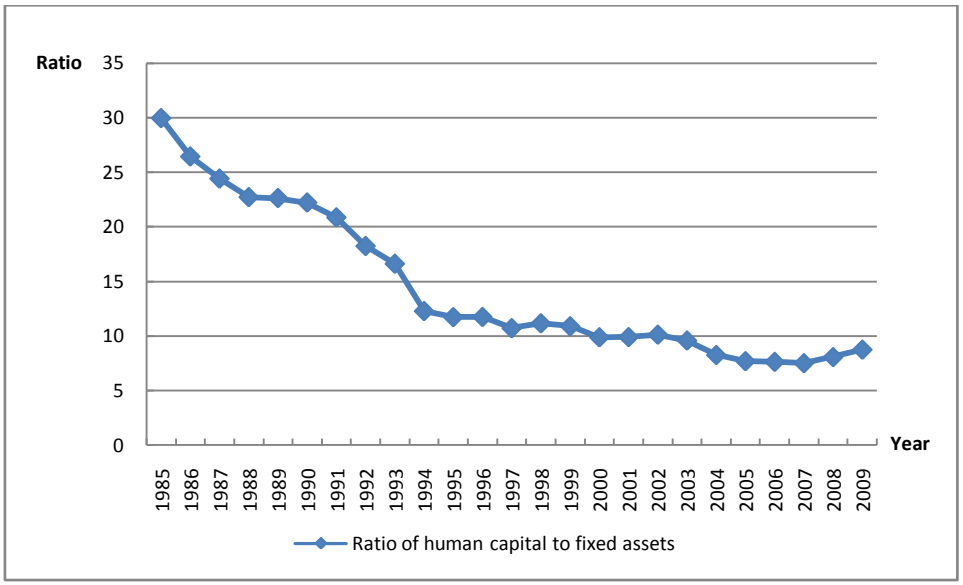


Figure ZJ-4.2 Ratio of Human Capital to Fixed Assets for Zhejiang

Figure ZJ-4.3 reports the ratio of human capital to GDP and ratio of labor force human capital to GDP for Zhejiang. The two ratios are similar. Both are decreasing before 1996, to a great extent and remained stable after that year.

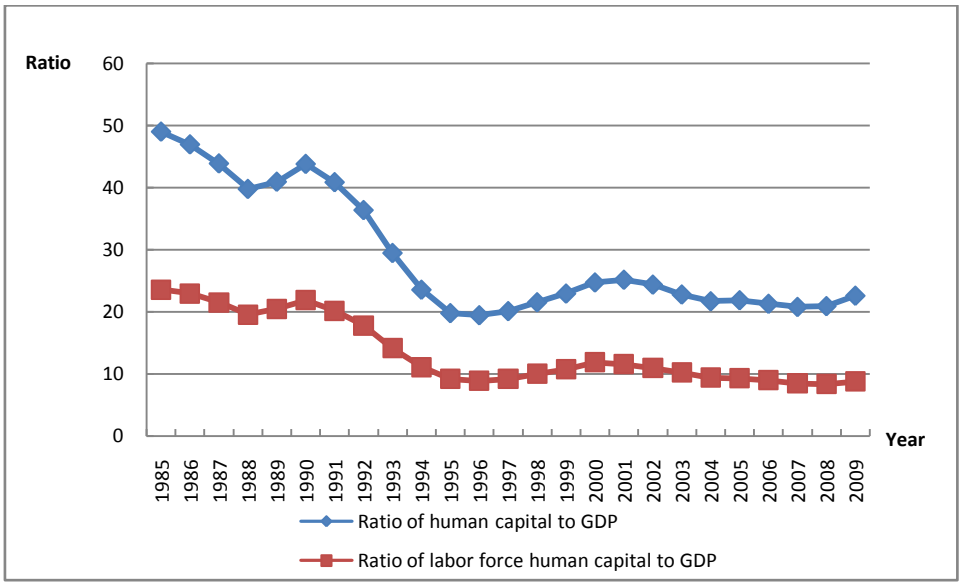


Figure ZJ-4.3 Ratio of Human Capital to GDP and Ratio of Labor Force Human Capital to GDP for Zhejiang

Figure ZJ-4.4 reports the ratio of fixed assets to GDP for Zhejiang. The ratio itself reveals the rate of output of fixed assets. The general trend of this ratio is upward but the ratio remains fluctuating from 1985 to 2009.

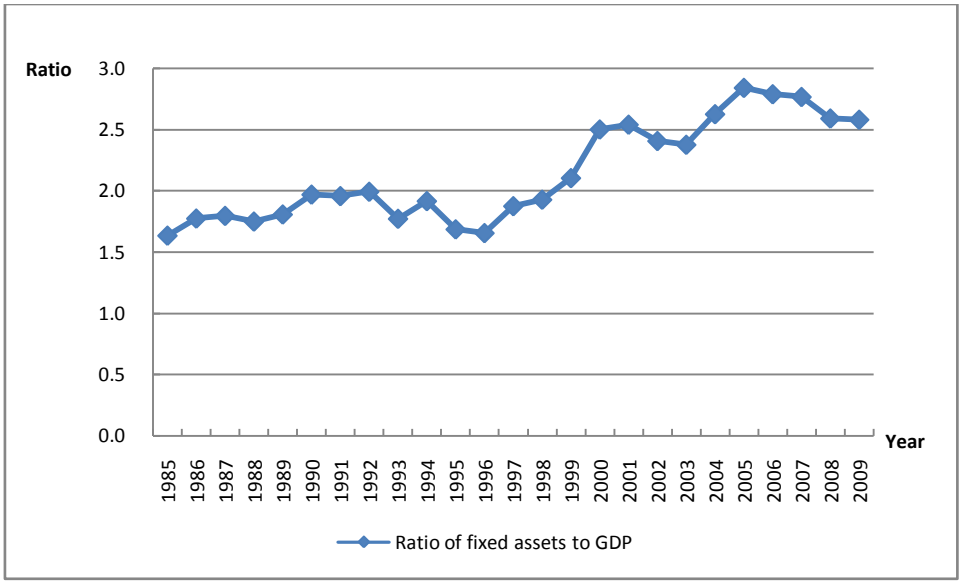


Figure ZJ-4.4 Ratio of Fixed Assets to GDP for Zhejiang

5. Conclusion

1. The nominal and real human capital for Zhejiang in 2009 is 51.890 trillion Yuan and 11.799 trillion Yuan. Urban and rural human capital in real values are accounting for 75.95% and 24.05% of the total human capital respectively. Male and Female human capital in real values are accounting for 66.23% and 33.77%.

2. The nominal and real human capital per capita for Zhejiang increase from 58,780 Yuan to 1,222,430 Yuan and 58,780 Yuan to 277,960 Yuan respectively from 1985 to 2009. In 2009, the real human capital per capita is 356,740 Yuan for urban, 163,780 Yuan for rural, 348,140 Yuan for male and 199,240 Yuan for female.

3. The average annual growth rate of real human capital is 9.83% for urban and 3.40% for rural. The real human capital per capita for urban area is larger than that for rural. After 1997, their average annual growth rate becomes even larger and reaches 6.32% for urban and 4.92% for rural respectively.

4. In 2009, the nominal and real labor force human capital for Zhejiang reaches 20.327 trillion Yuan and 4.677 trillion Yuan respectively. And the real labor force human capital for urban and for rural are accounting for 69.08% and 30.92% of the total labor force human capital respectively.

5. Before 1993, both total human capital and total labor force human capital for urban are lower than those for rural. But after 1993, the urban ones begin to exceed the rural ones. Moreover, the gap between urban and rural human capital is increasingly larger after 1997.

6. Before 1993, the average annual population growth rate for urban is 4.26% and -1.35% for rural. After 1997, the two growth rates change to 3.09% and -1.47%. It indicates that the population growth rate is lower than that for human capital. Thus one potential explanation for the pattern of Zhejiang human capital is the urbanization, education and other unobserved factors.

Chapter 22 Human Capital for Guangxi

1. Total human capital

Human capital stocks of Guangxi are calculated based on estimated income parameters and a 4.58% discount rate. The results are reported in Table GX-1.1. Column 1 and 2 contain the nominal human capital; column 3 and 4 contain the real human capital deflated by CPI(in 1985 Yuan).[103]

Table GX-1.1Nominal and Real Human Capital for Guangxi

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	980		980	
1986	1,104		1,040	
1987	1,239		1,091	
1988	1,419		1,043	
1989	1,619		972	
1990	1,853		1,085	
1991	2,116		1,204	
1992	2,409		1,295	
1993	2,745		1,223	
1994	3,094		1,093	
1995	3,471		1,035	
1996	3,947		1,103	
1997	4,498		1,248	
1998	5,088		1,455	
1999	5,757		1,686	

[103] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
2000	6,580	6,574	1,931	1,929
2001	7,453	7,455	2,176	2,176
2002	8,385	8,386	2,470	2,469
2003	9,561	9,574	2,784	2,788
2004	10,777	10,801	3,006	3,013
2005	12,033	12,063	3,275	3,283
2006	13,604	13,646	3,653	3,663
2007	15,772	15,832	3,991	4,008
2008	18,015	18,094	4,225	4,244
2009	20,792	20,884	4,985	5,007

Figure GX-1.1 graphs real and nominal human capital for Guangxi. As shown, both the nominal and real human capital rise steadily but the former grows faster than the latter.

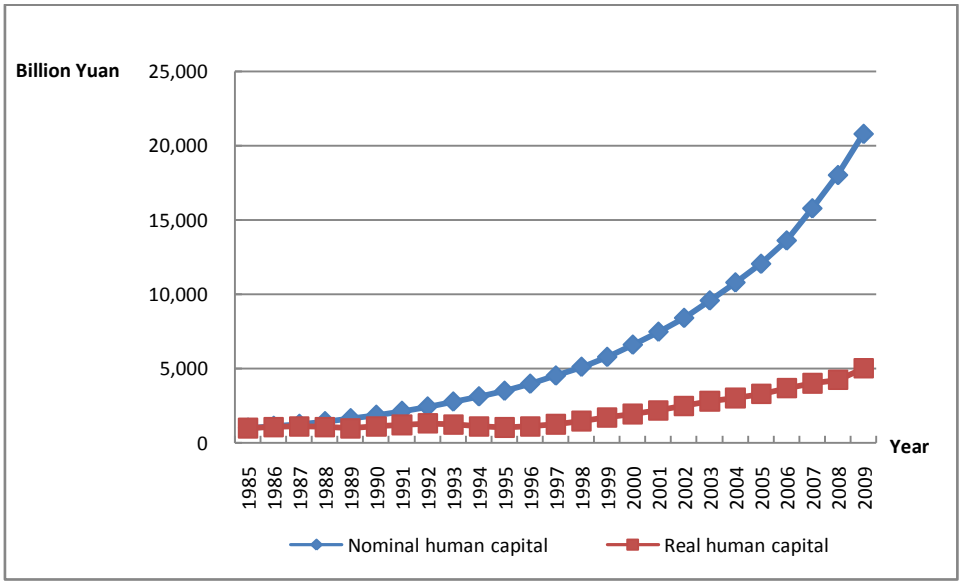


Figure GX-1.1 Nominal and Real Human Capital for Guangxi

Table GX-1.2 reports the real human capital for Guangxi by gender and region. Overall, the results based on five education categories show that human capital for Guangxi during the years 1985-2009 keeps growing rapidly. More specifically, total real human capital for Guangxi increases from 0.980 trillion Yuan to 4.985 trillion Yuan, and the average annual growth rate is about 7.01%. However, the total real human capital for male is apparently much larger than that of female. It increases from 0.589 trillion Yuan to 3.187 trillion Yuan for male, and from 0.391 trillion Yuan to 1.798 trillion Yuan for female. At the same time, the real human capital for urban area and rural area also increase a lot, from 0.265 trillion Yuan to 3.459 trillion Yuan for urban area and from 0.715 trillion Yuan to 1.526 trillion Yuan for rural area. The average annual growth rate is 11.29% and 3.21% for urban and rural respectively. In 2009, the total real human capital for urban is almost 3times the amount of that for rural in Guangxi. Before 1999, the real human capital for urban is smaller than that for rural, while after 1999 the former is larger than the later.

Table GX-1.2 Real Human Capital by Gender and Region for Guangxi[104]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	980	589	391	265	715
1986	1,040	627	413	289	751
1987	1,091	658	432	302	789
1988	1,043	634	409	286	756
1989	972	594	378	281	691
1990	1,085	667	418	331	754
1991	1,204	744	460	392	812
1992	1,295	803	492	440	854
1993	1,223	763	460	424	799

[104] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1994	1,093	685	408	393	700
1995	1,035	650	386	384	651
1996	1,103	695	409	455	649
1997	1,248	789	459	559	689
1998	1,455	927	528	696	760
1999	1,686	1,078	608	861	825
2000	1,931	1,240	690	1,020	911
2001	2,176	1,391	784	1,190	986
2002	2,470	1,576	893	1,401	1,069
2003	2,784	1,776	1,009	1,650	1,134
2004	3,006	1,910	1,096	1,841	1,165
2005	3,275	2,080	1,196	2,034	1,241
2006	3,653	2,333	1,320	2,304	1,349
2007	3,991	2,536	1,456	2,619	1,372
2008	4,225	2,690	1,535	2,863	1,362
2009	4,985	3,187	1,798	3,459	1,526

In Figure GX-1.2, the real human capital of male and female for Guangxi exhibit a rising trend from 1985 to 2009. Starting from 1997, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

The pattern that the human capital of male is higher than that of female is consistent with that at the national level. Analyzing from the perspective of lifetime income, one reason behind this pattern is that men have a higher wage than women for the same job, and the other reason is that men have a higher retirement age than women, and thus ends up with a higher lifetime income relative to women.[105] In addition, the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[105] To ensure the consistency of urban and rural, we define the working age of male and female in rural area as 60 and 55.

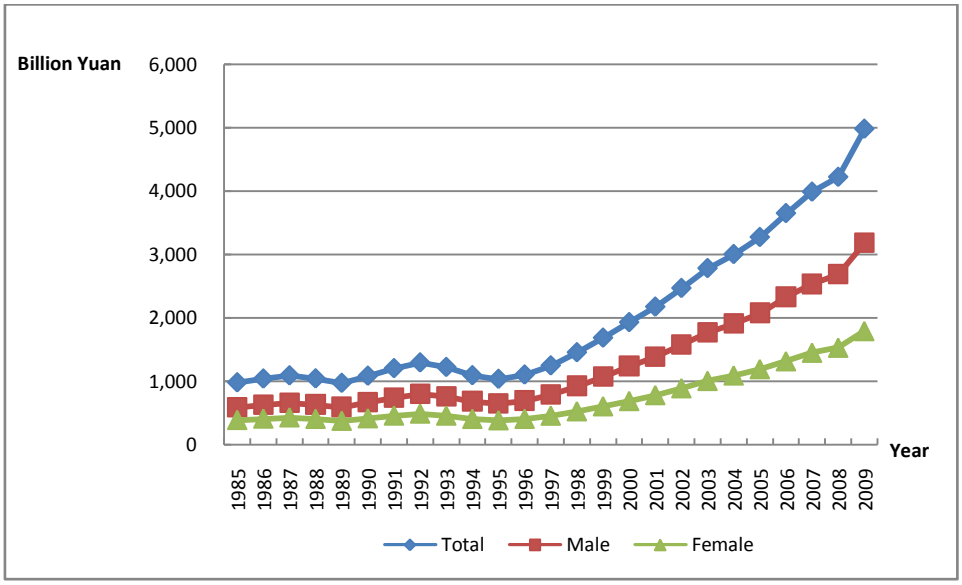


Figure GX-1.2 Real Human Capital by Gender for Guangxi

Figure GX-1.3 shows the real human capital for urban and rural separately. The urban human capital remains larger than that for rural from 1985 to 2009. Before 1996, the growth rate for urban and rural does not show much difference. Starting from 1996, however, the urban human capital is rising much more rapidly than the rural human capital, leading to an increasingly larger gap between rural and urban.

The gap between rural and urban can be partially explained by the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another possible contributing factor could be the education gap between the rural and urban population.

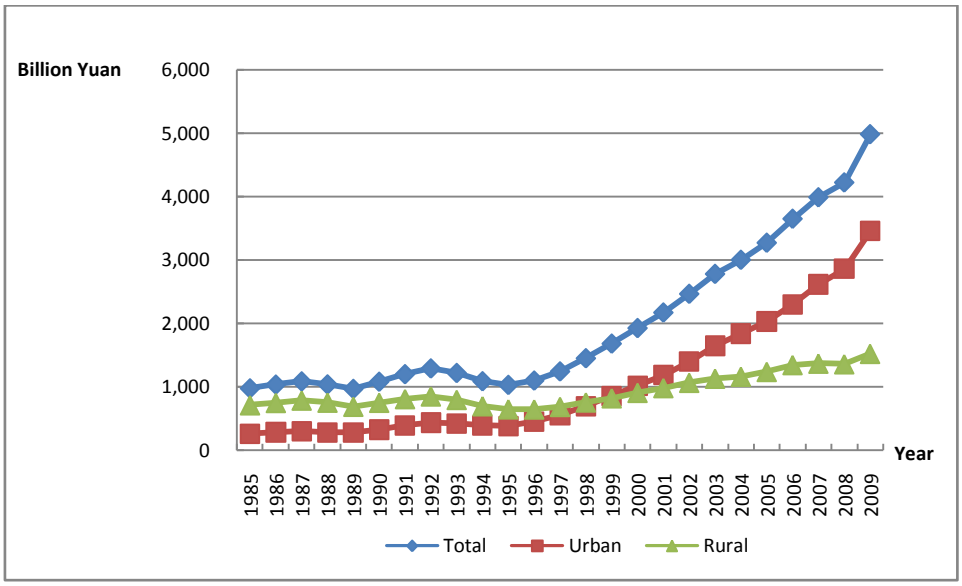


Figure GX-1.3 Real Human Capital by Region for Guangxi

Human capital index could reflect the trend of human capital directly. Table GX-1.3 reports a set of indices of real human capital classified by gender and region for Guangxi from 1985 to 2009. We calculate them using year 1985 as the base year.

Table GX-1.3 Real Human Capital Index for Guangxi(1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.10	106.47	105.55	108.74	105.12
1987	111.26	111.76	110.46	113.60	110.40
1988	106.39	107.62	104.51	107.91	105.82
1989	99.17	100.81	96.66	105.73	96.74
1990	110.69	113.27	106.78	124.64	105.51
1991	122.85	126.26	117.70	147.81	113.59
1992	132.09	136.26	125.75	165.86	119.55
1993	124.78	129.47	117.67	159.61	111.85
1994	111.50	116.28	104.25	148.19	97.87

1995	105.62	110.27	98.60	144.84	91.06
1996	112.57	117.96	104.45	171.33	90.75
1997	127.29	133.92	117.29	210.63	96.35
1998	148.50	157.38	135.06	262.09	106.31
1999	171.98	182.99	155.34	324.34	115.41
2000	196.99	210.56	176.54	384.33	127.42
2001	221.99	236.17	200.50	448.38	137.92
2002	252.02	267.58	228.32	527.88	149.57
2003	284.05	301.51	257.98	621.70	158.67
2004	306.70	324.26	280.25	693.67	163.01
2005	334.15	353.06	305.72	766.39	173.64
2006	372.72	396.08	337.60	868.12	188.75
2007	407.20	430.40	372.33	986.81	191.97
2008	431.08	456.68	392.48	1,078.75	190.57
2009	508.62	541.03	459.78	1,303.32	213.52

Figure GX-1.4 shows the index of real human capital. It is obvious that the human capital has been rising much more rapidly since 1996.

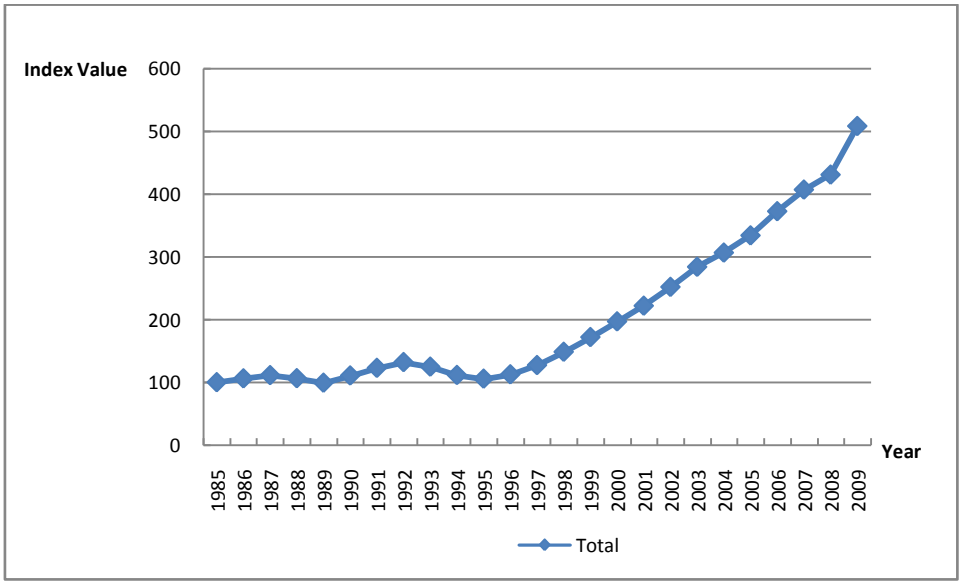


Figure GX-1.4 Human Capital Index for Guangxi

2. Human capital per capita

The increase in human capital can be caused by changes in demographic structure, education, migration and urbanization etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital to non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it could exclude the influence of population factor to a large extent. Thus it could serve as a better indicator of the average human capital.

Table GX-2.1 presents the trend of human capital per capita for Guangxi by gender in both nominal and real terms. Human capital per capita of male remains larger than that of female. Real human capital per capita for male increases 3.6 times, from 31,520 Yuan to 145,570 Yuan. For female, it increases 3 times from 23,620 Yuan to 95,460 Yuan.

Table GX-2.1 Nominal and Real Human Capital Per Capita by Gender for Guangxi

Year	Nominal Human Capital Per Capita (Thousands of Yuan)			Real Human Capital Per Capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	27.81	31.52	23.62	27.81	31.52	23.62
1986	30.84	35.04	26.09	29.04	33.00	24.57
1987	34.09	38.79	28.76	29.99	34.11	25.33
1988	38.40	43.81	32.22	28.21	32.14	23.72
1989	43.22	49.27	36.21	25.95	29.56	21.77
1990	48.36	55.01	40.54	28.32	32.21	23.73
1991	54.62	62.47	45.39	31.08	35.55	25.83
1992	61.31	70.25	50.78	32.94	37.74	27.28
1993	69.22	79.92	56.62	30.84	35.61	25.24
1994	77.23	89.53	62.74	27.28	31.61	22.17
1995	85.92	99.76	69.62	25.63	29.75	20.77

1996	98.32	114.57	79.22	27.48	32.02	22.15
1997	112.62	131.43	90.40	31.24	36.44	25.08
1998	128.38	150.49	102.05	36.72	43.05	29.19
1999	146.40	171.78	116.00	42.87	50.29	33.96
2000	166.23	195.49	131.01	48.78	57.37	38.44
2001	187.81	221.12	148.19	54.83	64.54	43.26
2002	210.76	248.94	165.88	62.09	73.32	48.83
2003	240.53	284.50	189.10	70.04	82.88	55.08
2004	271.94	321.12	214.70	75.85	89.57	59.88
2005	303.99	359.10	239.91	82.74	97.77	65.29
2006	340.89	405.65	265.95	91.54	108.96	71.40
2007	392.34	463.16	309.69	99.28	117.26	78.38
2008	444.71	527.55	348.69	104.30	123.74	81.79
2009	510.47	606.99	398.12	122.39	145.57	95.46

Figure GX-2.1 shows that the real human capital per capita of male is larger than that of female for Guangxi from 1985 to 2009. Starting from 1997, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

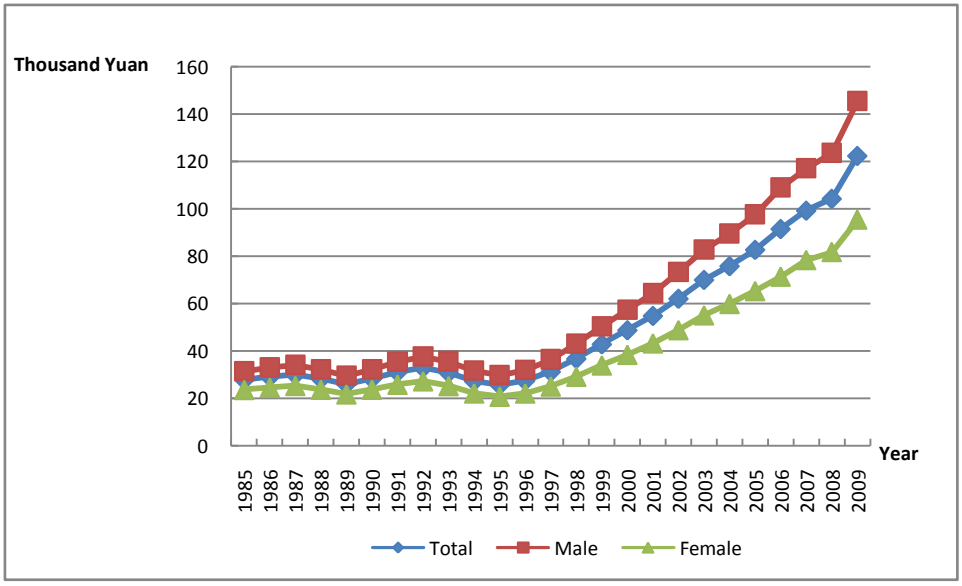


Figure GX-2.1 Human Capital Per Capita by Gender for Guangxi

Table GX-2.2 reports the results of human capital per capita by region for Guangxi in both nominal and real terms. From 1985 to 2009, the human capital per capita in urban area is significantly larger than that for rural. The real human capital per capita for urban increases from 57,010 Yuan to 211,440 Yuan, the human capital per capita for rural area increases from 23,360 Yuan to 62,630 Yuan. The human capital per capita for urban area grows much faster than the one for rural.

Table GX-2.2 Nominal and Real Human Capital Per Capita by Region for Guangxi

Year	Nominal Human Capital Per Capita (Thousands of Yuan)			Real Human Capital Per Capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	27.81	57.01	23.36	27.81	57.01	23.36
1986	30.84	63.08	25.78	29.04	59.40	24.28
1987	34.09	69.73	28.32	29.99	59.58	25.21
1988	38.40	78.55	31.75	28.21	54.43	23.87
1989	43.22	88.86	35.39	25.95	51.44	21.57
1990	48.36	99.53	39.56	28.32	58.62	23.10
1991	54.62	113.14	43.73	31.08	64.89	24.79
1992	61.31	127.79	48.39	32.94	68.49	26.03
1993	69.22	143.81	53.82	30.84	62.51	24.30
1994	77.23	159.58	59.54	27.28	55.32	21.26
1995	85.92	175.22	65.69	25.63	51.47	19.77
1996	98.32	197.45	72.57	27.48	54.98	20.34
1997	112.62	223.32	80.27	31.24	61.75	22.32
1998	128.38	248.91	88.72	36.72	70.88	25.48
1999	146.40	278.44	98.00	42.87	81.57	28.67
2000	166.23	308.73	109.45	48.78	90.45	32.18
2001	187.81	347.92	119.87	54.83	100.62	35.38
2002	210.76	388.13	131.00	62.09	113.50	38.94

2003	240.53	444.52	143.52	70.04	128.83	42.11
2004	271.94	500.12	157.76	75.85	139.23	44.13
2005	303.99	554.41	173.30	82.74	149.85	47.71
2006	340.89	615.24	191.41	91.54	163.68	52.23
2007	392.34	699.20	212.05	99.28	176.15	54.18
2008	444.71	773.73	234.16	104.30	181.16	55.14
2009	510.47	884.31	259.41	122.39	211.44	62.63

Figure GX-2.2 reflects the trend of real human capital per capita by region. As is shown, after 1996, the real human capital per capita of both urban and rural area increase faster than before 1996, and the gap between urban and rural expands rapidly after 1996.

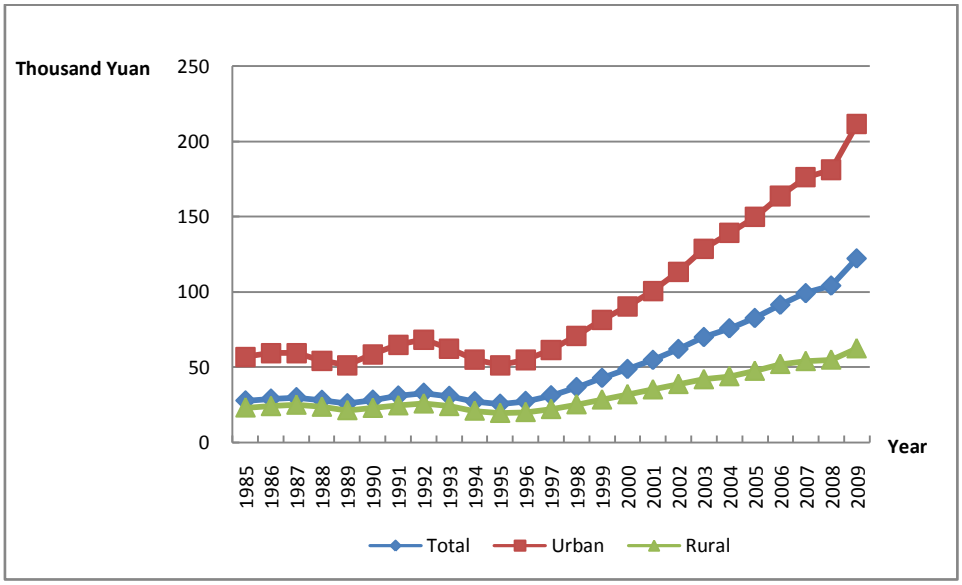


Figure GX-2.2 Real Human Capital Per Capita by Region for Guangxi

Figure GX-2.3 shows the human capital per capita index for Guangxi. It's obvious that the human capital per capita has been rising much more rapidly since 1996.

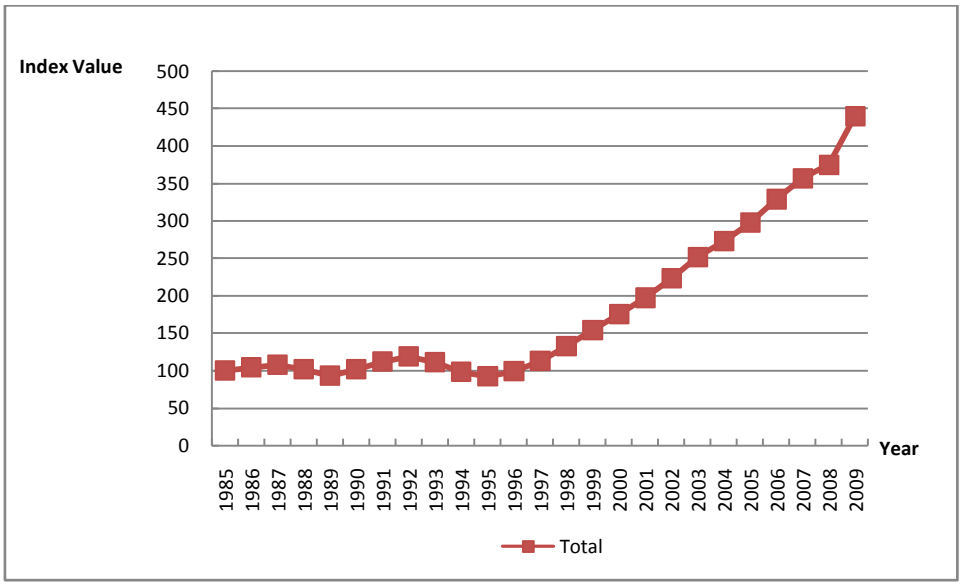


Figure GX-2.3 Real Human Capital Per Capita Index for Guangxi

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimation method is the same as before. The labor force human capital for Guangxi is reported in Table GX-3.1. The real values in this table are calculated by using CPI as the deflator.

Table GX-3.1 Nominal and Real Labor Force Human Capital and GDP for Guangxi

Year	Nominal Labor Force Human Capital (Billions of Yuan)		Real Labor Force Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	433		433	
1986	502		472	
1987	584		515	
1988	661		487	
1989	743		447	
1990	829		485	
1991	934		531	
1992	1,044		561	
1993	1,175		525	
1994	1,314		465	
1995	1,476		441	
1996	1,686		472	
1997	1,926		535	
1998	2,209		632	
1999	2,529		740	
2000	2,944	2,903	864	852
2001	3,275	3,239	957	947
2002	3,634	3,603	1,072	1,062
2003	4,041	4,017	1,178	1,171
2004	4,397	4,387	1,227	1,224
2005	4,912	4,902	1,339	1,336
2006	5,523	5,515	1,486	1,484
2007	6,264	6,258	1,588	1,587
2008	7,120	7,111	1,671	1,669
2009	8,074	8,059	1,939	1,935

The trends of labor force human capital in both real and nominal terms for Guangxi are presented in Figure GX-3.1. From 1985 to 2009, the nominal labor force human capital keeps rising while the real labor force human capital fluctuates between 1985 and 1996, and then it keeps rising too. Another point to pay attention to is that the growth rate of nominal labor force human capital is larger than the real labor force human capital because the former contains inflation factor.

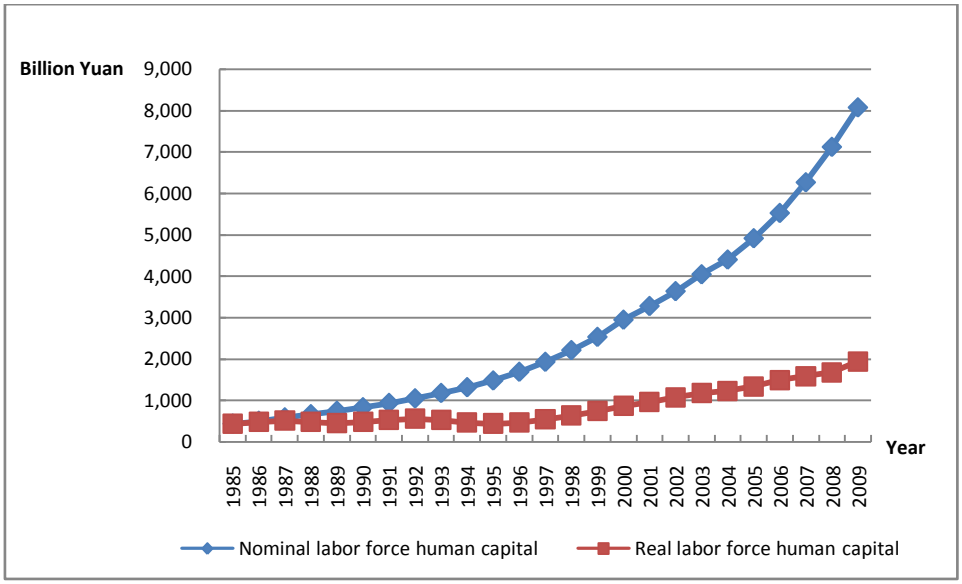


Figure GX-3.1 Nominal and Real Labor Force Human Capital for Guangxi

Table GX-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital remains larger than that for rural from 1985 to 2009.

Table GX-3.2 Nominal and Real Labor Force Human Capital by Region for Guangxi

Year	Nominal Labor Force Human Capital (Billions of Yuan)			Real Labor Force Human Capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	433	96	337	433	96	337
1986	502	118	384	472	111	361
1987	584	145	439	515	124	391
1988	661	167	494	487	116	371
1989	743	193	550	447	112	335
1990	829	223	606	485	132	354
1991	934	255	679	531	146	385
1992	1,044	291	753	561	156	405
1993	1,175	339	835	525	148	377
1994	1,314	395	919	465	137	328
1995	1,476	464	1,012	441	136	305
1996	1,686	573	1,113	472	160	312
1997	1,926	715	1,211	535	198	337
1998	2,209	901	1,308	632	257	376
1999	2,529	1,134	1,395	740	332	408
2000	2,944	1,410	1,534	864	413	451
2001	3,275	1,591	1,684	957	460	497
2002	3,634	1,804	1,830	1,072	528	544
2003	4,041	2,064	1,977	1,178	598	580
2004	4,397	2,325	2,072	1,227	647	580
2005	4,912	2,720	2,192	1,339	735	604
2006	5,523	3,033	2,490	1,486	807	680
2007	6,264	3,473	2,791	1,588	875	713
2008	7,120	4,001	3,119	1,671	937	734
2009	8,074	4,589	3,485	1,939	1,097	842

Figure GX-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the

same as that for human capital. The rural labor force human capital grows quite slowly and is much less than the one for urban.

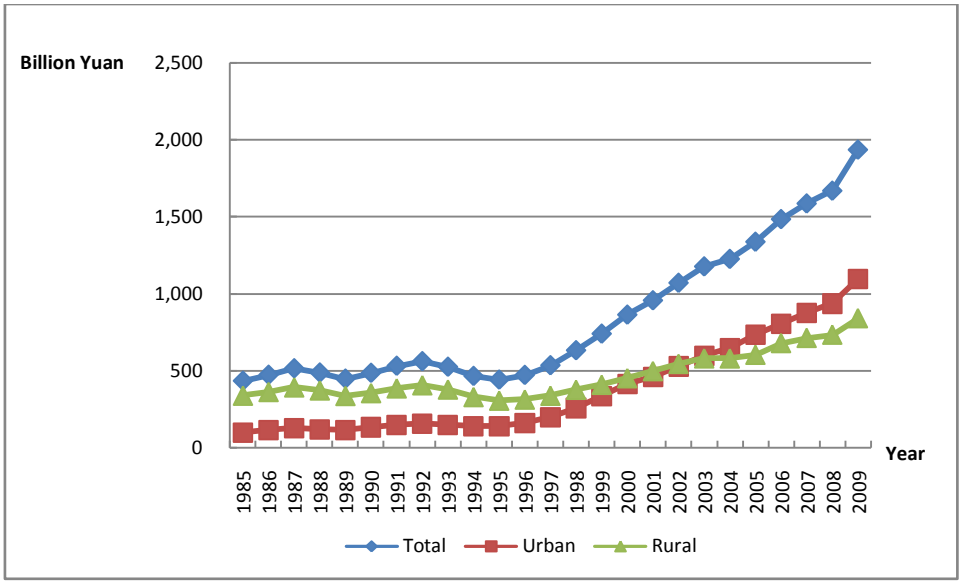


Figure GX-3.2 Real Labor Force Human Capital by Region for Guangxi

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. The average labor force human capital means the labor force human capital divided by the population that are over 15 years old, non-retired and out of school.

Table GX-3.3 reports the real average labor force human capital by gender. The real average labor force human capital for female is smaller than that for male. More specifically, the number of the real labor force human capital for male is about 1.65 times that for female in 2009.

Table GX-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Guangxi

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	21.34	24.20	18.08	21.34	24.20	18.08
1986	23.87	27.19	20.08	22.47	25.61	18.91
1987	26.68	30.58	22.29	23.51	26.92	19.66
1988	29.95	34.38	24.86	22.07	25.30	18.36
1989	33.68	38.77	27.76	20.26	23.31	16.72
1990	37.74	43.38	31.01	22.08	25.39	18.15
1991	41.79	48.32	34.07	23.77	27.48	19.38
1992	45.90	53.07	37.40	24.67	28.52	20.10
1993	51.15	59.65	41.18	22.85	26.64	18.41
1994	56.39	65.94	45.16	19.96	23.33	15.99
1995	62.64	73.58	49.84	18.72	21.98	14.89
1996	70.92	83.70	55.90	19.84	23.40	15.63
1997	80.37	95.10	62.88	22.30	26.38	17.44
1998	91.57	109.07	70.66	26.20	31.22	20.22
1999	104.16	124.62	79.50	30.49	36.48	23.27
2000	118.66	142.65	89.62	34.83	41.85	26.31
2001	130.30	156.93	98.52	38.09	45.89	28.80
2002	143.08	173.17	107.76	42.19	51.07	31.78
2003	158.21	192.13	118.80	46.13	56.04	34.63
2004	173.88	211.97	130.03	48.52	59.14	36.28
2005	193.77	236.86	144.42	52.81	64.56	39.36
2006	215.48	264.41	159.12	57.99	71.18	42.82
2007	240.73	294.96	177.96	61.04	74.77	45.11
2008	269.39	328.55	200.66	63.23	77.12	47.09
2009	303.88	371.33	225.01	72.96	89.15	54.03

Table GX-3.4 reports the real average Labor force human capital by region. The real average labor force human capital is much smaller in rural area than in urban area. The number of the real average labor force human

capital for urban is about 2.31 times that for rural in 2009.

Table GX-3.4 Nominal and Real Average Labor Force Human Capital by Region for Guangxi

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	21.34	38.30	18.95	21.34	38.30	18.95
1986	23.87	42.95	20.99	22.47	40.44	19.77
1987	26.68	48.05	23.28	23.51	41.06	20.72
1988	29.95	53.41	26.09	22.07	37.02	19.61
1989	33.68	59.50	29.15	20.26	34.45	17.77
1990	37.74	66.43	32.59	22.08	39.13	19.03
1991	41.79	73.49	35.87	23.77	42.15	20.33
1992	45.90	81.20	39.39	24.67	43.52	21.19
1993	51.15	90.61	43.43	22.85	39.38	19.61
1994	56.39	99.94	47.62	19.96	34.64	17.00
1995	62.64	110.48	52.34	18.72	32.45	15.76
1996	70.92	124.08	58.06	19.84	34.55	16.27
1997	80.37	140.28	64.29	22.30	38.79	17.88
1998	91.57	158.54	70.92	26.20	45.15	20.37
1999	104.16	178.23	77.83	30.49	52.22	22.77
2000	118.66	200.64	86.25	34.83	58.78	25.36
2001	130.30	218.98	94.24	38.09	63.33	27.82
2002	143.08	238.99	102.52	42.19	69.89	30.47
2003	158.21	263.21	111.67	46.13	76.28	32.77
2004	173.88	288.17	120.33	48.52	80.23	33.66
2005	193.77	319.78	130.16	52.81	86.43	35.84
2006	215.48	351.07	146.55	57.99	93.40	39.99
2007	240.73	385.09	164.19	61.04	97.02	41.95
2008	269.39	422.64	183.86	63.23	98.95	43.30
2009	303.88	478.16	205.35	72.96	114.33	49.58

4. Relative trend in human capital

Figure GX-4.1 illustrates the ratio of labor force human capital to human capital based on five-education categories[106], and the ratio of total population in labor force to total non-retired population. After 2000, the two ratios show different trends. One potential explanation is that the student population, especially tertiary education students, increases a lot.

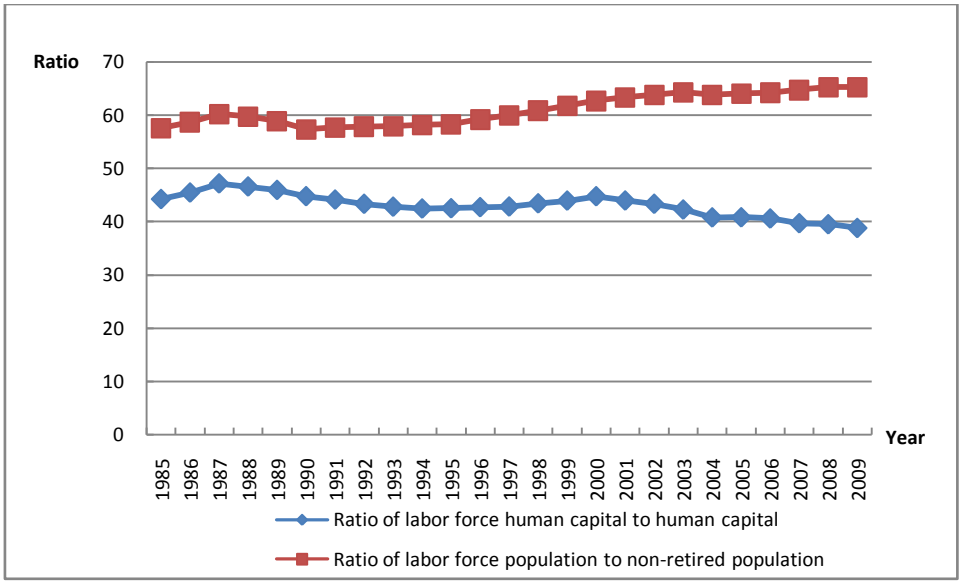


Figure GX-4.1 Ratio of Labor Force Human Capital to Human Capital and Ratio of Labor Force Population to Non-retired Population for Guangxi

Figure GX-4.2 reports the ratio of human capital to fixed assets for Guangxi. We can see that human capital is always larger than fixed assets. From 1985 to 2009, it shows an obvious downward trend.

[106] Unless otherwise stated, all human capitals refer to nominal ones and based on five-education categories.

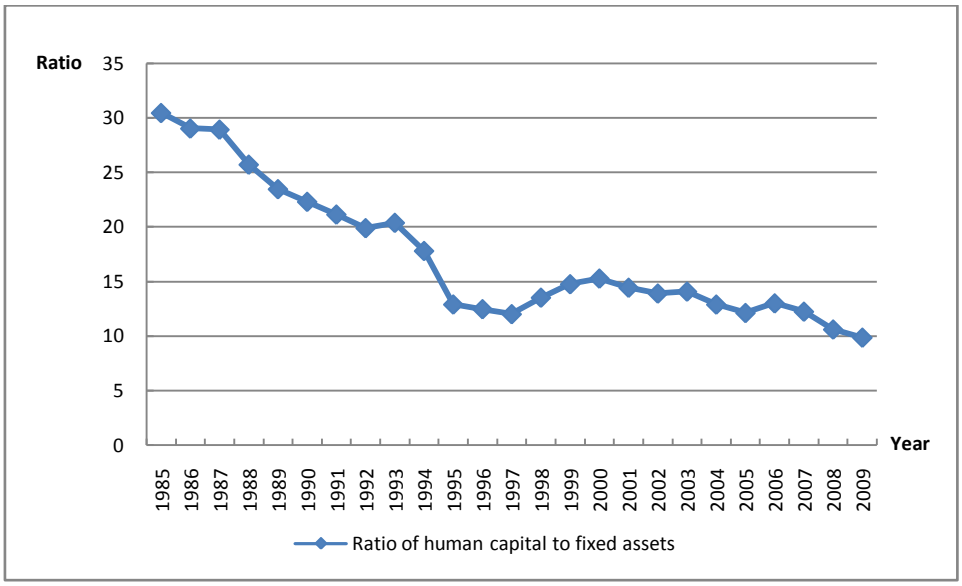


Figure GX-4.2 Ratio of Human Capital to Fixed Assets for Guangxi

Figure GX-4.3 reports the ratio of human capital to GDP and ratio of labor force human capital to GDP for Guangxi. The two ratios are similar. Both experience downward trend from 1985 to 1995 and then see a hump from 1996 to 2008.

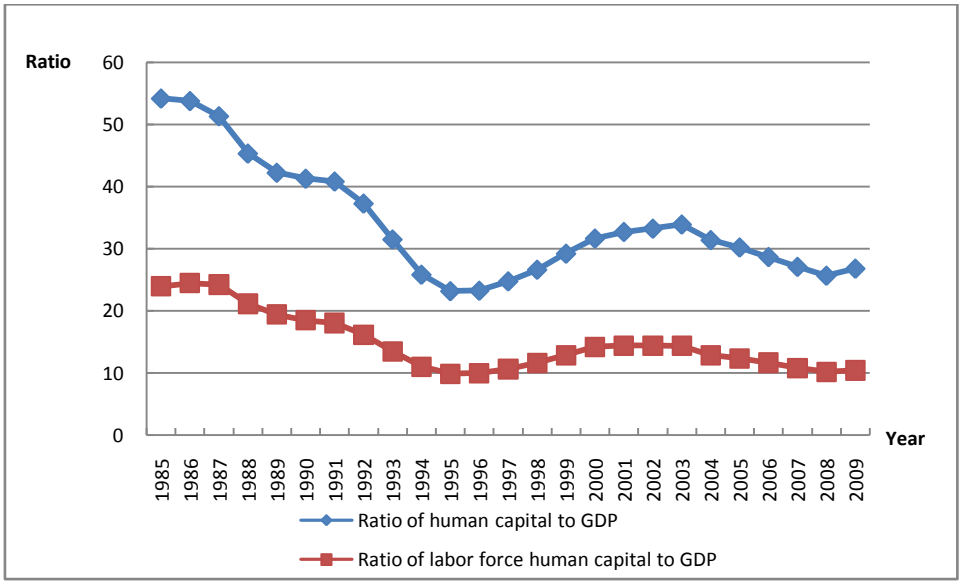


Figure GX-4.3 Ratio of Human Capital to GDP and Ratio of Labor Force Human Capital to GDP for Guangxi

Figure GX-4.4 reports the ratio of fixed assets to GDP for Guangxi. The ratio itself reveals the rate of output of fixed assets. Generally speaking, the ratio exhibits an upward trend while there are some fluctuations in the period of 1992 to 1995 and 2005 to 2009.

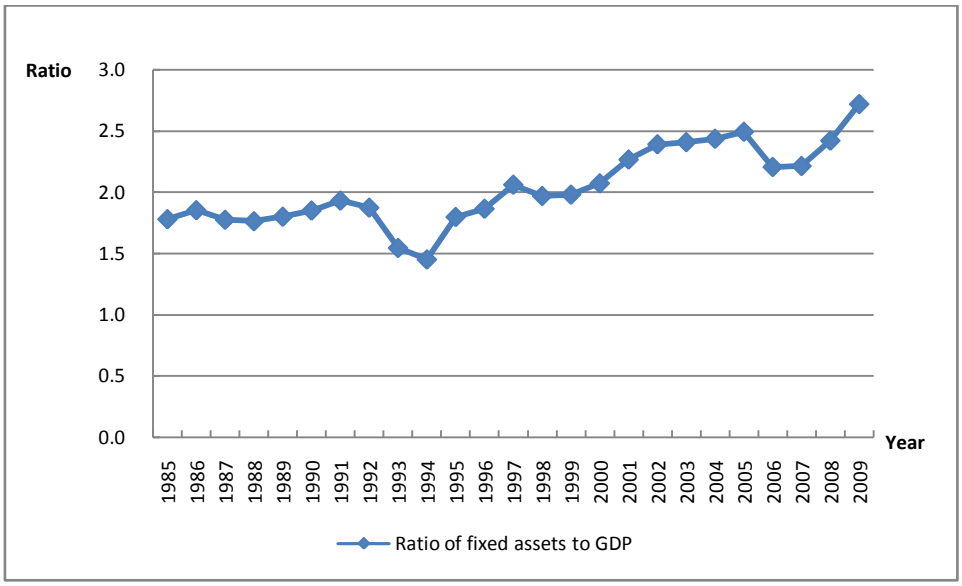


Figure GX-4.4 Ratio of Fixed Assets to GDP for Guangxi

5. Conclusion

1. The nominal and real human capital for Guangxi in 2009 are 20.792 trillion Yuan and 4.985 trillion Yuan separately. Real urban and rural human capitals are 3.459 trillion Yuan and 1.526 trillion Yuan, accounting for 69.39% and 30.61% of the total human capital respectively. Male and Female human capital in real values are 3.187 trillion Yuan and 1.798 trillion Yuan, accounting for 63.93% and 36.07%.

2. The nominal and real human capital per capita for Guangxi increase from 27,810 Yuan to 510,470 Yuan and 27,810 Yuan to 122,390 Yuan

respectively from 1985 to 2009. In 2009, the real human capital per capita is 211,440 Yuan for urban, 62,630 Yuan for rural, 145,570 Yuan for male and 95,460 Yuan for female.

3. The average annual growth rate of real human capital is 5.61% for urban and 4.20%for rural. The real human capital per capita for urban area is larger than that for rural area. After 1996, their average annual growth rates become even larger and reach 10.92% for urban area and 9.04% for rural area respectively.

4. In 2009, the nominal and real labor force human capital for Guangxi reach 8.074 trillion Yuan and 1.939 trillion Yuan. And the real labor force human capital is 1.097 trillion Yuan for urban area and 0.842 trillion Yuan for rural area, accounting for 56.27% and 43.73% of the total labor force human capital.

5. Due to the urbanization, the rural population of Guangxi is decreasing, so both the real total human capital and the real human capital per capita for rural area show smaller growth rates than those for urban area.

Chapter 23 Human Capital for Shaanxi

1. Total human capital

Human capital stocks of Shaanxi are calculated based on estimated income parameters and a 4.58% discount rate. The results are reported in Table SAX-1.1. Column 1 and 2 contain the nominal human capital; column 3 and 4 contain the real human capital deflated by CPI (in 1985 Yuan).[107]

Table SAX-1.1 Nominal and Real Human Capital for Shaanxi

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	674		674	
1986	763		720	
1987	867		759	
1988	985		726	
1989	1,121		694	
1990	1,305		782	
1991	1,497		851	
1992	1,718		902	
1993	1,981		910	
1994	2,268		821	
1995	2,557		778	
1996	2,948		813	
1997	3,376		887	
1998	3,920		1,044	
1999	4,450		1,212	

[107] Because the provincial human capital is the sum of rural and urban human capital, we use the CPI for rural and urban separately in the estimation.

Year	Nominal Human Capital (Billions of Yuan)		Real Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
2000	5,417	5,446	1,473	1,480
2001	6,064	6,102	1,627	1,638
2002	6,900	6,943	1,869	1,879
2003	7,764	7,814	2,067	2,080
2004	8,675	8,740	2,240	2,256
2005	9,654	9,739	2,464	2,485
2006	10,909	11,015	2,739	2,764
2007	12,796	12,937	3,052	3,085
2008	14,836	15,018	3,326	3,365
2009	17,264	17,485	3,852	3,900

Figure SAX-1.1 graphs real and nominal human capital for Shaanxi. As shown, both the nominal and real human capital rise steadily but the former grows faster than the latter.

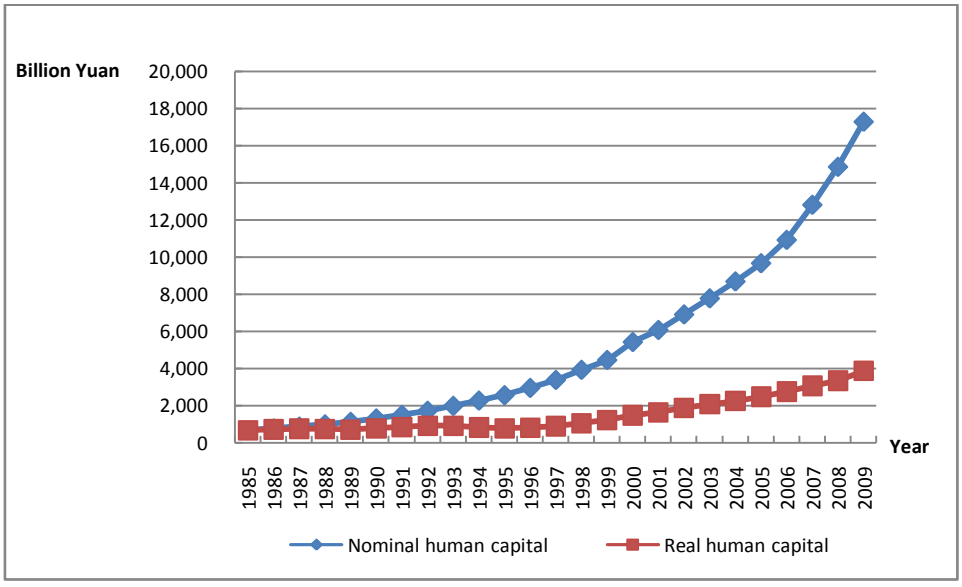


Figure SAX-1.1 Nominal and Real Human Capital for Shaanxi

Table SAX-1.2 reports the real human capital for Shaanxi by gender and region. Overall, the results based on five-education categories show that human capital for Shaanxi during the years 1997-2009 keeps growing rapidly. More specifically, total real human capital for Shaanxi increases from 0.674 trillion Yuan to 3.852 trillion Yuan, and the average annual growth rate is about 7.27%. However, the total real human capital for male is apparently much larger than that of female. It increases from 0.420 trillion Yuan to 2.437 trillion Yuan for male, and from 0.253 trillion Yuan to 1.415 trillion Yuan for female. At the same time, the real human capital for urban and rural also increase a lot, from 0.307 trillion Yuan to 2.984 trillion Yuan for urban area and from 0.367 trillion Yuan to 0.868 trillion Yuan for rural area. The average annual growth rate is 9.48% and 3.59% for urban and rural area respectively. In 2009, the total real human capital for urban is almost 3.4 times the amount of that for rural in Shaanxi.

Table SAX-1.2 Real Human Capital by Gender and Region for Shaanxi[108]

Billions of 1985 Yuan

Year	Total	Male	Female	Urban	Rural
1985	674	420	253	307	367
1986	720	449	270	328	392
1987	759	474	285	342	417
1988	726	455	271	327	399
1989	694	435	259	319	375
1990	782	491	291	366	416
1991	851	535	316	401	450
1992	902	567	335	425	477
1993	910	574	336	444	466
1994	821	518	303	407	415

[108] Some discrepancy may exist when summing up male and female, or urban and rural to get the total amount. This is mainly caused by rounding errors.

Year	Total	Male	Female	Urban	Rural
1995	778	491	287	394	383
1996	813	514	299	432	381
1997	887	563	324	486	402
1998	1,044	662	382	603	441
1999	1,212	768	444	713	500
2000	1,473	926	547	912	561
2001	1,627	1,027	601	1,046	581
2002	1,869	1,181	688	1,246	623
2003	2,067	1,308	759	1,419	648
2004	2,240	1,411	829	1,562	678
2005	2,464	1,545	919	1,742	722
2006	2,739	1,721	1,018	1,959	780
2007	3,052	1,916	1,135	2,248	804
2008	3,326	2,092	1,233	2,513	813
2009	3,852	2,437	1,415	2,984	868

In Figure SAX-1.2, the real human capital of male and female for Shaanxi exhibits a rising trend from 1985 to 2009. Starting from 1996, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

The pattern that the human capital of male is higher than that of female is consistent with that at the national level. One reason behind this pattern is that male has a higher retirement age than female, and thus ends up with a higher lifetime income relative to female.[109] In addition, the income gap between male and female keeps expanding, which directly results in widening gap of the human capital between them.

[109] To ensure the consistency of urban and rural, we define the working age of male and female in rural area as 60 and 55.

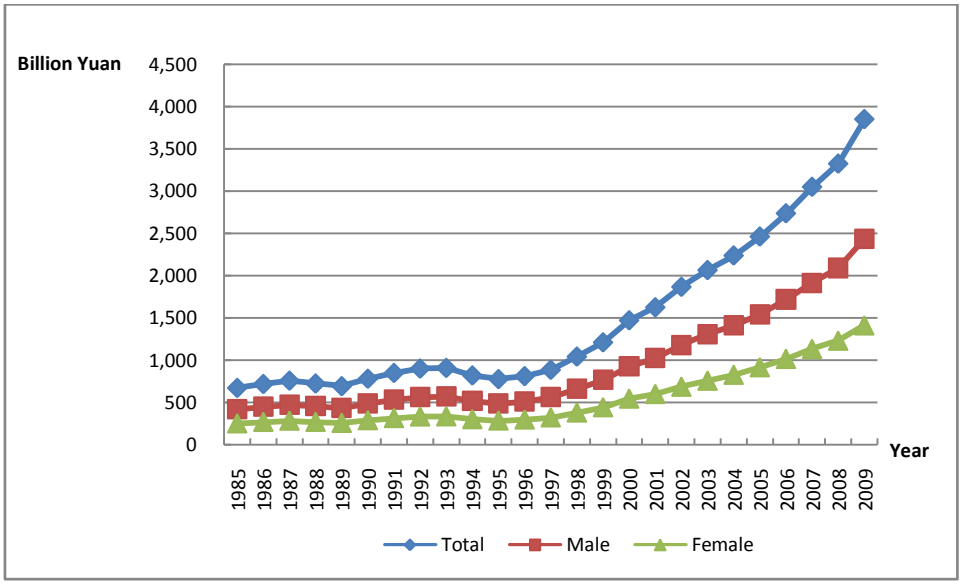


Figure SAX-1.2 Real Human Capital by Gender for Shaanxi

Figure SAX-1.3 shows the real human capital for urban and rural separately. The urban human capital remains larger than that for rural from 1995 to 2009. Before 1996, the growth rate for urban and rural does not show much difference. Starting from 1996, however, the urban human capital is rising much more rapidly than the rural human capital, leading to an increasingly larger gap between rural and urban.

The gap between rural and urban can be partially explained by the rapid urbanization during the course of economic transition and a large scale migration of rural population to urban areas. Another possible contributing factor can be the education gap between the rural and urban population.

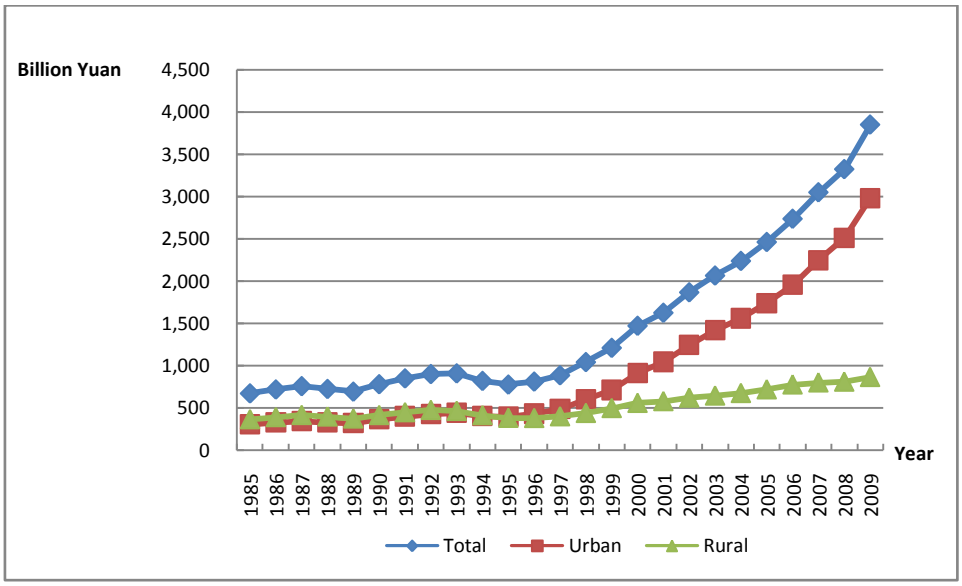


Figure SAX-1.3 Real Human Capital by Region for Shaanxi

Human capital index can reflect the trend of human capital directly. Table SAX-1.3 reports a set of indices of real human capital classified by gender and region for Shaanxi from 1985 to 2009. We calculate them using year 1985 as the base year.

Table SAX-1.3 Real Human Capital Index for Shaanxi (1985=100)

Year	Total	Male	Female	Urban	Rural
1985	100	100	100	100	100
1986	106.87	106.85	106.88	106.91	106.84
1987	112.71	112.75	112.69	111.54	113.69
1988	107.78	108.25	107.00	106.59	108.78
1989	103.03	103.52	102.25	103.85	102.34
1990	116.12	116.86	114.94	119.30	113.47
1991	126.33	127.24	124.90	130.65	122.71
1992	133.96	134.94	132.33	138.64	130.04
1993	135.10	136.44	132.92	144.83	126.96
1994	121.93	123.31	119.68	132.61	113.00

1995	115.46	116.84	113.24	128.59	104.47
1996	120.70	122.26	118.10	140.69	103.98
1997	131.76	134.02	128.06	158.33	109.54
1998	155.00	157.54	150.79	196.48	120.31
1999	179.97	182.64	175.61	232.34	136.18
2000	218.71	220.36	216.05	297.49	152.84
2001	241.62	244.22	237.55	341.05	158.48
2002	277.46	280.92	271.78	406.26	169.77
2003	306.89	311.16	299.96	462.67	176.64
2004	332.59	335.54	327.83	509.29	184.84
2005	365.82	367.48	363.08	567.98	196.78
2006	406.64	409.37	402.37	638.73	212.57
2007	453.10	455.71	448.77	732.96	219.08
2008	493.81	497.67	487.51	819.37	221.59
2009	571.98	579.76	559.29	972.94	236.72

Figure SAX-1.4 shows the index of real human capital. It is obvious that the human capital has been rising much more rapidly since 1996.

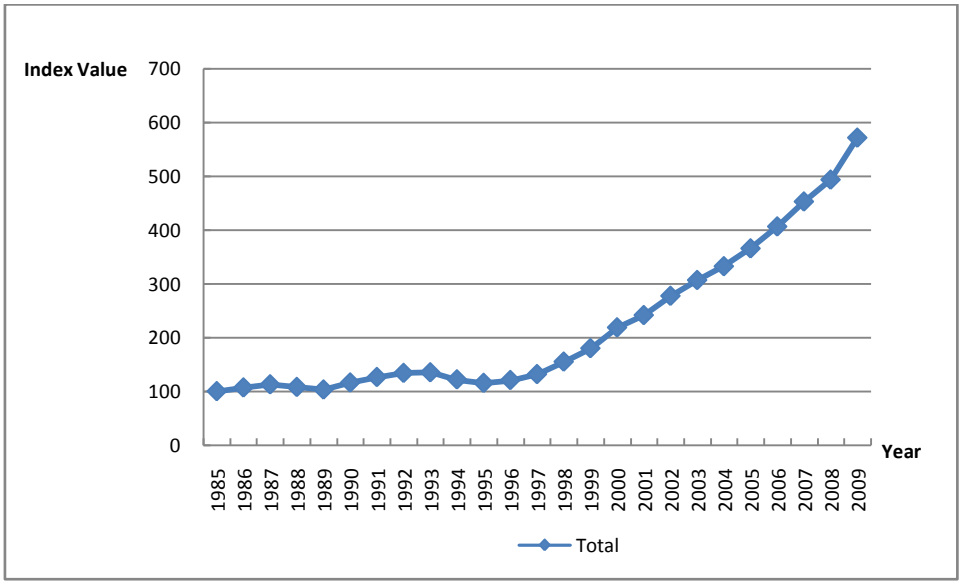


Figure SAX-1.4 Human Capital Index for Shaanxi

2. Human capital per capita

The increase in human capital can be caused by changes in demographic structure, education, migration and urbanization etc. In order to get further information on the dynamics of human capital, we calculate human capital per capita, defined as the ratio of human capital to non-retired population. Although the human capital per capita is influenced by the age distribution of the population, it can exclude the influence of population factor to a large extent. Thus it can serve as a better indicator of the average human capital.

Table SAX-2.1 presents the trend of human capital per capita for Shaanxi by gender in both nominal and real terms. Human capital per capita of male remains larger than that of female. Real human capital per capita for male increases 4.1 times from 29,079 Yuan to 149,219 Yuan. For female, it increases almost 4 times from 19,447 Yuan to 96,646 Yuan. From 1985 to 2009, the average annual growth rate is 6.81% for male, and 6.68% for female.

Table SAX-2.1 Nominal and Real Human Capital Per Capita by Gender for Shaanxi

Year	Nominal Human Capital Per Capita (Thousands of Yuan)			Real Human Capital Per Capita (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	24.52	29.08	19.45	24.52	29.08	19.45
1986	27.46	32.60	21.75	25.92	30.76	20.54
1987	30.78	36.58	24.35	26.96	32.01	21.36
1988	34.43	40.99	27.12	25.37	30.17	20.01
1989	38.51	45.76	30.39	23.84	28.31	18.83
1990	43.19	51.31	34.07	25.88	30.73	20.43
1991	48.85	58.08	38.47	27.77	32.98	21.91
1992	55.47	65.92	43.68	29.13	34.54	23.00
1993	63.51	75.49	49.94	29.17	34.62	23.00
1994	72.14	85.92	56.55	26.12	31.05	20.54

1995	80.87	96.36	63.37	24.59	29.25	19.32
1996	92.91	110.97	72.54	25.62	30.54	20.05
1997	106.00	126.96	82.25	27.86	33.31	21.69
1998	122.73	146.83	95.44	32.68	39.05	25.47
1999	139.21	166.08	108.73	37.92	45.20	29.66
2000	160.54	191.42	126.03	43.65	52.03	34.29
2001	187.25	222.81	147.07	50.25	59.78	39.52
2002	213.83	255.68	166.83	57.91	69.22	45.21
2003	241.82	290.39	187.67	64.38	77.30	49.98
2004	272.52	326.61	212.56	70.37	84.33	54.91
2005	306.53	367.06	239.97	78.23	93.67	61.23
2006	353.29	423.98	275.60	88.69	106.44	69.21
2007	413.07	494.17	323.45	98.51	117.81	77.15
2008	478.85	573.82	374.12	107.34	128.57	83.85
2009	557.36	668.98	433.10	124.37	149.22	96.65

Figure SAX-2.1 shows that the real human capital per capita of male is larger than that of female for Shaanxi from 1985 to 2009. Starting from 1997, both the growth of human capital of male and female accelerate, and the gender gap appears to be expanding.

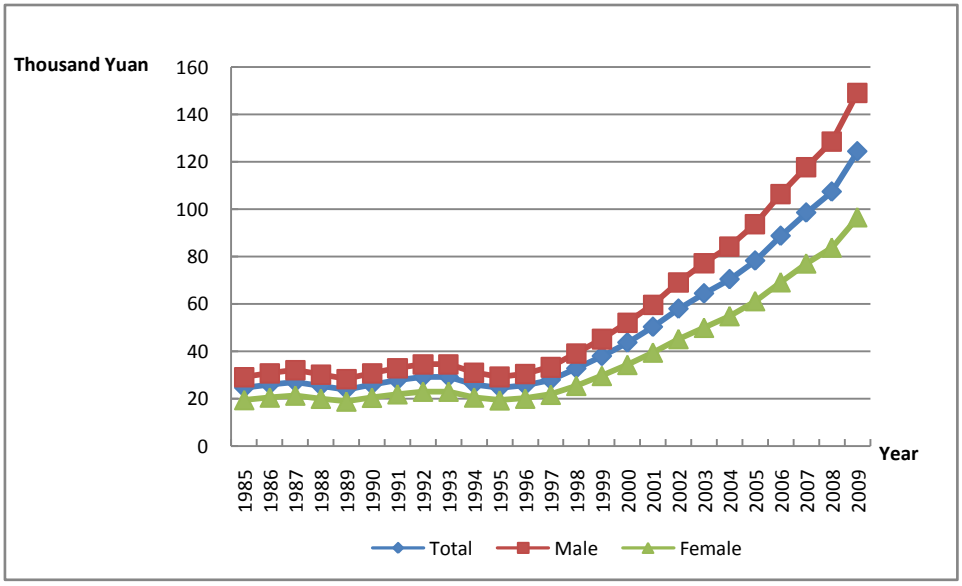


Figure SAX-2.1 Human Capital Per Capita by Gender for Shaanxi

Table SAX-2.2 reports the results of human capital per capita by region for Shaanxi in both nominal and real terms. From 1986 to 2009, the human capital per capita in urban area is significantly larger than that for rural. The real human capital per capita for urban increases from 54,884 Yuan to 221,470 Yuan, the per capita rural human capital increases from 16,763 Yuan to 49,611 Yuan. The human capital per capita in urban area grows much faster than the one for rural.

Table SAX-2.2 Nominal and Real Human Capital Per Capita by Region for Shaanxi

Year	Nominal Human Capital Per Capita (Thousands of Yuan)			Real Human Capital Per Capita (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	24.52	54.88	16.76	24.52	54.88	16.76
1986	27.46	61.21	18.72	25.92	57.42	17.76
1987	30.78	68.16	20.99	26.96	58.55	18.69
1988	34.43	75.83	23.38	25.37	54.24	17.67
1989	38.51	84.44	26.08	23.84	51.36	16.39
1990	43.19	94.31	29.06	25.88	55.91	17.58
1991	48.85	106.96	32.33	27.77	59.10	18.87
1992	55.47	122.16	35.98	29.13	60.70	19.90
1993	63.51	141.22	40.13	29.17	61.55	19.42
1994	72.14	161.03	44.65	26.12	54.74	17.26
1995	80.87	180.00	49.49	24.59	51.86	15.96
1996	92.91	199.43	55.29	25.62	52.09	16.27
1997	106.00	220.53	61.80	27.86	54.76	17.48
1998	122.73	251.22	68.84	32.68	63.84	19.61
1999	139.21	284.53	77.06	37.92	74.39	22.31
2000	160.54	299.58	86.91	43.65	78.09	25.42
2001	187.25	369.76	95.09	50.25	96.29	27.02
2002	213.83	419.40	104.47	57.91	111.22	29.56

2003	241.82	471.02	114.74	64.38	123.91	31.37
2004	272.52	527.38	126.47	70.37	134.70	33.51
2005	306.53	586.98	140.27	78.23	148.59	36.50
2006	353.29	671.80	157.36	88.69	166.56	40.79
2007	413.07	768.00	175.57	98.51	181.00	43.30
2008	478.85	872.73	195.27	107.34	193.67	45.13
2009	557.36	997.88	218.46	124.37	221.47	49.61

Figure SAX-2.2 reflects the trend of real human capital per capita by region. As is shown, the gap between urban and rural expands rapidly after 1997. This is partly due to the long-term stagnant status in the rural area before 1997. Based on five education categories, the ratio of urban to rural increases from 3.27 in 1985 to 4.46 in 2009, which indicates an increasing urban-rural gap. From 1985 to 2009, the annual growth rate is 6.77% for the urban area, and 5.81% for the rural area.

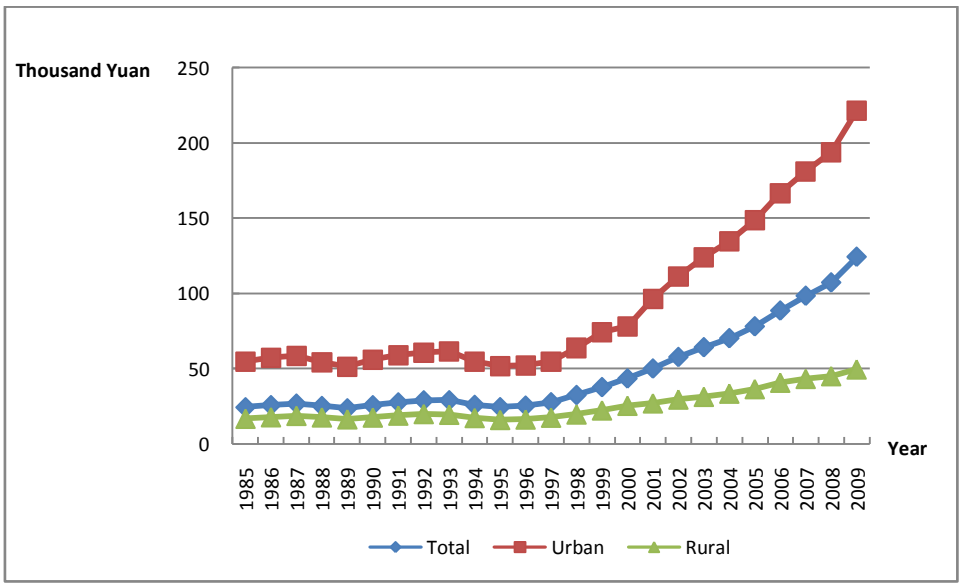


Figure SAX-2.2 Real Human Capital Per Capita by Region for Shaanxi

Figure SAX-2.3 shows the human capital per capita index for Shaanxi.

It's obvious that the human capital per capita has been rising much more rapidly since 1997.

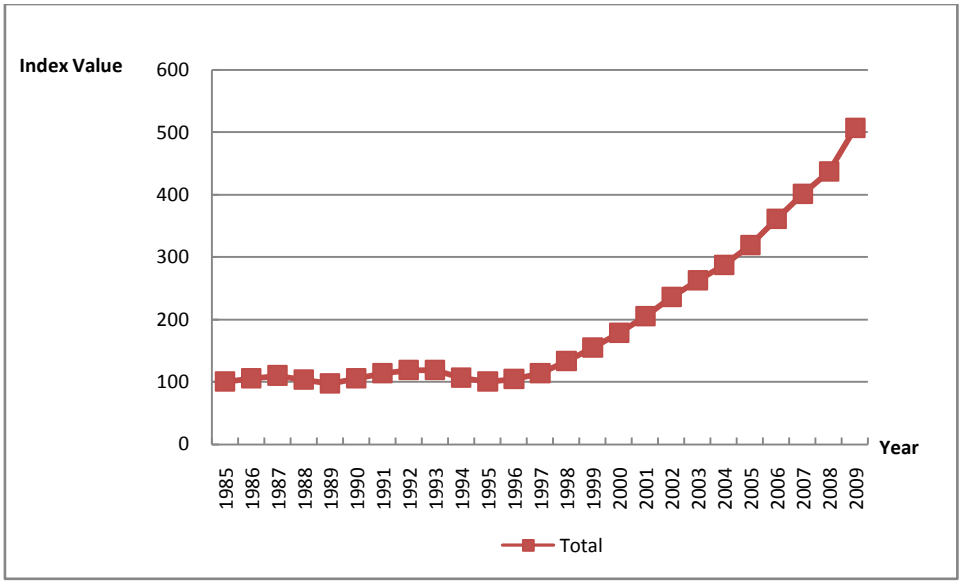


Figure SAX-2.3 Real Human Capital Per Capita Index for Shaanxi

3. Labor force human capital

3.1 Total labor force human capital

The labor force human capital represents the human capital of population that are over 15 years old, non-retired and out of school. The estimation method is the same as before. The labor force human capital for Shaanxi is reported in Table SAX-3.1. The real values in this table are calculated by using CPI as the deflator.

Table SAX-3.1 Nominal and Real Labor Force Human Capital and GDP for Shaanxi

Year	Nominal Labor Force Human Capital (Billions of Yuan)		Real Labor Force Human Capital (Billions of 1985 Yuan)	
	Five-education Category (1)	Six-education Category (2)	Five-education Category (3)	Six-education Category (4)
1985	308		308	
1986	351		331	
1987	401		352	
1988	474		350	
1989	552		342	
1990	653		391	
1991	735		419	
1992	819		433	
1993	918		425	
1994	1,023		374	
1995	1,139		349	
1996	1,288		358	
1997	1,464		388	
1998	1,682		451	
1999	1,888		518	
2000	2,271	2,230	621	611
2001	2,542	2,503	686	676
2002	2,734	2,703	745	737
2003	3,001	2,985	802	798
2004	3,246	3,243	842	841
2005	3,643	3,639	933	932
2006	3,985	3,981	1,007	1,006
2007	4,607	4,603	1,106	1,105
2008	5,213	5,209	1,176	1,175
2009	6,196	6,191	1,387	1,386

The trends of labor force human capital in both real and nominal terms for Shaanxi are presented in Figure SAX-3.1. From 1985 to 2009, the nominal labor force human capital keeps rising rapidly, while the real labor force human capital increases slowly.

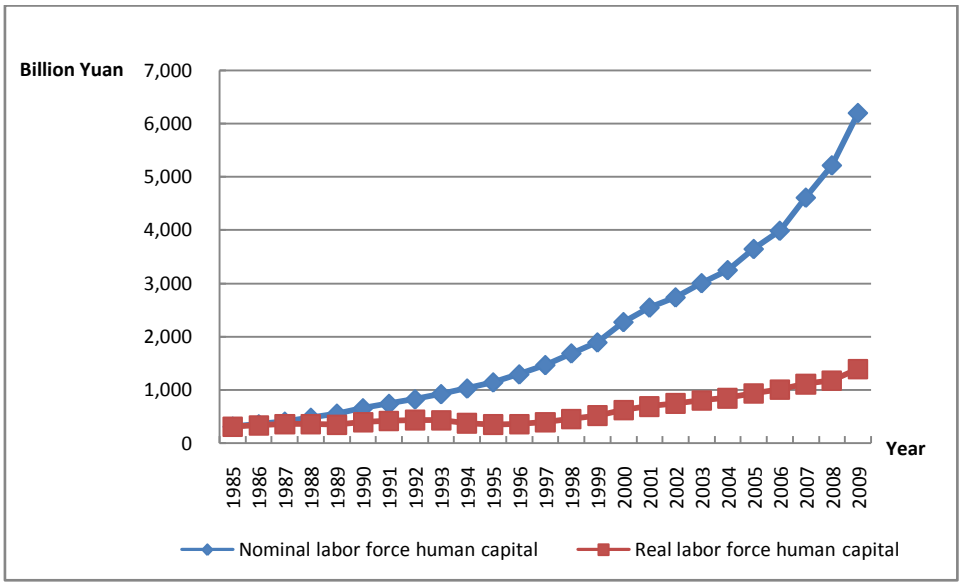


Figure SAX-3.1 Nominal and Real Labor Force Human Capital for Shaanxi

Table SAX-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the same as that for human capital. The urban human capital is smaller than that for rural form 1985 to 1997. But after 1997, the situation is reversed that the urban human capital is larger than that for rural from 1998 to 2009.

Table SAX-3.2 Nominal and Real Labor Force Human Capital by Region for Shaanxi

Year	Nominal Labor Force Human Capital (Billions of Yuan)			Real Labor Force Human Capital (Billions of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	308	121	187	308	121	187
1986	351	140	211	331	132	200
1987	401	165	237	352	141	211
1988	474	202	272	350	144	206
1989	552	242	310	342	147	195
1990	653	294	358	391	174	217
1991	735	331	405	419	183	236
1992	819	368	452	433	183	250
1993	918	413	505	425	180	244
1994	1,023	464	559	374	158	216
1995	1,139	522	616	349	151	199
1996	1,288	629	659	358	164	194
1997	1,464	755	709	388	187	201
1998	1,682	912	770	451	232	219
1999	1,888	1,042	846	518	272	245
2000	2,271	1,349	922	621	352	270
2001	2,542	1,529	1,013	686	398	288
2002	2,734	1,613	1,121	745	428	317
2003	3,001	1,747	1,254	802	460	343
2004	3,246	1,875	1,371	842	479	363
2005	3,643	2,139	1,504	933	542	391
2006	3,985	2,305	1,680	1,007	572	435
2007	4,607	2,717	1,890	1,106	640	466
2008	5,213	3,112	2,101	1,176	691	486
2009	6,196	3,870	2,326	1,387	859	528

Figure SAX-3.2 shows the real labor force human capital for urban and rural separately. The pattern of the labor force human capital is almost the

same as that for human capital. The rural labor force human capital grows quite slowly and much less than the one for urban.

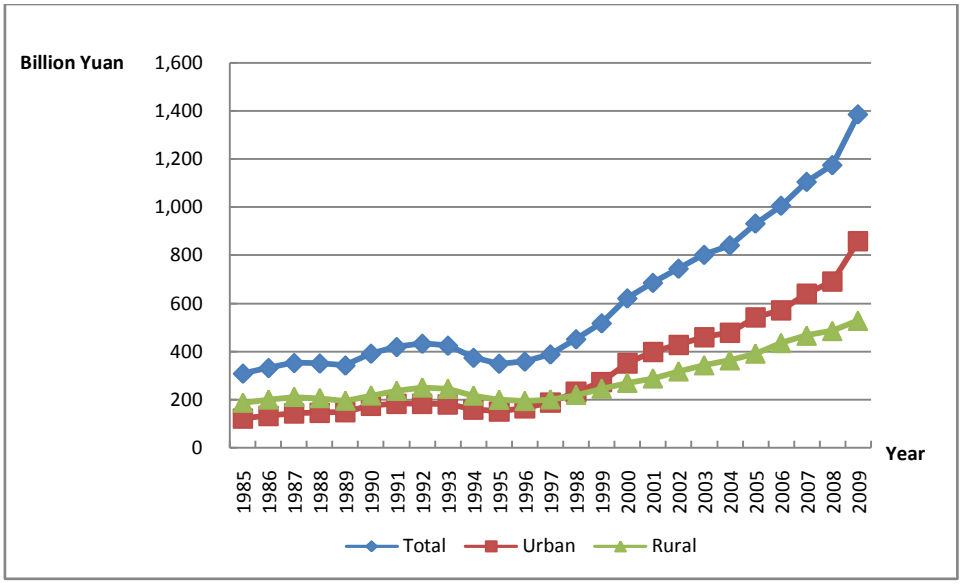


Figure SAX-3.2 Real Labor Force Human Capital by Region for Shaanxi

3.2 Average labor force human capital

Similar to the analysis of human capital per capita above, we calculate the average labor force human capital. The average labor force human capital means the ratio of the labor force human capital divided by the population that are over 15 years old, non-retired and out of school.

Table SAX-3.3 reports the nominal and real average labor force human capital by gender. The real average labor force human capital for female is smaller than that for male. More specifically, the real one for male is about 1.67 times that for female in 2009.

Table SAX-3.3 Nominal and Real Average Labor Force Human Capital by Gender for Shaanxi

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Male	Female	Total	Male	Female
1985	18.63	22.18	14.71	18.63	22.18	14.71
1986	20.88	24.94	16.41	19.72	23.55	15.50
1987	23.57	28.29	18.38	20.68	24.82	16.15
1988	26.81	32.24	20.80	19.80	23.78	15.39
1989	30.27	36.41	23.42	18.75	22.53	14.53
1990	34.19	41.12	26.36	20.50	24.64	15.81
1991	37.97	45.72	29.24	21.63	26.01	16.70
1992	42.07	50.67	32.37	22.21	26.69	17.16
1993	46.83	56.42	35.99	21.65	26.04	16.70
1994	51.94	62.62	39.88	18.98	22.84	14.63
1995	57.60	69.46	44.25	17.67	21.27	13.61
1996	65.26	79.02	49.74	18.15	21.94	13.88
1997	74.08	90.10	56.03	19.64	23.83	14.90
1998	84.31	103.01	63.23	22.61	27.58	17.01
1999	93.89	114.81	70.22	25.73	31.42	19.29
2000	104.76	127.41	79.80	28.66	34.85	21.85
2001	122.62	150.43	91.21	33.09	40.56	24.67
2002	132.41	162.81	98.62	36.07	44.31	26.91
2003	144.26	178.09	107.14	38.57	47.58	28.68
2004	156.17	192.94	116.36	40.52	50.03	30.21
2005	173.57	214.24	130.05	44.45	54.84	33.32
2006	194.74	240.83	145.06	49.21	60.83	36.69
2007	223.65	276.33	166.29	53.71	66.33	39.98
2008	253.63	313.49	187.81	57.22	70.70	42.42
2009	299.46	370.24	221.17	67.05	82.86	49.55

Table SAX-3.4 reports the nominal and real average Labor force human capital by region. The average labor force human capital is much smaller in rural area than in urban area, for both nominal and real terms. The

real values for urban is about 1.74 times that for rural in 2009.

Table SAX-3.4 Nominal and Real Average Labor Force Human Capital by Region for Shaanxi

Year	Nominal Average Labor Force Human Capital (Thousands of Yuan)			Real Average Labor Force Human Capital (Thousands of 1985 Yuan)		
	Total	Urban	Rural	Total	Urban	Rural
1985	18.63	36.86	14.10	18.63	36.86	14.10
1986	20.88	40.99	15.74	19.72	38.45	14.93
1987	23.57	45.90	17.61	20.68	39.43	15.68
1988	26.81	52.34	19.69	19.80	37.44	14.88
1989	30.27	58.89	21.96	18.75	35.82	13.80
1990	34.19	66.22	24.47	20.50	39.26	14.81
1991	37.97	73.42	27.24	21.63	40.56	15.89
1992	42.07	81.31	30.21	22.21	40.40	16.71
1993	46.83	90.88	33.52	21.65	39.61	16.23
1994	51.94	101.12	37.00	18.98	34.38	14.31
1995	57.60	112.48	40.75	17.67	32.40	13.14
1996	65.26	124.90	44.83	18.15	32.62	13.19
1997	74.08	139.65	49.39	19.64	34.67	13.97
1998	84.31	155.93	54.59	22.61	39.63	15.55
1999	93.89	171.91	60.23	25.73	44.95	17.44
2000	104.76	170.19	67.05	28.66	44.36	19.61
2001	122.62	218.40	73.76	33.09	56.87	20.96
2002	132.41	235.79	81.17	36.07	62.53	22.97
2003	144.26	256.09	89.67	38.57	67.37	24.52
2004	156.17	274.35	98.29	40.52	70.07	26.04
2005	173.57	301.56	108.23	44.45	76.34	28.16
2006	194.74	337.32	123.25	49.21	83.63	31.95
2007	223.65	382.33	140.05	53.71	90.11	34.54
2008	253.63	430.36	157.67	57.22	95.50	36.44
2009	299.46	509.63	177.61	67.05	113.11	40.33

4. Relative trend in human capital

Figure SAX-4.1 illustrates the ratio of labor force human capital to human capital based on five-education categories[110], and the ratio of total population in labor force to total non-retired population. After 1990, the two ratios show different trends. One potential explanation is that the student population, especially tertiary education students, increases a lot.

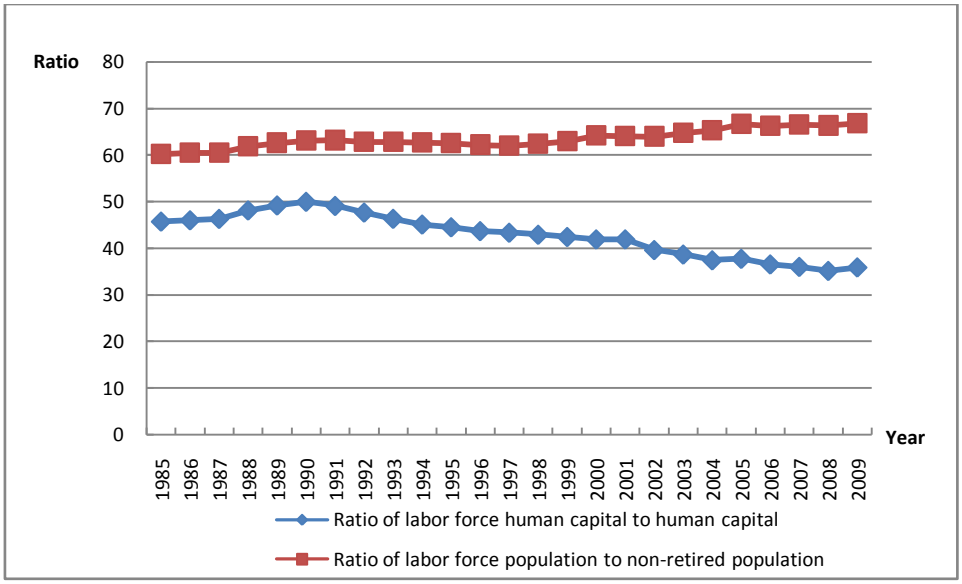


Figure SAX-4.1 Ratio of Labor Force Human Capital to Human Capital and Ratio of Labor Force Population to Non-retired Population for Shaanxi

Figure SAX-4.2 reports the ratio of human capital to fixed assets for Shaanxi. We can see that human capital is always larger than fixed assets. From 1985 to 1995, it shows an obvious downward trend, and the ratio remains relatively stable through 1995 to 2002. Through 2002 to 2007, it slightly declines. But after 2007, the trend is increasing.

[110] Unless otherwise stated, all human capital terms refer to nominal ones and are based on five-education categories.

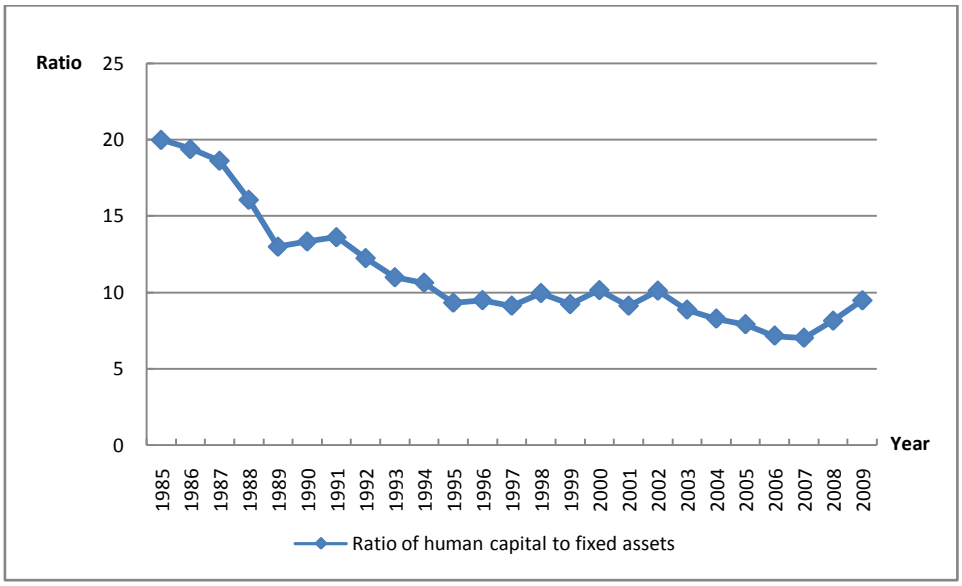


Figure SAX-4.2 Ratio of Human Capital to Fixed Assets for Shaanxi

Figure SAX-4.3 reports the ratio of human capital to GDP and ratio of labor force human capital to GDP for Shaanxi. The two ratios are similar. Both experiences the same fluctuations before 2008 and show a slight upward trend after 2008.

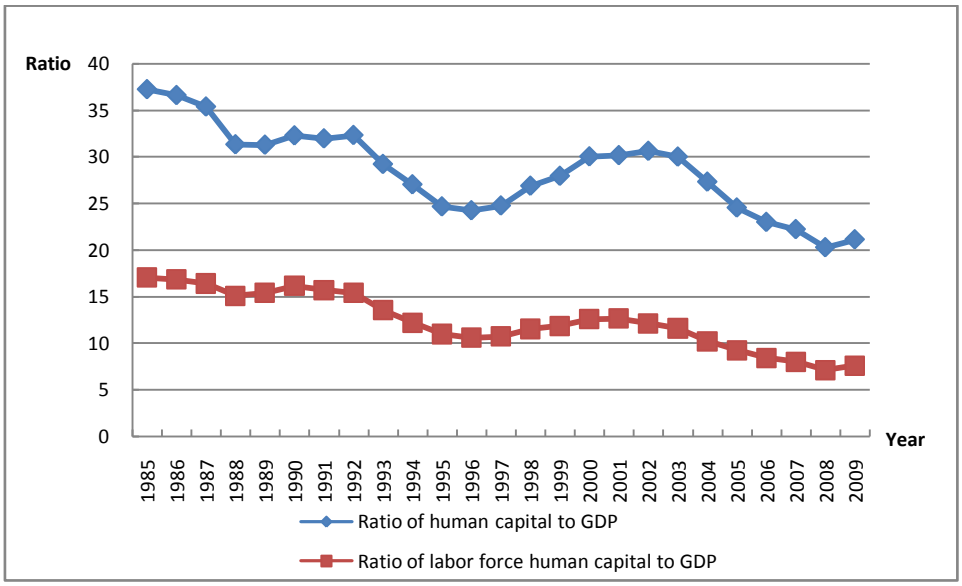


Figure SAX-4.3 Ratio of Human Capital to GDP and Ratio of Labor Force Human Capital to GDP for Shaanxi

Figure SAX-4.4 reports the ratio of fixed assets to GDP for Shaanxi. The ratio itself reveals the rate of output of fixed assets. Before 2003, there is a general upward trend. But it starts to decline after 2003.

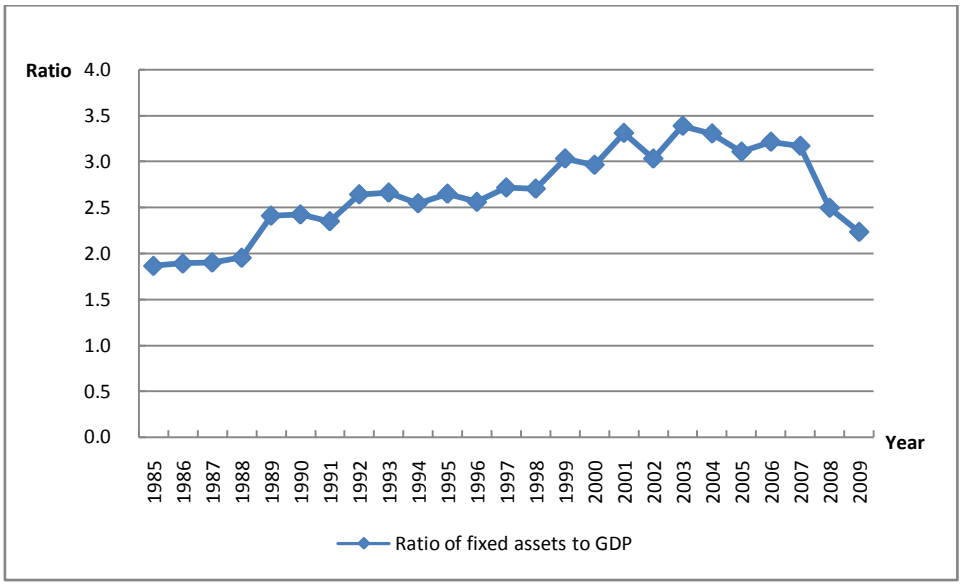


Figure SAX-4.4 Ratio of Fixed Assets to GDP for Shaanxi

5. Conclusion

1. The nominal and real human capital for Shaanxi in 2009 is 17.264 trillion Yuan and 3.852 trillion Yuan. Urban and rural human capital in real values are 2.984 trillion Yuan and 0.868 trillion Yuan, accounting for 77.47% and 22.53% of the total human capital respectively. Male and Female human capital in real values are 2.437 trillion Yuan and 1.415 trillion Yuan, accounting for 63.27% and 36.73%.

2. The nominal and real human capital per capita for Shaanxi increase from 24,520 Yuan to 557,360 Yuan and 24,520 Yuan to 124,370 Yuan respectively from 1985 to 2009. In 2009, the real human capital per capita is 221,470 Yuan for urban, 49,611 Yuan for rural, 149,219 Yuan for male and

96,646 Yuan for female.

3. The average annual growth rate of real human capital is 9.48% for urban and 3.59% for rural. The real human capital per capita for urban area is larger than that for rural area. After 1997, their average annual growth rates become even larger and reach 14.88% for urban and 6.33% for rural respectively.

4. In 2009, the nominal and real labor force human capital for Shaanxi reach 6.196 trillion Yuan and 1.387 trillion Yuan. And the real labor force human capital is 0.859 trillion Yuan for urban and 0.528 trillion Yuan for rural, accounting for 61.93% and 38.07% of the total labor force human capital.

5. The percentage of labor force population in total population remains stable for Shaanxi from 1985 to 2009, while the percentage of labor force human capital in total human capital shows an obvious downward trend. One possible explanation is that the student population, especially tertiary education students, increases a lot since the early 1990s.

6. The ratio of real human capital per capita of male to real human capital per capita of female increases from 1.495 to 1.544 from 1985 to 2009. At the same time, the same ratio of real human capital per capita for urban area to that for rural area increases from 3.274 to 4.464. Through the ratio comparison we can see that the gender difference of human capital per capita is much smaller than regional difference of human capital per capita. One possible explanation is that difference in wage and education decreases between male and female but increases between urban and rural areas.

Appendix A Population imputation

1. Data collection

1.1 Macro-data

When estimating population by age, gender and education in urban and rural areas, we use the following data sources:

Data	Sources	Notes
National, urban and rural "population aged 6 and over by age, gender and education attainment": 1982,1987, 1990,1995, 2000,2005	• 1982,*China Demographic Statistics Yearbook* 1988 edited by Department of Demographic Statistics of National Bureau of Statistics • 1987,*China 1987 1% Demographic Sampling* Survey edited by Department of Demographic Statistics of National Bureau of Statistics • 1990,*China 1990 Census* edited by Census Office of State Council, and Department of Demographic Statistics of National Bureau of Statistics • 1995,*China Demographic Statistics Yearbook.*1998 edited by Department of Demographic and Employment Statistics of National Bureau of Statistics • 2000,http://www.stats.gov.cn/tjsj/ndsj/renkoupucha /2000pucha/pucha.htm • 2005,http://www.stats.gov.cn/tjsj/ndsj/renkou/2005 /renkou.htm	

National, urban and rural population aged 0-5 by age and sex: 1982,1987, 1990,1995, 2000,2005	• 1982,*China 1982 Census* edited by State Department Census Office, Department of Demographic Statistics of National Bureau of Statistics • 1987,*China Demographic Statistics Yearbook.1989* edited by Department of Demographic Statistics of National Bureau of Statistics • 1990,*China 1990 Census* edited by State Department Census Office, Department of Demographic Statistics of National Bureau of Statistics • 1995,*China Demographic Statistics Yearbook.1996* edited by Department of Demographic and Employment Statistics of National Bureau of Statistics • 2000,http://www.stats.gov.cn/tjsj/ndsj/renkoupucha /2000pucha /pucha.htm • 2005,http://www.stats.gov.cn/tjsj/ndsj/renkou/2005 /renkou.htm	We assume that those aged 0-5 receive no schooling
National, urban and rural population by age and sex: 1982-2009	• *China Demographic Statistics Yearbook.1988-1993* edited by Department of Demographic Statistics of National Bureau of Statistics • *China Demographic Statistics Yearbook.1994-1998*,2006 edited by Department of Demographic and Employment Statistics of National Bureau of Statistics	

	• *China Demographic Statistics Yearbook.1999-2005* edited by Department of Demographic and Social Science Statistics of National Bureau of Statistics • *China Demographic and Employment Statistics Yearbook 2007-2009* edited by Department of Demographic and Employment Statistics of National Bureau of Statistics	
Mortality rate by age and sex: 1986,1989-1990, 1994-2009	• *China Demographic Statistics Yearbook：1988-2009*	In the yearbooks of 1988 and 1989, the only mortality rate is of 1986. In the yearbooks of 1992 and 1993, the mortality rate is not separated by age and sex.
Enrollment by education level: 1980-2009	• *Educational Statistics yearbook of China.1987* edited by the Plan and Finance Bureau of National Educational Committee • *Educational Statistics yearbook of China.1989-1992* edited by the Plan and Development Department of National Educational Committee • *Educational Statistics yearbook of China 1993-1996* edited by the Plan and Development Department of National Educational Committee	*Educational Statistics Yearbook of China. 1980-1986,1988, 1992* are downloaded from http://www.pinggu.org/bbs/thread-140641-2-1.html

	• *Educational Statistics yearbook of China 1997* edited by the Plan and Development Department of National Educational Ministry • *Educational Statistics yearbook of China.1998-2009* edited by the Plan and Development Department of National Educational Ministry	
National, urban and rural population and birth rate for each year	• *China Statistics Yearbook 2010.* • *Statistics Summary for 55 years in China.* China Statistics Press	
Students by age and grade of primary and junior school: 20032009	• *Educational Statistics yearbook of China.2003-2010* edited by the Plan and Development Department of National Educational Ministry	

1.2 Micro-data

(1) Urban Household Survey (UHS)

The Urban Household Survey aims to study the conditions and living standard of urban households. Using sampling techniques and daily accounting method, the survey collects data from non-agricultural households in different cities and counties. It records household information about income and consumption expenditure, demographic characteristics, work and employment, accommodation and other family related information. This is a continuous, large scale social-economic survey, which covers from

1986 to 1997. One hundred and three cities and 80 counties are included in the survey.

(2) China Health and Nutrition Survey (CHNS)

The China Health and Nutrition Survey, implemented by national and local governments, was designed to examine the effects of the health, nutrition, and family planning policies and programs and to investigate how the social and economic transformation of Chinese society is affecting the health and nutritional status of its population. The survey was conducted by an international team of researchers in nutrition, public health, economics, sociology, Chinese studies, and demography. It is funded by National Institutes of Health (NIH). The CHNS is coordinated by Barry Popkin of the Carolina Population Center at the University of North Carolina. The CHNS is a collaborative project of the National Institute of Nutrition and Food Safety (INFS), the Chinese Center for Disease Control and Prevention (CCDC), and the University of North Carolina at Chapel Hill (UNC-CH). Nine provinces were covered in the survey: Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning, Shandong. Four counties were selected in each province. In addition, the provincial capital and a lower income city were selected when feasible. The surveyed years include 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009.

(3) Chinese Household Income Project (CHIP)

Chinese Household Income Project (1988-92), funded by Ford Foundation, was conducted by Institute of Economic Studies, Chinese Academy of Social Science in collaboration with some foreign scholars such as Keith Griffin, Carl Riskin and John Knight. The survey consists of

two parts: urban and rural. The urban sample includes 9,009 households and the rural one includes 10,258 households. Items surveyed include basic information of both the sample households and their members, focusing on income and wage, sources of income and household expenditure. For rural households, information of assets and debts, sales and consumption of products, and purchase of production means were also collected. The 1995 survey records information on urban and rural household income and expenditure of that year. Because of the change in the economic structure in China, the questionnaire was redesigned to reflect this change. Provinces covered by the survey involve 28 provinces for the rural survey, excluding Xinjiang and Tibet and 10 provinces (Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Yunan and Gansu) for the urban area. The years surveyed include 1988, 1995, 2002 and 2007.

2. Data processing

2.1 Basic population data

2.1.1 Census data

Due to direct registration and computer aggregation, the Census data do not take into account the left-out population.[111] The total populations from the 1982, 1990 and 2000 census data published at that time are slightly different from the population released in *China Statistics Yearbook 2010*. Thus, some adjustments need to be made to the population data by age, sex and educational attainment. The adjustment is implemented by the

[111] See Zhang, Weimin and Hongyan Cui(2003),"The estimation accuracy of China Census 2000",*Population Research*, Vol.27, No.4 (July), pp.25-35.

following method. The adjusted urban population by age, sex and educational attainment equals the urban population by age, sex and educational attainment from the census data times the ratio of total urban population released in *China Statistics Yearbook 2010* to the total urban population in the census data. A similar formula is applied to the rural population.

2.1.2 1%-Sample data

We adjust the sample data to match the total rural and urban data. Urban population by age, sex and educational attainment is divided by urban sampling ratio, which is the ratio of urban sample population to urban total population released in *China Statistics Yearbook 2008.* The same method is applied to the rural data.

2.2 New enrollment

2.2.1 Educational category in China

There are six education levels in China: no schooling, primary school, junior middle school (including regular junior middle school and vocational junior middle school), senior middle school (including regular senior middle school, regular specialized middle school and vocational high school), college, and university and above. “College” and “university and above” were combined as “college and above” before 2000.

2.2.2 National enrollment data

The new enrollments by gender of primary school from 1985 to 1990 are not available, so it is assumed that the share of females in the new

enrollments equals that in Grade 1.

From 1980 to 1983, we have no information about the share of females in the new enrollments, so we use female share in new enrollment of the closest year.

From 1983 to 2003, we only have the total new enrollment of college and university and the total females in college and university. To get the female enrollments in college and university, we assume that the proportion of female is the same as in college and university enrollments.

From 2004 to 2009, the female enrollment data for university and college is available in the statistic yearbooks.

2.2.3 New enrollment data of urban and rural areas

The new enrollments by gender in urban and rural areas in each educational level are not available. We assume that the proportions of female enrollment in urban and rural areas equal the corresponding proportion at the national level.

The new enrollments of specialized middle school are not separated by urban and rural. So we assume that the ratio of urban to rural new enrollments in specialized middle school is the same as that of regular senior middle school.

From 2003 to 2009, the new enrollments of vocational high school are not separated by urban and rural and the processing method is the same as above.

3. Imputation method

We use the perpetual inventory method to impute the population data.

3.1 Perpetual inventory method

The perpetual inventory formula is:

$$L(y,e,a,s) = L(y-1,e,a,s)\cdot(1-d(y,a,s)) + IF(y,e,a,s) - OF(y,e,a,s) + EX(e,a,s)$$

where $L(y,e,a,s)$ is the population in year y with education level e, age a and sex s. $d(y,a,s)$ is the mortality rate. $IF(y,e,a,s)$ is the inflow of population of age a, sex s and education level e in year y. $OF(y,e,a,s)$ represents the outflow of population of age a and sex s and education level e in year y. $EX(e,a,s)$ is a residual term.

$$IF(y,e,a,s) = l(y,e,a,s)\cdot ERS(y,e,s)$$

$$OF(y,e,a,s) = l(y,e+1,a,s)\cdot ERS(y,e+1,s)$$

ERS is the new enrollment of different education levels, λ is the age distribution of new enrollment of different education levels and

$$\sum_a l(y,e,a,s) = 1$$

3.2 Estimate the age distribution λ

3.2.1 Estimate the age distribution λ: using micro-data

The micro-data we use include CHNS (China Health and Nutrition Survey: 1989, 1991, 1993, 1997, 2000) and CHIP (Chinese Household Income Project: 1995). CHNS includes not only the age, gender of the

individuals but also the grade if the individuals are in school. CHIP only records the education level without grade. For this reason, we consider CHNS firstly when we estimate the age distribution of new enrollment.

3.2.1.1 Using CHNS data

(1) The age distribution of the students in Grade 1 of primary school

Select the students in Grade 1 of primary school from the CHNS sample, and classify them according to age. The last two rows in Table A.1 show that the students in Grade 1 of primary school are mainly 5-10 years old, with the share over 95%. For simplicity and also for consistency with the age limits of other education levels, students aged less than 5 and over 10 are dropped from the sample. The age distribution is calculated for the students in Grade 1 of primary school of age 5-10 (Table A.2).

(2) The age distribution of students in Grade 1 of junior middle school

The number of students in Grade 1 of junior middle school can be obtained by the same fashion, as shown in Table A.3. These students are mainly aged 11-16, with the share over 95% except for 1993. In 1993, the number of students in Grade 1 of junior middle school is as large as 47, which is rare under the education framework of China, so they are dropped (Table A.4).

(3) The age distribution of students in Grade 1 of senior middle school, college and university.

The number of students in Grade 1 of senior middle school, college and university in CHNS sample is too small to estimate the age distributions. The number of students in Grade 1 of senior middle school is shown in

Table A.5, and there are only 81 students in Grade 1 of college and university from 1989 to 2000 in CHNS sample.

3.2.1.2 Using CHIP95 data

Select the students in senior middle school (including professional schools), college and above (Table A.6). CHIP95 only records the education level, thus we do not know which grade the student is in. To estimate the age distribution for Grade 1, we assume the age distributions of students at each grade are the same as their Grade 1. Take the male students in senior middle school for example, as shown in Table A.7.

We also assume that the numbers of students in Grade 1, Grade 2 and Grade 3 are x, y, and z, respectively. We have

$a \cdot x = 26$

$b \cdot x + a \cdot y = 72$

$c \cdot x + b \cdot y + a \cdot z = 147$

$d \cdot x + c \cdot y + b \cdot z = 203$

$e \cdot x + d \cdot y + c \cdot z = 175$

$f \cdot x + e \cdot y + d \cdot z = 61$

$f \cdot y + e \cdot z = 60$

$f \cdot z = 28$

$a + b + c + d + e + f = 1$

Solve these equations for the age distribution ($a, b, c, d, e, f,$). Similarly, we can derive the age distributions of female students in Grade 1 of senior middle school, male students in Grade 1 of college and university, and female students in Grade 1 of college and university. We present some

results in Table A.8 and Table A.9.

3.2.2 Estimate the age distribution λ: using macro-data

We use the data in *China Educational Statistical Yearbook: 2003-2009* to estimate the age distribution of new enrollments.

We have the data of new enrollment of primary school by age and the data of new enrollment of junior middle school by age and grade from 2003 to 2009.

For primary school, we assume that males and females have the same age distribution.

For junior middle school, we assume that the age distribution of Grade 1 students is the same as that of new enrollments. Then we assume that males and females have the same age distribution.

For senior middle school, we assume that students in Grade 3 in junior middle school have the same age distribution as those of new entrants to senior middle school in the same year. Then we assume that males and females have the same age distribution. For example, in 2004 the age distribution of new entrants to senior middle school is the same as that of Grade 3 students in junior middle school (TableA.10).

For university, we assume that the age distribution of new entrants to university is the same as that of Grade 1 students in senior middle school three years ago. For example, in 2007, the age distribution of new entrants to university is the same as that of Grade 1 students of senior middle school in 2004. See Table A.11.

Using the method above, we can get the age distribution of enrollment

of each educational level (Table A.12). Here males and females have the same age distribution.

3.3 Method of imputing population data: 1985-2005

When adopting the perpetual inventory method to estimate the urban and rural population, we ignore migrants between urban and rural China. To take these migrants into account, we make the following adjustments. For example, from 1982 to 1990, we get the estimated 1990 population data by gender, education and age using the perpetual inventory method. The actual 1990 population by gender, education and age subtracted the estimated 1990 population by gender, education and age gives the net migrants between urban and rural China in these eight years. We assume that the number of immigrants in each year is the same, and then we add the average difference to the estimated population data.

3.4 Method of imputing population data: 2006-2009

With the population by age, gender and education level of 2005 as the benchmark, we use the perpetual inventory method to obtain preliminary estimates, and then adjust the sum of population estimated to match total urban and rural population data of 2006, 2007, 2008, 2009 that is released in *China Statistics Yearbook 2010*.

The method of adjustment is as follows: we use the total population reported in *China Statistics Yearbook 2010*, deduct the sum of the estimated population and we retrieve the difference. Then we add the difference back to the estimated population data according to the 2005 structure of the population by age, gender and education level.

When it comes to estimating the enrollment data, we assume that the enrollment rate of the population of a certain sex, age and education level from 2006 to 2009 equals that of the 2005 population. For example, the rate of male population of 15 years old of junior middle school in 2004 divided by male entrants of 16 years old of senior middle school in 2005 is defined as the enrollment rate. Thus we get the enrollment rate by age, gender and education level. When we calculate the number of population in college and university of rural areas, we assume that the annual change of each year equals that from 2004 to 2005.

4. Some specific problems

4.1 National, rural and urban population at age zero: 1985-2009

4.1.1 National population at age zero

The total population at the end of the year and the birth rates for each year are obtained from Table 3-1 'Population and Its Composition' and Table 3-2 'Birth Rate, Death Rate and Natural Growth Rate of Population' in *China Statistic Yearbook 2010*. We assume that the population at the beginning of a given year equals that at the end of the previous year. Thus, the average of the population at the end of the given year and the previous year is the average population of the given year. The product of the average population and the corresponding birth rate gives the new-born population. Multiplying the new-born population by the survival rate of those aged zero at the corresponding year gives the population at age zero at the end of the year.

(Definition: birth rate, also called gross birth rate, refers to the ratio of the new-born population in a given region during a given period, usually one year, and the average population of the same period. The birth rate here

is yearly birth rate, which is calculated from the following equation: Birth rate = (new-born population/average population)* 1000‰, where new-born population is the number of the new-born babies who are alive when they are detached from the mothers no matter how long they have been in their mother's body. Average population is the average of the populations at the beginning and at the end of the year, or the population at the middle of the year.)

4.1.2 Rural and urban population at age zero

The data used include total national population for each year from 1983 to 2009, birth rate for each year from 1983 to 2009, national, rural and urban population by age and gender from the population sampling surveys for 1987 and each year from 1989 to 2009.

The share of urban population at age zero in the national population at age zero can be calculated from these sampling data, and this share is assumed to be the true share. In other words, multiplying it with the national population at age zero produces the urban population at age zero. Further, the gender ratio from the sampling data is also assumed to be true, thus we can divide the urban population at age zero into the two genders. Similar steps are used for the rural population at age zero.

Since there is no population sampling data for 1983-1986 and 1988, we assume the numbers of those aged 1, 3, 4, 5, 6 in 1989 equals the new-born population for 1988, 1986, 1985, 1984 and 1983 respectively with the sampling weights adjusted. Migration between urban and rural regions is neglected here.

4.2 The death rate of those aged 65 and over

When imputing the population by age, gender and education level with perpetual inventory method, the number of those aged 65 and over should be multiplied by (1-death rate). The death rate is calculated in the following way. With the population and the death rate, both by age and gender, from the population sampling data for each year, the number of deaths of those aged 65 and over for each year can be calculated, and dividing it by the corresponding total population gives the death rate of those aged 65 and over. Since there is no population sampling data for 1983-1986 and 1988, the death rate of the closest year is used.

4.3 Application of the age distributions of every education level for each year

The age distributions are obtained from the macro- and micro-level data, and the enrollment numbers for each year are used with adjustments. They change over time, but do not vary between urban and rural regions.

4.4 STATA programming

The imputation process is realized by a STATA program, which includes adjustments for negative numbers.

Tables and figures of appendix A

Table A.1 Number of Students in Grade 1 of Primary School in CHNS Sample

Age	1989	1989	1991	1991	1993	1993	1997	1997	2000	2000
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
4	1									
5	7	5	13	8	3	3	11	6	5	3
6	48	39	32	30	14	13	31	37	12	9
7	67	64	41	40	21	9	50	47	22	12
8	47	23	24	12	5	4	23	7	6	3
9	6	4	10	6	3	2	3	1		4
10	3	2	2	3	2	3	1	1		1
11							1		2	
12	1	1	2	1	1					
13	1						1			
14	1		1			1		1		1
15				1						
16							1			
25							1			
Total	182	138	125	101	49	35	123	100	47	33
Of which:										
Those aged 5-10	178	137	122	99	48	34	119	99	45	32
The share of those aged 5-10	0.978	0.993	0.976	0.98	0.98	0.971	0.967	0.99	0.957	0.97

Table A.2 Age Distribution of Students in Grade 1 of Primary School in CHNS Sample

Age	1989	1989	1991	1991	1993	1993	1997	1997	2000	2000
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
5	0.0393	0.0365	0.1066	0.0808	0.0625	0.0882	0.0924	0.0606	0.1111	0.0938
6	0.2697	0.2847	0.2623	0.3030	0.2917	0.3824	0.2605	0.3737	0.2667	0.2813
7	0.3764	0.4672	0.3361	0.4040	0.4375	0.2647	0.4202	0.4747	0.4889	0.3750
8	0.2640	0.1679	0.1967	0.1212	0.1042	0.1176	0.1933	0.0707	0.1333	0.0938
9	0.0337	0.0292	0.0820	0.0606	0.0625	0.0588	0.0252	0.0101	0.0000	0.1250
10	0.0169	0.0146	0.0164	0.0303	0.0417	0.0882	0.0084	0.0101	0.0000	0.0313
Total	1	1	1	1	1	1	1	1	1	1

Table A.3 Number of Students in Grade 1 of Junior Middle School in CHNS Sample

Age	1989	1989	1991	1991	1993	1993	1997	1997	2000	2000
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
6					1					
7					8	7				
8					4	12				
9	1				9	6				
10					2		1		2	
11	5	1	5	8	7	8	6	11	16	10
12	16	21	24	23	28	31	26	19	51	38
13	36	32	22	30	34	30	41	43	56	40
14	35	21	22	28	25	22	20	19	23	12
15	18	8	16	11	11	6	7	4	3	3
16	8	4	10	1	1	1	1	2	1	1
17	1		4		1	3	1		1	
18				1		1		1		
19		1								1
21				1						
22							1			
35	1									
36		1								
38				1						
45	1					1				
63								1		
Total	122	89	103	104	131	128	104	100	153	105
Of which:										
Those aged 11-16	118	87	99	101	106	98	101	98	150	104
The share of those aged 11-16	0.97	0.98	0.96	0.97	0.81	0.77	0.97	0.98	0.98	0.99

Table A.4 Age Distribution of Students in Grade 1 of Junior Middle School in CHNS Sample

Age	1989	1989	1991	1991	1993	1993	1997	1997	2000	2000
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
11	0.0424	0.0115	0.0505	0.0792	0.0660	0.0816	0.0594	0.1122	0.1067	0.0962
12	0.1356	0.2414	0.2424	0.2277	0.2642	0.3163	0.2574	0.1939	0.3400	0.3654
13	0.3051	0.3678	0.2222	0.2970	0.3208	0.3061	0.4059	0.4388	0.3733	0.3846

14	0.2966	0.2414	0.2222	0.2772	0.2358	0.2245	0.1980	0.1939	0.1533	0.1154
15	0.1525	0.0920	0.1616	0.1089	0.1038	0.0612	0.0693	0.0408	0.0200	0.0288
16	0.0678	0.0460	0.1010	0.0099	0.0094	0.0102	0.0099	0.0204	0.0067	0.0096
Total	1	1	1	1	1	1	1	1	1	1

Table A.5 Number of Students in Grade 1 of Senior Middle School in CHNS Sample, with Professional School Included

Age	1989	1989	1991	1991	1993	1993	1997	1997	2000	2000
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
11					1	1				
12						2				
13			1		1					
14	1	2	2		1		1	5	1	4
15	6	8	9	6	10	11	13	13	7	9
16	10	5	9	7	6	10	19	14	16	20
17	5	5	5	5	6	10	4	10	15	9
18	1	1	1		4	1	1	3	3	5
19	1	1	2			2	1	2		3
20									1	1
21			1							
28								1		
Total	24	22	30	18	29	37	39	48	43	51

Table A.6 Number of Students in Senior Middle School and Above in CHIP95 Sample

Age	Senior middle school (including professional schools)	Senior middle school (including professional schools)	College and higher	College and higher
	Male	Female	Male	Female
1	1			
2		1		
3		1		
4	1			
5				1
6	2	1	1	1
7			2	3

Age	Senior middle school (including professional schools)	Senior middle school (including professional schools)	College and higher	College and higher
	Male	Female	Male	Female
8		3	5	3
9	1	1	1	
10	6	2	1	1
11	2	3		1
12	5	4	4	
13	14	16		3
14	26	23	1	1
15	72	78	1	4
16	147	176	2	4
17	203	162	6	10
18	175	164	17	20
19	61	86	26	22
20	60	45	34	26
21	28	23	21	19
22	13	11	16	9
23	6	3	11	4
24	2	2	3	5
25		2	5	
26				1
27			1	
28	1			
31		1		
38		1		
40		1		
88		1		
Total	826	811	158	138
Of which:	age 14-21		age 17-24	
Number of students	772	757	134	115
share	0.9346	0.9334	0.8481	0.8333

Table A.7 Age Distribution of Students in Each Grade: Assumption

Age	Grade 1	Grade 2	Grade 3
14	a		
15	b	A	
16	c	B	a
17	d	C	b
18	e	D	c
19	f	E	d
20		F	e
21			f

Table A.8 Age Distribution of Male Students in Grade 1 of Senior Middle School

Age	Share
15	0.273
16	0.351
17	0.158
18	0.144
19	0.085

Table A.9 Age Distribution of Students in Grade 1 of College and University

Age	Male	Female
17	0.288	0.288
18	0.378	0.378
19	0.205	0.205
20	0.129	0.129
21	0.288	0.288

TableA.10 Age Distribution of New Entrants in Senior Middle School, 2004

Age	Grade three students in junior middle school	Proportion
11 and below	21	0.000001
12	2185	0.000098
13	79869	0.003586
14	1279586	0.057452

Age	Grade three students in junior middle school	Proportion
15	8893796	0.399322
16	9785227	0.439346
17	1899324	0.085278
18	293469	0.013176
19 and above	38789	0.001742
Total	22272266	1.000000

Table A.11 Age Distribution of New Entrants in university, 2007

Age	Proportion
14 and below	0.000001
15	0.000098
16	0.003586
17	0.057452
18	0.399322
19	0.439346
20	0.085278
21	0.013176
22 and above	0.001742
Total	1.000000

Table A.12 Age Distribution of New Enrollments by Educational Level, 2007

Age	Illiterate to primary school	Primary school to junior middle school	Junior middle school to senior middle school	Senior middle school to college	Senior middle school to university
	Proportion	**Proportion**	**Proportion**	**Proportion**	**Proportion**
5	0.029				
6	0.624				
7	0.325				
8	0.018				
9	0.003				
10	0.001	0.001			

11		0.041			
12		0.445			
13		0.415	0.002		
14		0.079	0.006		
15		0.016	0.447		
16		0.003	0.440	0.004	0.004
17		0.001	0.087	0.058	0.058
18			0.015	0.399	0.399
19			0.003	0.439	0.439
20				0.085	0.085
21				0.013	0.013
22				0.002	0.002
Sum	1	1	1	1	1

Appendix B Mincer parameters

Main Equation:

$$\ln(inc) = \alpha + \beta \cdot Sch + \gamma \cdot Exp + \delta \cdot Exp^2 + u$$

where *inc* is income; *Sch* is years of schooling; *exp* is years of work experience; α, β, γ, δ are corresponding parameters; u is an error term.

1. Samples and methods

1.1 Surveys

(1) The annual Urban Household Survey (UHS);

(2) Chinese Health and Nutrition Survey (CHNS);

(3) Chinese Household Income Project (CHIP).

1.2 Components of income

(1) Main job and Second job salaries;

(2) Other cash income from work;

(3) Pension;

(4) Estimated market value of received items;

(5) Various subsidies;

(6) Individual's share of household income according to working-hour share.

1.3 Work experience

exp = age–*Sch*–6.

1.4 Selection of sample

(1) 16-60 years old for males, and 16-55 years old for females;

(2) Must have information on income and educational attainment;

(3) Students, retirees, people who are unemployed but looking for a job, the disabled, people who are waiting to enter school and housekeepers are excluded.

1.5 Imputation method

(1) To make all parameters comparable, we first use UHS, CHIP, CHNS to obtain all urban and rural parameters by gender and then get the annual results by weighting the available datasets sample sizes for that year. When all three data sets are available for a sample year, we drop CHNS and use UHS and CHIP estimates because of the relatively low quality of CHNS income measures, then they are weighted by respective sample size.

(2) We use UHS to get urban parameters for 1986-1997.

(3) We use CHIP to get urban and rural parameters for 1988, 1995, 2002 and 2007.

(4) We use CHNS to obtain urban parameters[112] for 2000, 2004, 2006, 2009, and rural parameters for 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009.

For example, for the intercept term,

We estimate the urban intercept $\alpha^u 88$ (UHS) using UHS 1988, with the sample size of $n^u 88$ (UHS). We also could get the urban and rural intercepts $\alpha^u 88$ (CHIP), $\alpha^r 88$ (CHIP), with the sample sizes of $n^u 88$(CHIP), $n^r 88$(CHIP) respectively. Then the annual urban and rural intercepts are:

[112] We have urban datasets of UHS for 1989, 1991, 1993 and 1997, so we don't use the CHNS datasets of the above years for urban parameter estimation

$$\alpha^u 88 = \frac{\alpha^u 88(UHS) \times n^u 88(UHS)}{n^u 88(UHS) + n^u 88(CHIP)} + \frac{\alpha^u 88(CHIP) \times n^u 88(CHIP)}{n^u 88(UHS) + n^u 88(CHIP)}$$

$$\alpha^r 88 = \alpha^r 88(CHIP)$$

The same principle is applied to estimating other relevant parameters for urban and rural areas.

1.6 Parameter α

$$\ln(inc) = \alpha + \beta \cdot Sch + \gamma \cdot Exp + \delta \cdot Exp^2$$

$\hat{y} = \alpha \times e^{\hat{\ln y}}$, where α is an adjustment factor. We estimate it as follows:

(1) Obtain $\hat{\ln y}$ from the regression of $\ln(y_i)$ on all right-hand-side variables.

(2) Obtain $\hat{m}_i = e^{\hat{\ln y}}$.

(3) Regress y_i on $\hat{m}_i$ without the intercept: $\hat{y} = \alpha \times \hat{m}_i$ and keep α.

(4) For given values *Sch*, *Exp*, *Exp*^2, obtain $\hat{\ln y}$.

(5) $\hat{y} = \alpha \times e^{\hat{\ln y}}$.

2. Data

We use two well-known household surveys in China. The first one is the annual Urban Household Survey (UHS) conducted by the National Statistical Bureau of China from 1986 to 1997. It records household information about income and consumption expenditure, demographic characteristics, work and employment, accommodation and other family related matters. UHS covers 103 cities and 80 counties.

The second one is the China Health and Nutrition Survey (CHNS), which covers nine provinces-Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning, Shandong. Four counties are sampled in

each province. In addition, the provincial capital and a lower income city are selected when feasible. CHNS was conducted in 1988, 1991, 1993, 1997, 2000, 2004, 2006, 2009. Numbers of households participated in the first five waves are 3,795, 3,616, 3,441, 3,875, and 4,403 respectively.

The CHIP (Chinese Household Income Project) data include 9,009 urban households and 10,258 rural households. Basic information are collected for both the sample households and their members, focusing on income and wage, sources of income and household expenditure. For rural households, information on assets and debts, sales and consumption of products, and purchase of production means are also collected. The rural survey covers 28 provinces, only excluding Xinjiang and Tibet ; and the urban survey covers 10 provinces (Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Yunan and Gansu). The years surveyed include 1988, 1995, 2002, and 2007.

Table B.1 shows the distribution of the three datasets across years.

3. Key variables

3.1. UHS

3.1.1 Definition of income

1) Salaries from working in the state-owned, collective or other institutions;

2) Other income from working units;

3) Private employment income;

4) Income from re-employment after retirement;

5) Other employment income;

6) Other working income;

7) Pension;

8) Price subsidies;

9) Household avocation production income.

3.1.2 Years of schooling

(1)**1986-1991**

LEVEL	Sch
College	16
Professional school	11
Senior middle school	12
Junior middle school	9
Primary school	6
Others	0

(2)**1992-1997**

LEVEL	Sch
College	16
Community college	15
Professional school	11
Senior middle school	12
Junior middle school	9
Primary school	6
Others	0

3.1.3 Selection of sample

(1) Include male individuals of 16 to 60 years old and female individuals from 16 to 55 years old；

(2) Discard individuals whose value of regular wage is missing, individuals who failed to report education information；

(3) Discard individuals who are self-employed, short term contract

workers, the retired, job seekers, the disabled, homemakers, students in school, workers waiting for job assignment, students waiting to enter a higher level school, etc.

3.2 CHIP

3.2.1 Definition of income

Urban income definitions:

In 1988 it includes: employment salary and subsidies, other income from work units, pension;

In 1995 it includes: employment salary and subsidies, other income from work units, other goods from work units, pension;

The same principle is applied in CHIP 2002 and CHIP 2007.

Rural income definitions:

Sum of individual income and household income;

In 1988 individual part includes: regular income, pension, other cash income and other goods from work units; household income part is net household income from agriculture.

In 1995 individual part includes: regular income (such as salary, bonus, subsidies), pension, other cash income and received goods from work units; household income part is net household income from agriculture.

In 2002 individual part includes: wages, pensions, subsidies, received goods from work units; household income part is net household income from agriculture.

In 2007 it only has the total household income, including both non-rural income and rural income.

3.2.2 Years of schooling

(1)**1988**

LEVEL	Sch
College and above	16
Professional school	15
Middle level professional, technical or vocational school	11
Upper middle school	12
Lower middle school	9
Junior middle school	6
4 or more years of elementary school	4
1-3 years of elementary school	2
Illiterate or semi-illiterate	0

(2)**1995**

LEVEL	Sch
College and above	16
Professional school	15
Middle level professional school	11
Upper middle school	12
Lower middle school	9
Elementary school	6
Illiterate or semi-illiterate	0

(3)**2002**

LEVEL	Sch
College and above	16
Professional school	15
Middle level professional, technical or vocational school	11
Upper middle school	12
Lower middle school	9
Elementary school	6
Illiterate or semi-illiterate	0

(4)**2007**

LEVEL	Sch
Graduate school	18
College and above	16
Professional school	15
Middle level professional, technical or vocational school	11
Upper middle school	12
Lower middle school	9
Elementary school	6
Illiterate or semi-illiterate	0

3.2.3 Selection of sample

(1) Include male individuals of 16 to 60 years old and female individuals from 16 to 55 years old;

(2) Discard individuals whose value of years of schooling is missing, individuals who failed to report education level information;

(3) Keep individuals whose current status is working or employed, or re-employed after retirement;

(4) Discard individuals who are self-employed, private enterprise owners or managers;

(5) Discard individuals whose reported income is 0 or below.

3.3 CHNS

3.3.1 Income variables

Income includes wages, subsidies, other job-related income and household agricultural income. For CHNS, we use the sum of INDINC (Total net individual income, nominal), INDSUB (Individual subsidies) and individual share of HHSUB (Household subsidies) to calculate the final targeted individual income variable.

3.3.1.1 Total net individual income, nominal (INDINC)

Variable: INDINC - Total net individual income, nominal

Data files: INDBUSN - business income

INDFARM - farming income

INDFISH - fishing income

INDGARD - gardening income

INDLVST - livestock income

INDRETIRE - retirement income

INDWAGE - non-retirement wages

a) Non-Retirement Wages

Variable: INDWAGE - Total individual income from all non-retirement wages earned by individuals. Annual wage is calculated for each job record in the wages file.

Generally, annual wage income is Months Worked times Average Monthly non-Retirement Wage, annualized, plus Bonuses and Other Cash or In-Kind Income. For 1989, annualized income from piece work is calculated.

Source:

C3, months worked last year (job level), 1991 - 2006

C8, average month's wages (job level), 1991 - 2006

C6, wages per piece of completed work, 1989

C7, average number of pieces completed/work, 1989

I19, value of bonuses received last year (job level), 1989-2006

I101, other cash income (job level), 2006

I103, value of other non-cash income (job level), 2006

B2, B3B, B4, B5, B9, B10, filter questions (person level)

b) Retirement Income

Variable: INDRET - Total Individual Retirement Income

Source:

J5, retirement pensions/salaries (individual), 1989 - 2000

B2D, retirement wage from this job (job level), 2004 - 2006

c) Business Income

Variable: INDBUS - Total individual net income from all businesses operated by household that the individual participated in.

Source:

Individual proportion of net income from household businesses:

H6, Months worked in household business last year

H7, Days per week worked in household business last year

H8, Hours per day worked in household business last year

Total household net income from all household businesses:

H2, Business type

H3, Revenue from this business

H4, Expenses

d) Farming Income

Variable: INDFARM - Total individual net income from farming.

Source:

Individual proportion of net income from household farming:

E4A, months worked on farm last year

E4B, days worked on farm per week last year

E4C, hours worked on farm per day last year

E2A, worked on HH farm/orchard last year (from 2004 on)

E4, 12-month average hours worked on farm per week (1989 only)

Total household net income from farming:

E7, cash for collective farming (individual level), 1989 - 2006

E9, in-kind for collective farming (individual level), 1989 - 2006

E13B, expenses to raise crop (crop level), 1989

E15B, receipts from sale of crop (crop level), 1989

E17B, receipts if crop kept had been sold (crop level), 1989

E19B, receipts if crop given away had been sold (crop level), 1989

E13, kg of crop grown (crop level), 1991-1997

E14, kg of crop sold to government (crop level), 1991-1997

E15, government price for crop (crop level), 1991-1997

E16, kg of crop sold to free market (crop level), 1991-1997

E17, free-market price for crop (crop level), 1991-1997

E12, expenses to raise all crops (household level), 1991 - 2006

E14A, receipts from sale of all crops (household level), 1991 - 2006

E16A, value of all crops consumed (household level), 1991 - 2006

e) Fishing Income

Variable: INDFISH - Individual income from fishing.

Source:

Individual proportion of net income from household farming:

G4A, months worked on fishing last year

G4B, days worked on fishing per week last year

G4C, hours worked on fishing per day last year

G2, filter: worked on fishing last year (from 2004 on)

G4, 12-month average hours worked on fishing per week (1989 only)

Total household net income from farming:

G7, wages received from collective fishing (individual)

G9, market value of fish received in-kind from the collective (individual)

G11, revenue from fish sales (household)

G13, value of fish consumed at home (household)

G15, value of fish given as gift (household)

G16, expenses of fishing business (household)

f) Gardening Income

Variable: INDGARD - Total individual net income from gardening

Source:

Individual proportion of net income from household gardening:

D3A, months worked on gardening last year

D3B, days worked on gardening per week last year

D3C, hours worked on gardening per day last year

D2A, worked in HH garden last year (from 2004 on)

D3, 12-month average hours worked on gardening per week (1989 only)

Total household net income from household garden or orchard

D5, revenue from sale of home garden produce, 1989 - 2006

D6, market value of consumed produce, 1989 - 2006

D7, expenses to grow produce, 1991-2006

g) Livestock Income

Variable: INDLVST - Total individual net income from raising livestock.

Source:

Individual proportion of net HH income (HHLVST) from household livestock business:

F4A, months worked on raising livestock last year

F4B, days worked on raising livestock per week last year

F4C, hours worked on raising livestock per day last year

F2A, raising livestock last year (from 2004 on)

F4, 12-month average hours worked on raising livestock per week (1989 only)

Total household net income from all livestock activities:

F7, wages received from collective animal husbandry (individual)

F9, market value of livestock received in-kind from collective (individual)

F14, expenses to raise livestock (livestock level)

F15, expenses from using home-grown feed (livestock level)

F17, revenue from sale of livestock products (livestock level)

F19, value of livestock products consumed at home (livestock level)

F21, value of livestock products given as gifts (livestock level)

3.3.1.2 Subsidies

The subsidies include INDSUB (Individual subsidies) and individual share of HHSUB (Household subsidies). We distribute household subsidies equally among household individuals, the household subsidies are divided by the number of members in one household.

INDSUB=(I9+I11+I12+I13+I13A+I14+I14A+I14B)*12

HHSUB=I10A+I15A+I16A+I17A+I21+K47

Source:

ANNUAL subsidies for the following items, at the Household level:

I10A, one-child subsidy, 1991 - 2006

I15A, gas subsidy, 1993 - 2006

I16A, coal subsidy, 1993 - 2006

I17A, electricity subsidy, 1993 - 2006

I21, food/gift/discounts from work unit, 1989 - 2006

K47, childcare subsidy, 1989 - 2006

MONTHLY subsidies for the following items, at the Individual level:

I9, food subsidy, 1989 - 1997

I11, health subsidy, 1989 - 1997

I12, bath/haircut subsidy, 1989 - 1997

I13, book/newspaper subsidy, 1989 - 1997

I13A, housing subsidy, 1989 - 1997

I14, other subsidy, 1989 - 1997

I14A, average monthly subsidy from job 1, 2000 - 2006

I14B, average monthly subsidy from job 2, 2004 - 2006

3.3.2 Imputing individual share of household income

Agricultural income includes incomes from five sources: gardening, farming, livestock raising, fishing, and small handicraft and commercial household businesses. These incomes come from either collective or household businesses or both.

We assume each individual's contribution to the household income is proportional to his or her share of time allocated to five activities: gardening, farming, raising livestock, fishing and small handicraft and commercial household business. First, we add up all working hours of all family members in each of these activities. Second, we calculate the working hour share of each member in the family's total hours. Third, we multiply the household income by the share to approximate individual income for each category. Finally, we add up individual income from the four categories for each family member.

3.3.3 Years of schooling

Level	Sch
None	0
Completed primary school	6
Junior middle school degree	9
Senior middle school degree	12
Middle technical, professional , or vocational degree	11
3- or 4- year college degree	16
Master's degree or above	18

3.3.4 Selection of sample

(1) Males of 16 to 60 years of age and females of 16 to 55 years of age；

(2) Exclude individuals who fail to provide information on wage and educational attainment, those who are self-employed or business owners；

4. Imputing parameters

4.1. Imputation method of urban parameters

4.1.1 Parameter estimates based on UHS, CHIP, CHNS

We use UHS, CHIP, CHNS data to estimate the earnings equation by gender and year. Table B.1.1-B.1.3 contain means and standard deviations of each variable for UHS, CHIP, CHNS.

4.1.2 General idea about imputation

We use UHS, CHIP and CHNS to estimate parameters of the basic Mincer equation, and get the fitted values for the intercept, return to education, and experience related terms. They are weighted by respective

sample size if more than one sample is available. Then we use the parameter estimates to fit a time trend model, and then get the fitted values of each parameter by gender for the years 1985-2009. These fitted values are the final urban imputed parameters.

4.1.3 Specifications

We treat a , b , g , d separately and use the parameters of each group as the dependent variable and use time (i.e., year) as the independent variable.

For a , b , g and d , we use the linear time trend model. The regression equation is: $Y = a0 + a1 * time + u$.

For a , b , g and d , we assume that they increase or decrease at a constant rate each year. Taking the a _male as an example, we assume that the intercept increases at the growth rate of a1 per year.

Figure B.1- Figure B.8 show the parameter estimates of each group and the sample regression lines of the time trend models. The fitted values of the time trend models are the values of our imputed parameters for the period 1985 to 2009.

Tables and figures of appendix B

Table B.1 Micro Datasets

Year	UHS	CHIP	CHNS
1985			
1986	U		
1987	U		
1988	U	U/R	
1989	U		U/R
1990	U		
1991	U		U/R
1992	U		
1993	U		U/R
1994	U		
1995	U	U/R	
1996	U		
1997	U		U/R
1998			
1999			
2000			U/R
2001			
2002		U/R	
2003			
2004			U/R
2005			
2006			U/R
2007		U/R	
2008			
2009			U/R

Note: CHIP: Chinese Household Income Project

UHS: Urban Household Survey

CHNS: China Health and Nutrition Survey

Table B.1.1 Summary Statistics: UHS Samples

Year	Variables	Male		Female	
		Mean	S.D.	Mean	S.D.
1986	inc.	1484.83	550.33	1244.13	496.67
	e	10.48	2.92	9.77	2.79
	exp	20.47	11.06	17.80	9.50
	exp2	541.56	475.90	407.06	350.80
1987	inc.	1542.71	612.87	1292.50	496.48
	e	10.61	2.91	9.84	2.71
	exp	21.03	10.89	18.43	9.46
	exp2	560.94	471.92	429.09	353.99
1988	inc.	1973.86	860.82	1632.92	721.84
	e	10.77	2.93	9.94	2.76
	exp	20.61	10.93	17.93	9.40
	exp2	544.37	473.04	410.04	348.28
1989	inc.	2262.58	1019.21	1886.99	873.03
	e	10.92	2.96	10.10	2.69
	exp	20.80	10.96	18.26	9.36
	exp2	552.68	472.52	421.23	348.02
1990	inc.	2488.05	1094.79	2088.16	931.65
	e	11.09	2.92	10.28	2.70
	exp	21.14	10.83	18.49	9.33
	exp2	564.19	472.00	428.74	348.20
1991	inc.	2734.07	1175.66	2327.27	1015.47
	e	11.25	2.95	10.49	2.66
	exp	20.68	10.54	18.22	9.03
	exp2	538.57	458.48	413.44	337.06
1992	inc.	3204.91	1678.20	2661.58	1294.45
	e	11.34	2.81	10.56	2.65
	exp	21.66	10.96	19.63	9.63
	exp2	589.10	495.59	477.91	386.69
1993	inc.	3886.54	2471.99	3251.78	1972.98
	e	11.39	2.71	10.75	2.54
	exp	21.36	10.58	19.06	9.10
	exp2	568.01	464.42	445.89	344.57
1994	inc.	5432.23	3620.87	4455.86	2962.17
	e	11.51	2.77	10.92	2.49
	exp	21.21	10.55	18.90	9.10
	exp2	561.18	465.53	439.98	346.76
1995	inc.	6656.28	4196.61	5522.89	3497.76
	e	11.60	2.71	10.96	2.49
	exp	21.43	10.29	19.16	8.97
	exp2	564.96	452.06	447.58	342.98
1996	inc.	7354.62	5044.70	6124.44	4435.34
	e	11.64	2.69	11.07	2.43
	exp	21.76	10.30	19.51	8.99
	exp2	579.54	454.23	461.26	345.12

1997	inc.	8512.26	6050.73	7017.49	5333.35
	e	11.64	2.68	11.11	2.42
	exp	21.97	10.14	19.71	8.98
	exp2	585.36	447.17	469.00	346.25

Table B.1.2 Summary Statistics: CHIP samples

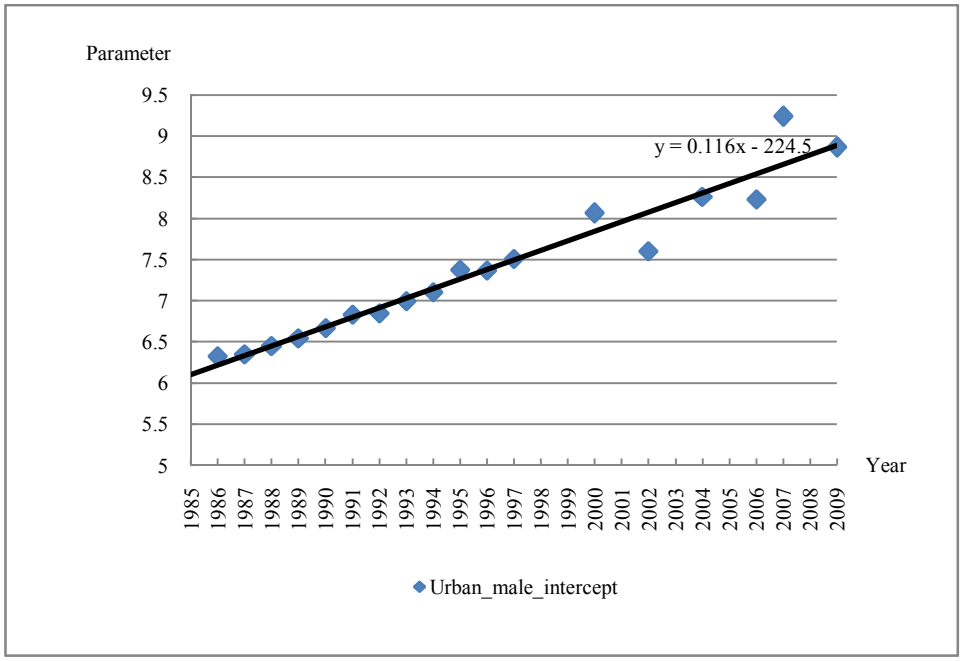
Year	Variables	Urban				Rural			
		Male		Female		Male		Female	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1988	inc.	1929.73	948.86	1633.48	946.90	967.03	1054.63	856.77	845.65
	e	10.70	2.92	9.99	2.75	7.16	3.28	5.01	3.88
	exp	20.95	10.98	18.24	9.43	18.33	12.39	15.40	10.87
	exp2	559.21	480.24	421.77	354.84	489.62	516.15	355.40	390.61
1995	inc.	6643.41	3720.13	5486.28	3067.29	4828.23	5626.44	4601.42	4564.63
	e	11.71	2.74	11.03	2.54	7.91	2.83	6.22	3.40
	exp	22.51	10.76	20.66	9.63	21.41	11.95	20.18	11.17
	exp2	622.43	492.14	519.39	394.29	601.41	543.29	532.08	472.12
2002	inc.	12246.93	8058.56	9788.37	6920.72	5295.99	5636.03	3664.75	3998.78
	e	12.07	2.82	11.63	2.73	8.52	2.76	6.91	3.67
	exp	24.38	10.30	22.79	9.72	21.76	12.10	19.73	11.09
	exp2	700.49	489.23	613.91	421.81	619.95	543.64	512.29	443.08
2007	inc.	34207.11	31304.61	24437.88	24972.30	14310.20	13124.36	10783.55	11125.28
	e	12.48	2.98	12.19	2.92	8.20	2.39	7.55	2.52
	exp	22.67	11.50	20.88	10.94	22.43	12.79	19.45	11.36
	exp2	646.29	526.24	555.61	456.47	666.64	579.67	507.34	448.32

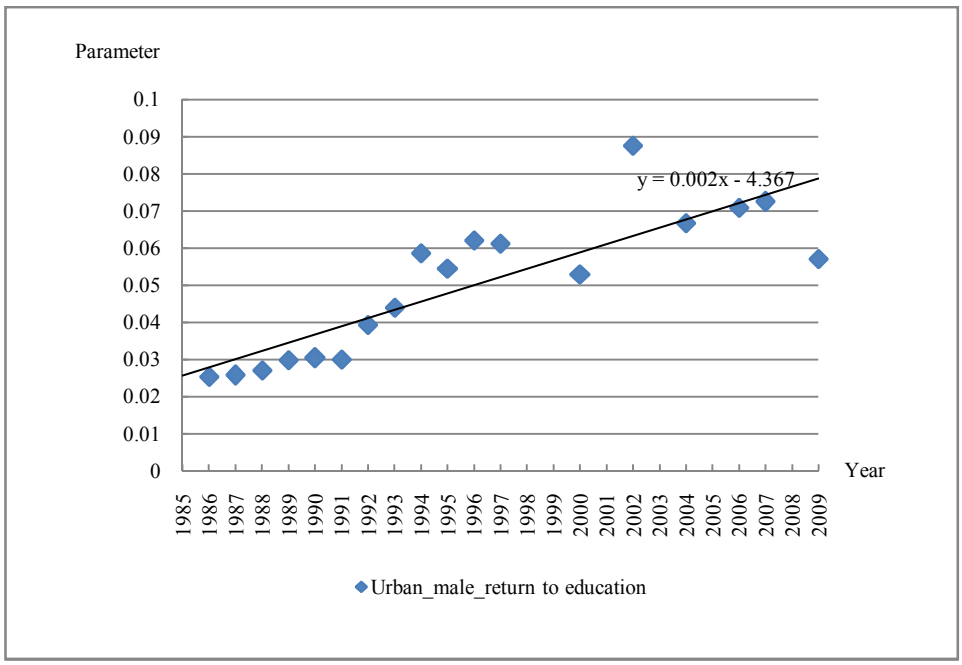
Table B.1.3 Summary Statistics: CHNS samples

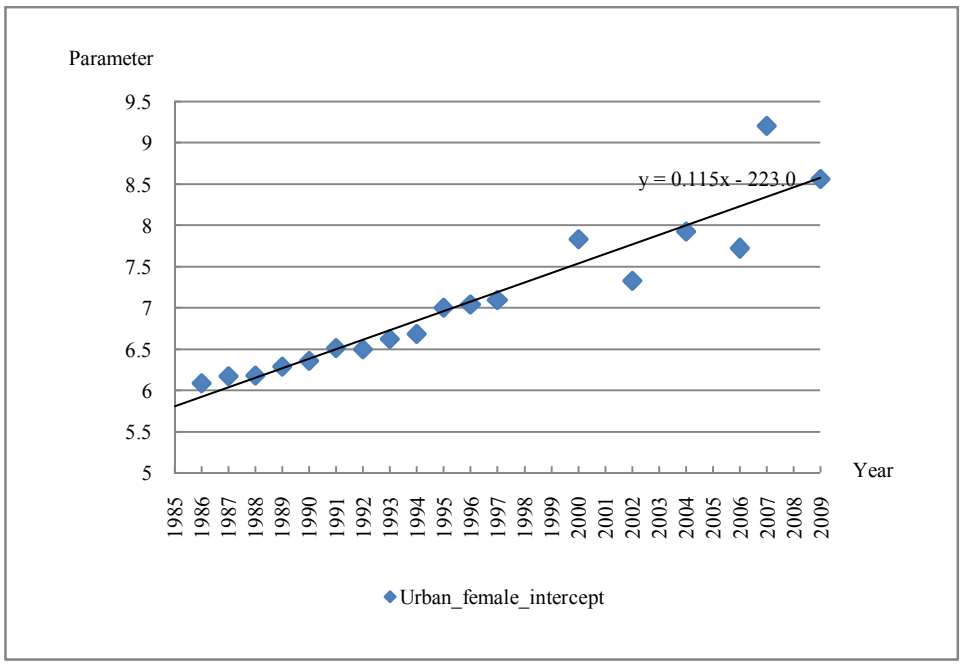
Year	Variables	Urban				Rural			
		Male		Female		Male		Female	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1989	inc.	1798.70	2344.70	1586.70	2811.08	1528.22	4327.60	1163.61	1208.51
	e	8.97	3.99	8.48	4.03	6.30	4.07	4.62	4.35
	exp	18.83	11.28	16.22	9.52	18.58	11.19	16.49	10.18
	exp2	481.46	496.74	353.69	357.28	470.40	470.24	375.41	379.95

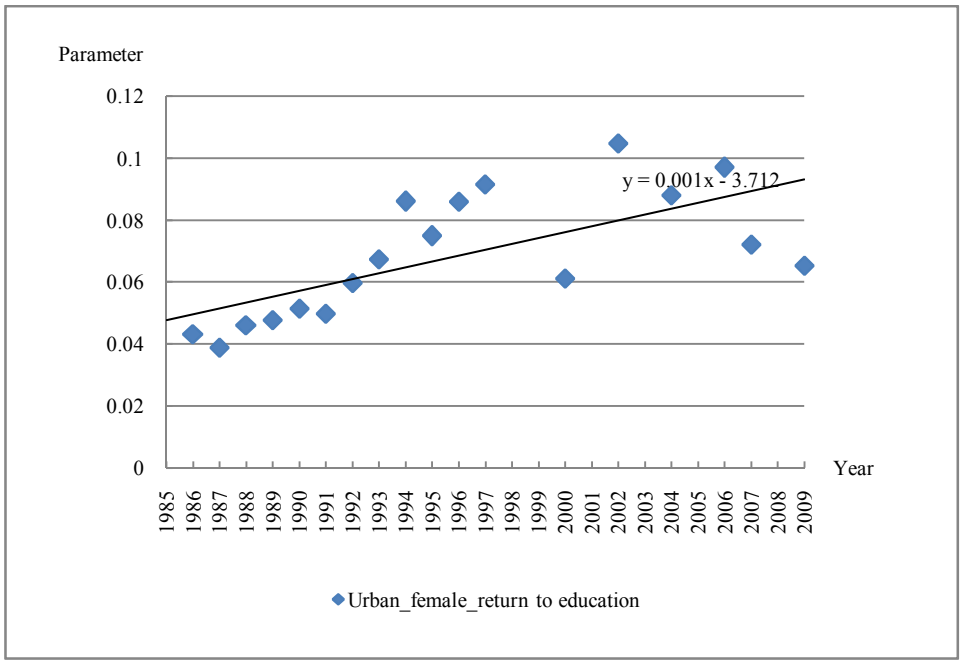
Year	Variables	Urban				Rural			
		Male		Female		Male		Female	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1991	inc.	1982.20	1166.19	1658.30	1101.16	1488.30	1536.87	1218.69	1150.49
	e	9.03	4.01	8.40	4.08	6.68	3.94	4.90	4.31
	exp	20.29	11.67	17.57	10.03	19.47	11.43	17.24	10.29
	exp2	547.69	536.04	409.28	400.77	509.78	491.39	403.10	388.17
1993	inc.	3004.28	2713.91	2572.46	2350.75	2077.52	2287.98	1708.76	1725.63
	e	9.50	3.67	8.85	3.73	7.08	3.72	5.29	4.27
	exp	21.12	11.13	18.49	9.66	20.01	11.40	18.13	10.27
	exp2	569.96	519.48	435.08	383.87	530.22	492.58	433.94	394.98
1997	inc.	6736.15	5557.51	5494.90	4417.92	4510.02	4667.66	3482.20	3338.41
	e	10.17	3.36	9.65	3.48	7.33	3.54	5.59	4.17
	exp	21.75	10.76	19.00	9.46	21.26	11.56	19.58	10.55
	exp2	588.88	496.39	450.29	375.41	585.44	516.52	494.49	426.10
2000	inc.	9531.14	10001.12	7680.28	6977.01	5372.80	5953.70	4049.79	3861.85
	e	10.86	3.24	10.49	3.45	7.94	3.27	6.38	4.13
	exp	22.61	10.71	20.26	9.80	22.12	11.68	20.92	10.49
	exp2	625.58	499.59	506.24	401.96	625.85	529.18	547.67	434.83
2004	inc.	12698.23	10912.61	10486.85	9471.15	7228.57	9316.07	5497.96	6418.09
	e	11.09	3.05	10.63	3.23	8.29	3.19	6.78	4.04
	exp	25.31	10.41	23.10	9.77	25.87	10.94	23.60	9.62
	exp2	748.65	509.74	628.71	426.33	788.78	543.67	649.36	430.63
2006	inc.	17566.76	22706.18	13106.66	14583.46	10744.52	13026.88	7506.87	8592.91
	e	11.31	3.22	10.93	3.48	8.38	3.64	6.94	4.34
	exp	26.17	9.96	23.88	9.41	26.46	10.67	24.18	9.39
	exp2	784.05	497.25	658.56	424.07	813.95	540.02	672.88	425.50
2009	inc.	25380.83	31297.40	18287.02	17651.27	16781.56	25841.87	12409.02	14177.14
	e	11.07	3.23	11.05	3.33	8.26	3.39	7.29	4.13
	exp	27.02	10.40	23.94	9.83	26.78	10.81	24.16	9.57
	exp2	838.20	524.35	669.66	433.39	833.89	551.49	675.04	422.00

Figures B.1-B.4 Plotting Parameter Estimates Against Time: Urban Sample

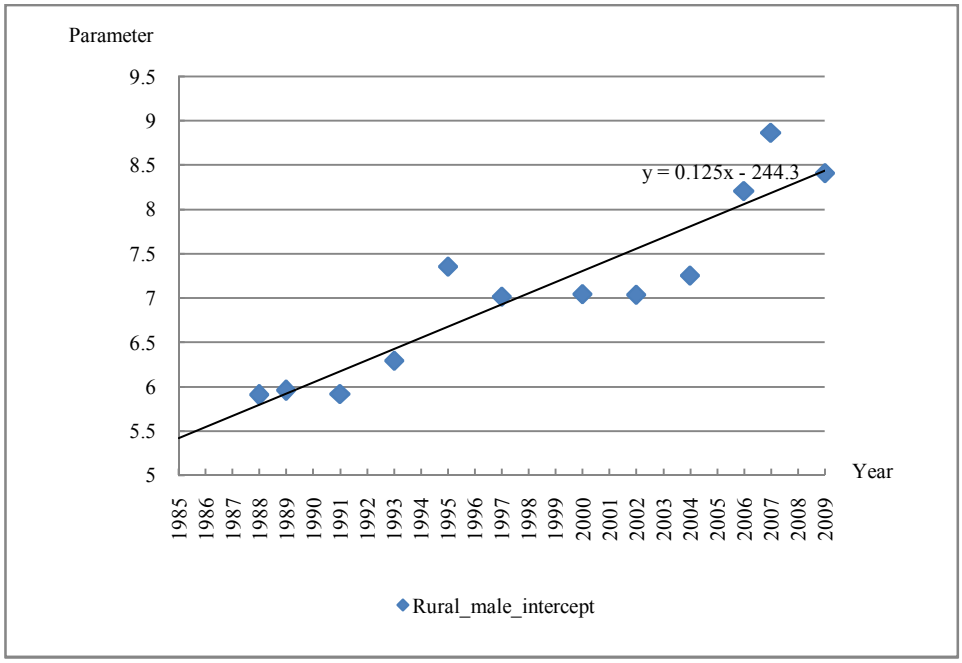


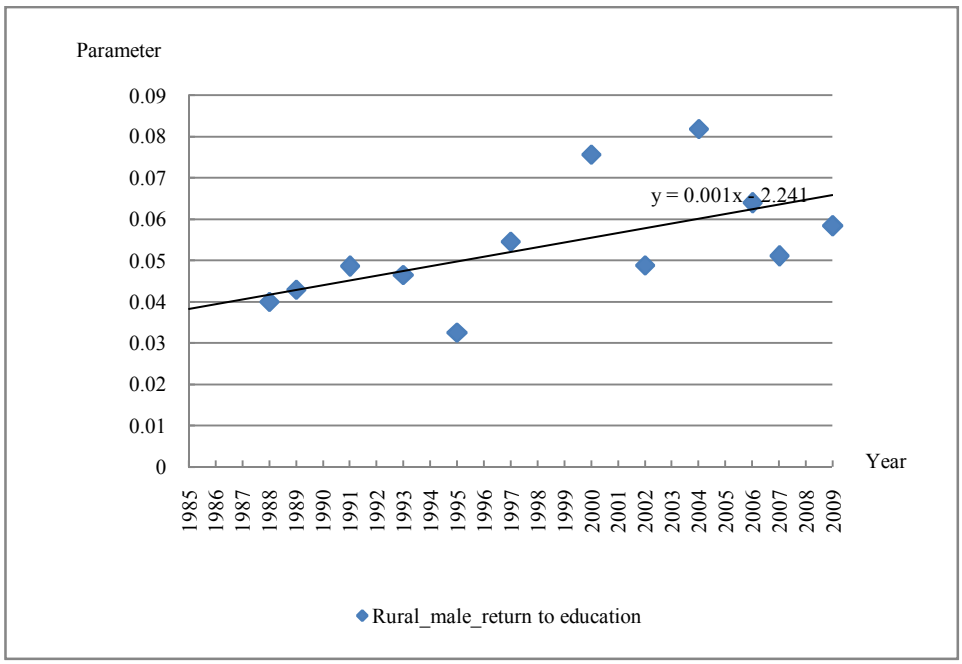


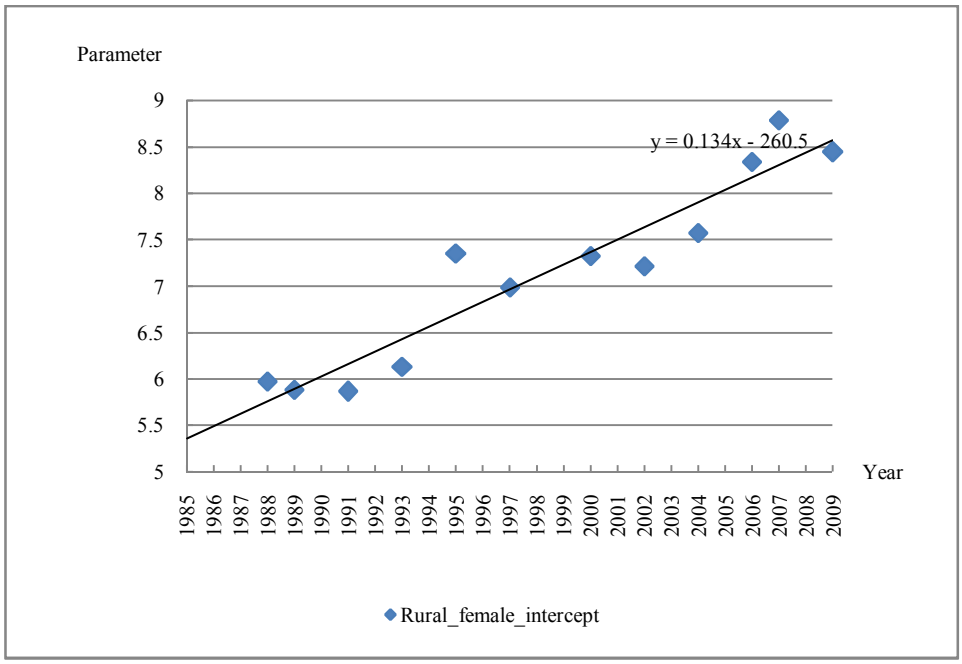

Parameter
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
y = 0.115x - 223.0
Year
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Urban_female_intercept

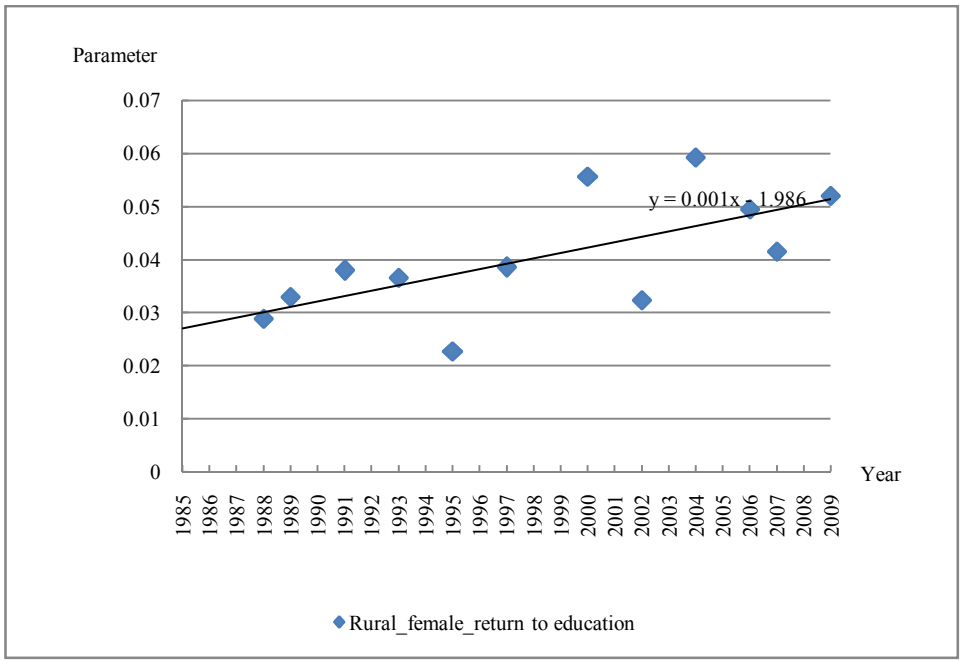

Parameter
0.12
0.1
0.08
0.06
0.04
0.02
0
y = 0.001x - 3.712
Year
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Urban_female_return to education

Figures B.5~8 Plotting Parameter Estimates Against Time: Rural Sample






Parameter
9
8.5
8
7.5
7
6.5
6
5.5
5
y = 0.134x - 260.5
Year
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Rural_female_intercept


Parameter
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
y = 0.001x - 1.986
Year
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Rural_female_return to education

Appendix C: Human capital stock calculation

This section summarizes the basic methods and procedures of estimating China's human capital stock from 1985 to 2009 based on the J-F approach. In particular, it explains the necessary data estimation of the J-F approach based on China's data. We use the following notations:

y = 1980, 1981, 1982, … 2009, calendar year;

s = 1, 2, sex, male or female;

a = 0, 1, …. 60, age;

e: education level, which is described below.

For years 1985-2009 it is classified into five categories: no schooling (ns), primary school (pri), junior middle school (jm), senior middle school (sm), and college (col). For years 2000-2009 it is classified into six categories: no schooling (ns), primary school (pri), junior middle school (jm), senior middle school (sm), college (col) and university (uni).

Variables used in measuring the human capital stock:

whrs(y,s,a,e): annual market hours worked per employed person in year y, with sex s, age a , and education level e;

empr(y,s,a,e): employment rate in year y, for persons with sex s, age a, and education level e;

mhrs(y,s,a,e): market labor time per capita in year y, for persons with sex s, age a, and education level e;

com(y,s,a,e): hourly compensation net of taxes on labor income;

yinc(y,s,a,e): annual income of the group employed in year y, with sex s, age a, and education level e;

ymi(y,s,a,e): annual market income per capita net of tax on labor compensation in year y, for persons with sex s, age a , and education level e

employed(y,s,a,e): the population employed in year y, with sex s, age a, and education level e

pop(y,s,a,e): the population in year y, with sex s, age a, and education level e

newEnroll(y,s,a,e): the population enrolled in education level e, in year y, with sex s, age a

pop_inschool(y,s,a,e-n): the number of the group in school in year y, with sex s, age a, education level e, in grade n+1.

senr(y,s,a,e+1,e-n): the share of the group enrolled in the next education level e+1 in school in year y, with sex s, age a , education level e, and grade n+1.

mi(y,s,a,e): the lifetime income of the population not in school in year y, with sex s, age a , and education level e.

R = (1+real growth rate of income)/(1+discount rate)

pop_inschool(y,s,a,e): the number of people in school in year y, with sex s, age a, and education level e.

pop_nischool(y,s,a,e): the number of people not in school in year y, with sex s, age a, and education level e.

Le(y)：total population with education level e in year y.

Ls(y)：total population with sex s.

Mi(s): lifetime income for both sexes (nominal income).

v_e：share of the present value of lifetime income for the population with education level e.

$\overline{v_e}$：average share of the present value of lifetime income for the population with education level e.

$\overline{v_s}$：average share of the present value of lifetime income for the population with sex s.

ΔlnK：growth rate of the aggregate human capital stock

Poplog(y,s): the logarithmic growth rate of the population for sex s in year y.

Mitg (y): cumulated growth rate of the aggregate human capital stock

MiQ(y): total lifetime income in year y measured in the base year's prices.

1. Age categories for calculating lifetime income using the J-F approach

no school or work	0-5
school only	6-16
work and school	16- a
work only	a -59
Retirement	male：60+；female：55+

(1) When calculating the lifetime income using the J-F approach, the retirement age is 60 for males and 55 for females. The legal retirement ages were set by the second meeting of the fifth NPC Standing Committee on May 24, 1978. Detailed regulations are described in "The Temporary Method of Settling the Old, Weak, Ill, and Disabled Cadre by the State Council" and "The Temporary Method of Settling the Retired Workers by the State Council"

(1978, No.104). In general, the legal retirement age is 60 for male and 50 for female workers and 55 for female cadres. However, for workers who work in high temperature, high elevation, highly exhausting conditions, and harmful conditions, the legal retirement age is 55 for males and 45 for females. For people who become disabled due to illness and other reasons, the legal retirement age is 50 for males and 45 for females.

(2) The *a* in the table is the upper bound of "work and school", and the lower bound of "work only". This age is determined according to the calculation of the lower bound of people in school in each year. The method of calculating the people in school is discussed in section 3.2.

2. Estimation of annual market income ymi(y,s,a,e)

2.1 Estimation of annual income of the employed

2.1.1 Estimation of annual income of the employed using Mincer equation.

Using data from CHIP (Chinese Household Income Project), CHNS (China Health and Nutrition Survey), and UHS (Urban Household Survey), we regress the logarithm of yearly income *ln yinc* on years of schooling *s*, work experience *exp* and work experience squared exp^2 by OLS.

$$\ln \text{yinc} = \alpha + \beta s + \gamma \exp + \delta \exp^2 + \text{u}$$

We use the fitted value of *ln yinc* from the equation above to obtain $\text{m}_\text{i} = e^{\ln \text{yinc}}$. We regress the yearly income observed in the survey data against m_i by OLS (without the intercept) to obtain the coefficient estimate

for m_i, α[113]. Finally, we estimate the yearly income of the employed as yinc= $\alpha \times e^{\ln yinc}$.

Note: The yearly income used for estimating the Mincer equation is in real terms with1985 as the based year.

2.1.2 Years of schooling and work experience in the Mincer equation

(1) Years of schooling:

	No schooling	Primary school	Junior middle school	Senior middle school	College	University
1985-1999	0	6	9	12	15	
2000-2009	0	6	9	12	15	16

(2) Work experience:

For people younger than16, working experience is 0: *exp*=0;

For people older than16, if s<10, working experience: *exp*=age-6;

For people older than16, if s≥10, working experience: exp=age-sch-6.

2.2 Estimation of annual market income

When estimate the yearly income of the employed using the Mincer equation, we obtain $yinc_{y,s,a,e} = whrs_{y,s,a,e} \times com_{y,s,a,e}$.

According to

$mhrs_{y,s,a,e}=whrs_{y,s,a,e} \times empr_{y,s,a,e}$, $ymi_{y,s,a,e}=whrs_{y,s,a,e} \times empr_{y,s,a,e} \times com_{y,s,a,e}$

to the annual market income is given by:

$$ymi_{y,s,a,e}=yinc_{y,s,a,e} \times empr_{y,s,a,e}.$$

[113] Jeffrey M. Wooldridge (2005), Introductory Econometrics: A Modern Approach, 3rd edition.

2.2.1 Calculation of employment rate empr(y,s,a,e)

To calculate employment rate empr(y,s,a,e) by age, sex and education level for people older than 16, we use the average of the employment rates in 1995 and 2000. We assume the employment rate for college is the same as that of university.

The formula used to calculate the employment rate is:

$$empr(y,s,a,e)=[employed(y,s,a,e)]/pop(y,s,a,e)$$

The data sources of employment rate are listed in the table below:

Data	Sources
The employed by age, sex, and education level in 1995	"China Population Statistical Yearbook 2000"
Population by age, sex, and education level in 1995	"China Population Statistical Yearbook 1999"
The employed by age, sex, and education level in 2000	"China Population Census 2000"
Population by age, sex, and education level in 2000	"China Population Census 2000"

Note: The 1% sample population in 1995 is converted into the whole population by the actual sampling percentage of 1.04%.

The employed in "China Population Census 2000" for each province, autonomous region and municipality directly under the central government is aggregated to the whole population employed by the actual sampling percentage of 10%.

3. Calculation of enrollment rate

Enrollment rate is the share that a group with education level e to enroll in a higher education level e+1.

3.1 Calculation of enrollment by sex, age and education level

According to the age distribution of enrollment number for a certain education level and sex, the enrollment number of each year by sex, age and education level is given by:

$$\text{NewEnroll}(y,s,a,e) = \text{NewEnroll}(y,s,e) * \lambda(y,s,a,e)$$

$$\sum_{a} l(y,s,a,e) = 1$$

Note: λ(y,s,a,e) refers to the age distribution of enrollment number for each education level and sex.

There is no college or university in rural area, so the enrollment number of college and university in rural areas is assumed to be 0.

3.2 In-school population of each education level and each grade

The in-school population of age *a*, sex *s*, education level *e*, grade *n*+1 in year *y* is the enrollment population of age a-n, sex s , education level e in year y-n:

$$\text{pop\_inschool}(y,s,a,e-n) = \text{NewEnroll}(y-n,s,a-n,e)$$

3.3 Enrollment rate of each education level and each grade

The probability of advancing to the next higher education level is estimated as the average ratio of the sum of all students of any age in a year who are initially enrolled to the sum of all students of any age initially enrolled in the next higher education level *X* years later, where "*X*" is the number of years it takes to complete an education level.

3.3.1 Enrollment rate from no schooling to primary school

The formula from no schooling to primary school is:

senr(y,s,a,pri-ns) = Newenroll(y+1,s,a+1,pri)/pop(y,s,a,ns)

The upper bound of people out of school in year y and enrolling into primary school in year y+1 is determined by the upper bound of age distribution for enrollment of primary school in year y+1. For example, the age distribution for enrollment of primary school in year y+1 is from 6 to 12, the upper bound of people who have no schooling in year y and enroll into primary school in year y+1 is 11. The upper bound of people out of school in 2007 and enrolling into primary school in 2008 is the same for 2006.

3.3.2 Enrollment rate from primary school to junior middle school

The steps of calculating this enrollment rate by sex and age in year y are:

(1) The enrollment rate of the first grade of primary school in year y by age and sex is the average enrollment rate that the group in this grade can enroll in the first grade of junior middle school six years later, and the formula is:

senr(y,s,a,jm-pri) = newEnroll (y+6, s, jm)/ newEnroll (y, s, pri)

(2) The population of the second grade of primary school in year y by age and sex is the enrollment population of primary school in year y-1 by age and sex. The probability of the group in this grade can enroll in junior middle school 5 years later is the average enrollment rate that the group in this grade can enroll in the first grade of junior middle school five years later, and the formula is:

senr(y,s,a,jm-pri-1) = newEnroll (y+5,s,jm)/ newEnroll (y-1,s,pri)

(3) The population of the third grade of primary school in year y by age

and sex is the enrollment population of primary school in year y-2 by age and sex. The probability of the group in this grade can enroll in junior middle school 4 years later is the average enrollment rate that the group in this grade can enroll in the first grade of junior middle school four years later, and the formula is:

senr(y,s,a,jm-pri-2) = newEnroll (y+4,s,jm)/ newEnroll (y-2,s,pri)

(4) Similarly, we can calculate the probability of the group of each grade in primary school that enroll in junior middle school in year y.

3.3.3 Enrollment rate from junior middle school to senior middle school

The steps of calculating this enrollment rate by sex and age in year *y* are:

(1) The enrollment rate of the first grade of junior middle school in year y by age is the average enrollment rate that the group in this grade can enroll in the first grade of senior middle school three years later, and the formula is:

senr(y,s,a,sm-jm) = newEnroll (y+3,s,sm)/ newEnroll (y,s,jm)

(2) The population of the second grade of junior middle school in year y by age and sex is the enrollment population of junior school in year y-1 by age and sex. The probability of the group in this grade can enroll in senior middle school two years later is the average enrollment rate that the group in this grade can enroll in the first grade of senior middle school two years later, and the formula is:

senr(y,s,a,sm-jm-1) = newEnroll (y+2,s,sm)/ newEnroll (y-1,s,jm)

(3) Similarly, we can calculate the probability of the group of each grade in junior middle school that enroll in senior middle school in year y.

3.3.4 Enrollment rate from senior middle school to college or university

The steps of calculating the enrollment rate from senior middle school to college by sex and age in year *y* are:

(1) The enrollment rate of the first grade of senior middle school in year *y* by age is the average enrollment rate that the group in this grade can enroll in the first grade of college three years later, and the formula is:

senr(y,s,a,col-sm) = newEnroll (y+3,s,col)/ newEnroll (y,s,sm)

(2) The population of the second grade of senior middle school in year y by age and sex is the enrollment population of senior school in year y-1 by age and sex. The probability of the group in this grade can enroll in college two years later is the average enrollment rate that individuals in this grade can enroll in the first grade of college two years later, and the formula is:

senr(y,s,a,col-sm-1) = newEnroll (y+2,s,col)/ newEnroll (y-1,s,sm)

(3) Similarly, we can calculate the probability of the group of each grade in senior middle school that can enroll in college in year *y*.

The steps of calculating the enrollment rate from senior middle school to university by sex and age in year *y* are:

(1) The enrollment rate of the first grade of senior middle school in year y by age is the average enrollment rate that the group in this grade can enroll in the first grade of university three years later, and the formula is:

senr(y,s,a,col-uni) =newEnroll (y+3,s,uni)/ newEnroll (y,s,sm)

(2) The population of the second grade of senior middle school in year y by age and sex is the enrollment population of senior school in year y-1 by age and sex. The probability of the group in this grade can enroll in university two years later is the average enrollment rate that the group in

this grade can enroll in the first grade of university two years later, and the formula is:

senr(y,s,a,uni -sm-1) = newEnroll (y+2,s,uni)/ newEnroll (y-1,s,sm)

(3)Similarly, we can calculate the probability of the group of each grade in senior middle school that can enroll in university in year *y*.

Note:

1) By using different years' enrollment population in the calculation of enrollment rate, an adjustment has already been made for survival rate. Therefore, the survival rate is not included in the formula. We also assume that no one drops out, skips a grade, repeats a grade, or takes leaves for a year or more within a certain education category.

2) We could only calculate the primary school enrollment rate till 2003 for lack of data We use the same enrollment rates in 2003 for years after 2003. Likewise, for junior middle school and high school enrollment rates, we fix the enrollment rates for 2007 and 2008 at the 2006 levels.

4. Lifetime income calculation for in-school population

The number of years discounted until they realize the higher level of lifetime income depends on the number of years it takes to complete the starting grade level and the current grade of enrollment within the starting grade level.

4.1 Lifetime income of population in primary school by age and sex

(1) If an individual in the first grade of primary school can advance to the

next higher education level, he could get lifetime income equal to someone who is currently six years older and whose educational attainment is junior middle school. We discount that income by 6 years to reflect the fact that it takes 6 years for him to reach junior middle school: senr(y,s,a,jm-pri)*mi(y,s,a+6,jm)*R^6.

(2) If an individual in the second grade of primary school can advance to the next higher education level, his life time income calculated as: senr(y,s,a,jm-pri-1)*mi(y,s,a+5,jm)*R^5 , discounted by 5 years as it takes him 5 years to reach junior middle school.

(3) Similarly, we can calculate the lifetime income of the group in each grade of primary school.

4.2 Lifetime income of the group in junior middle school and above by age and sex

Take junior middle school as an example,

(1) If an individual in the first grade of junior middle school can advance to the next higher education level, he could get lifetime income equal to someone who is currently three years older and whose educational attainment is senior middle school.- We discount that income by 3 years as it takes 3 years for him to reach senior middle school: senr(y,s,a,sm-jm)*mi(y,s,a+3,sm)*R^3

(2) If an individual in the second grade of junior middle school can advance to the next higher education level, his lifetime income is calculated as senr(y,s,a,sm-jm-1)*mi(y,s,a+2,sm)*R^2 , discounted by 5 years as it takes 2 years for hime to reach senior middle school.

(3) Similarly, we can calculate the lifetime income of the group in each

grade of junior middle school.

For the years that we do not home separate enrollments for university and college (there are five categories for education level, and the last level is college and above), we get the lifetime income of the group in the first grade of senior middle school as senr(y,s,a,col-sm)*mi(y,s,a+3,col)*R^3. For grade 2 and 3 students, the lifetime income are given by:

$$senr(y,s,a,col\text{-}sm\text{-}1)*mi(y,s,a+2,col)*R^2$$

and

$$senr(y,s,a,col\text{-}sm\text{-}1)*mi(y,s,a+2,col)*R$$

respectively.

For the years that separate university and college enrollments are available (there are six categories for education level, and the last level is university and above), we should use the lifetime income equation are:

$$senr(y,s,a,col\text{-}sm)*mi(y,s,a+3,col)*R^3+senr(y,s,a,uni\text{-}sm)*mi(y,s,a+3,uni)*R^3$$

as for a senior middle school students, they can go to college or university after their graduation.

For grade 2 students, the lifetime income is calculated as $senr(y,s,a,col\text{-}sm\text{-}1)*mi(y,s,\ a+2,col)*R^2+senr(y,s,a,uni\text{-}sm\text{-}1)*mi(y,s,a+2,uni)*R^2$. Similarly, we can calculate the lifetime income of the group in each grade of senior middle school.

Note: By using the average ratio of the sum of all students of any age in a year who are initially enrolled to the sum of all students of any age initially enrolled in the next higher education level 'X' years later, an adjustment has already been made for age-specific survival rates. Accordingly, survival rate does not appear in the formula.

5. Out-of-school population's lifetime income

5.1 Calculation of out-of-school population

In-school population of age a, sex s, education level e in year y, pop_inschool(y,s,a,e), is the sum of population of each grade:

$$pop\_inschool(y,s,a,e) = \sum_{n=0}^{y(e)} pop\_inschool(y,s,a,e-n)$$

where y(e) is the number of years to achieve education level e. The formula for calculating out-of-school population of age a, sex s, education level e in year y is:

pop_nischool(y,s,a,e) = pop(y, s, a,e) - pop_inschool(y,s,a,e)

Note: Following adjustment is made for negative values in out-of-school population

(1) Reset negative out-of-school population for certain gender, age, education level to 0. The negative out-of-school population mainly appears in primary school for students aged 5-10.

(2) Add the weighted negative out-of-school population for certain gender, age, education level to the in-school population by grades, where the weights are the proportion of population in each grade for by gender, age, and education level.

5.2 Out-of-school population's lifetime income

The out-of-school population consists of people who are working. For people below the age of 60, the formula for lifetime income is:

mi(y,s,a,e) = ymi(y,s,a,e) + sr(y+1,s)*mi((y,s,a+1,e)*R

For those who are over 60, lifetime income is zero, i.e. ymi = 0.

6. Growth rate of real wage and discount rate

6.1 Growth rate of real wage

We use the average labor productivity growth rate to approximate the real wage growth rate of urban and rural areas. Specifically, we use the labor productivity of the primary sector for the rural population and the labor productivity of the secondary and tertiary sectors for the urban population. The growth rates of real wage are 6.14% for the urban population and 4.33% for the rural population.

6.2 Discount rate

The discount rate we use is 4.58%, This discount rate was used in Jorgenson and Yun (1990) and Jorgenson and Fraumeni (1992a).- It is based on the rate of return on long-term investments in the private sector of the U.S. economy. This is also the rate adopted by the OECD consortium (OECD 2010).

7. Tax rate and non-market income

(1) We use the Mincer equation to estimate annual income of the employed population. For incomes reported in CHIP, CHNS and UHS, it is not clear whether it is the after-tax income. Therefore we do not deduct tax when estimating the average market annual income.

(2) Non-market lifetime income is not included in the calculation; the final human capital stock estimates are derived from market income only.

8. Human capital stock in China: 1985-2009

The income estimated by the Mincer equation is the real yearly income (using 1985 as the based). We use CPI and real income to obtain the nominal yearly income.

Tables C.1－C.8 report the real human capital in China with 1985 as the baseline year. Table C.9-C.16 show the labor force human capital. We create a new human capital series starting from 2000, as the reported education categories separates college from university or above.

Tables and figures of appendix C

Table C.1 Urban Real Human Capital 1985-2009, in Billions

Year	Total	Male	Female
1985	10140	6468	3672
1986	11051	7050	4001
1987	11905	7590	4315
1988	11517	7378	4139
1989	11447	7340	4107
1990	13228	8496	4732
1991	14463	9261	5202
1992	15377	9812	5565
1993	15423	9847	5576
1994	14227	9105	5122
1995	13965	8898	5067
1996	15648	9960	5688
1997	18506	11790	6716
1998	22447	14340	8107
1999	27368	17440	9928
2000	32430	20660	11770
2001	37330	23750	13580
2002	44230	28130	16100
2003	51300	32660	18640
2004	57350	36430	20920
2005	66550	41860	24690
2006	72440	46310	26130
2007	80210	51210	29000
2008	88340	56230	32110
2009	102920	65560	37360

Note: The results are based on five education categories.

Table C.2 Urban Real Human Capital 2000-2009, in Billions

Year	Total	Male	Female
2000	32710	20820	11890
2001	37680	23950	13730
2002	44690	28400	16290
2003	51870	32990	18880
2004	58020	36810	21210
2005	67690	42510	25180
2006	73370	46850	26520
2007	81320	51860	29460
2008	89690	57030	32660
2009	104590	66550	38040

Note: The results are based on six education categories.

Table C.3 Rural Real Human Capital 1985-2009, in Billions

Year	Total	Male	Female
1985	15893	9294	6599
1986	16732	9845	6887
1987	17603	10420	7183
1988	16898	10070	6828
1989	15924	9522	6402
1990	17169	10320	6849
1991	18714	11300	7414
1992	19850	12040	7810
1993	19541	11940	7601
1994	17678	10860	6818
1995	16664	10230	6434
1996	16965	10450	6515
1997	18251	11320	6931
1998	20242	12650	7592
1999	22593	14240	8353
2000	24923	15810	9113
2001	26734	16990	9744

2002	28940	18450	10490
2003	30680	19600	11080
2004	31750	20350	11400
2005	33510	21490	12020
2006	36480	23530	12950
2007	38080	24650	13430
2008	39390	25610	13780
2009	43540	28400	15140

Note: The results are based on five education categories.

Table C.4 Rural Real Human Capital 2000-2009, in Billions

Year	Total	Male	Female
2000	24706	15670	9036
2001	26503	16840	9663
2002	28700	18290	10410
2003	30410	19430	10980
2004	31440	20150	11290
2005	33140	21250	11890
2006	36080	23270	12810
2007	37630	24360	13270
2008	38920	25310	13610
2009	42940	28010	14930

Note: The results are based on six education categories.

Table C.5 Urban Per Capita Real Human Capital, 1985-2009

Unit: Thousand Yuan

Year	Total	Male	Female
1985	44.66	53.59	34.53
1986	46.50	56.09	35.74
1987	47.92	58.07	36.64
1988	44.70	54.03	34.19
1989	43.05	51.78	33.08
1990	48.58	58.16	37.50
1991	51.70	62.13	39.80

Year	Total	Male	Female
1992	53.64	64.55	41.32
1993	52.57	63.73	40.15
1994	47.35	57.63	35.95
1995	45.50	55.41	34.62
1996	47.85	58.34	36.39
1997	53.27	64.94	40.51
1998	61.10	74.32	46.48
1999	70.65	85.64	54.03
2000	79.69	96.26	61.20
2001	88.20	106.91	67.52
2002	100.43	122.44	76.43
2003	112.16	137.12	85.03
2004	122.01	148.92	92.81
2005	138.44	167.14	107.22
2006	147.63	181.03	111.26
2007	159.93	195.81	120.84
2008	172.46	210.48	131.02
2009	197.04	240.42	149.66

Note: The results are based on five education categories.

Table C.6 Urban Per Capita Real Human Capital, 2000-2009

Unit: Thousand Yuan

Year	Total	Male	Female
2000	80.39	96.99	61.86
2001	89.04	107.81	68.31
2002	101.48	123.61	77.34
2003	113.39	138.46	86.13
2004	123.44	150.50	94.09
2005	140.80	169.74	109.33
2006	149.53	183.16	112.90
2007	162.17	198.33	122.76
2008	175.09	213.46	133.27
2009	200.25	244.05	152.40

Note: The results are based on six education categories.

Table C.7 Rural Per Capita Real Human Capital, 1985-2009

Unit: Thousand Yuan

Year	Total	Male	Female
1985	21.68	24.24	18.88
1986	22.76	25.55	19.69
1987	23.86	26.88	20.51
1988	22.71	25.70	19.38
1989	21.21	24.06	18.03
1990	22.61	25.75	19.10
1991	24.56	28.11	20.59
1992	26.00	29.89	21.65
1993	25.55	29.57	21.05
1994	23.10	26.91	18.85
1995	21.78	25.44	17.73
1996	22.45	26.33	18.15
1997	24.46	28.81	19.62
1998	27.52	32.58	21.86
1999	31.24	37.16	24.56
2000	35.03	41.84	27.32
2001	38.45	46.10	29.82
2002	42.62	51.32	32.84
2003	46.34	56.01	35.48
2004	49.12	59.64	37.35
2005	53.19	64.77	40.31
2006	58.88	72.01	44.23
2007	62.74	76.80	46.95
2008	66.26	81.22	49.35
2009	74.71	91.75	55.41

Note: The results are based on five education categories.

Table C.8 Rural Per Capita Real Human Capital, 2000-2009

Unit: Thousand Yuan

Year	Total	Male	Female
2000	**35.03**	**41.85**	**27.32**
2001	**38.45**	**46.10**	**29.82**
2002	**42.62**	**51.32**	**32.84**
2003	**46.33**	**56.01**	**35.48**
2004	**49.11**	**59.64**	**37.35**
2005	**53.19**	**64.77**	**40.31**
2006	**58.88**	**72.01**	**44.23**
2007	**62.74**	**76.81**	**46.96**
2008	**66.26**	**81.22**	**49.36**
2009	**74.72**	**91.75**	**55.42**

Note: The results are based on six education categories.

Table C.9 Urban Real Labor Force Human Capital 1985-2009, in Billions

Year	Total	Male	Female
1985	4805	3094	1711
1986	5306	3407	1899
1987	5719	3668	2051
1988	5706	3675	2031
1989	5863	3791	2072
1990	6711	4368	2343
1991	7389	4787	2602
1992	7809	5041	2768
1993	7706	4971	2735
1994	6913	4450	2463
1995	6662	4273	2389
1996	7334	4725	2609
1997	8650	5599	3051
1998	10662	6936	3726
1999	13013	8492	4521

2000	15670	10280	5390
2001	17721	11600	6121
2002	20456	13370	7086
2003	23216	15170	8046
2004	25060	16380	8680
2005	28044	18330	9714
2006	31520	20740	10780
2007	33980	22400	11580
2008	36140	23850	12290
2009	41880	27730	14150

Note: The results are based on five education categories.

Table C.10 Urban Real Total Human Capital 2000-2009, in Billions

Year	Total	Male	Female
2000	**15294**	**10030**	**5264**
2001	**17393**	**11380**	**6013**
2002	**20210**	**13210**	**7000**
2003	**23117**	**15110**	**8007**
2004	**25188**	**16460**	**8728**
2005	**28205**	**18430**	**9775**
2006	**31720**	**20860**	**10860**
2007	**34210**	**22540**	**11670**
2008	**36410**	**24020**	**12390**
2009	**42220**	**27940**	**14280**

Note: The results are based on six education categories.

Table C.11 Rural Real Labor Force Human Capital 1985-2009, in Billions

Year	Total	Male	Female
1985	7922	4682	3240
1986	8451	5010	3441
1987	9092	5414	3678
1988	8874	5319	3555
1989	8491	5119	3372

Year	Total	Male	Female
1990	9276	5621	3655
1991	10251	6232	4019
1992	10958	6686	4272
1993	10774	6608	4166
1994	9613	5921	3692
1995	9041	5587	3454
1996	9234	5755	3479
1997	9996	6279	3717
1998	11230	7114	4116
1999	12509	7985	4524
2000	13831	8896	4935
2001	14837	9544	5293
2002	16071	10350	5721
2003	17229	11100	6129
2004	17547	11310	6237
2005	18433	11880	6553
2006	20588	13360	7228
2007	21980	14320	7660
2008	23026	15060	7966
2009	25628	16830	8798

Note: The results are based on five education categories.

Table C.12 Rural Real Labor Force Human Capital 2000-2009, in Billions

Year	Total	Male	Female
2000	13717	8823	4894
2001	14715	9466	5249
2002	15943	10270	5673
2003	17076	11000	6076
2004	17376	11200	6176
2005	18232	11750	6482
2006	20371	13220	7151
2007	21731	14160	7571
2008	22753	14880	7873
2009	25279	16600	8679

Note: The results are based on six education categories.

Table C.13 Urban Per Capita Real Labor Force Human Capital, 1985-2009

Unit: Thousand Yuan

Year	Total	Male	Female
1985	33.71	40.83	25.62
1986	35.24	42.94	26.66
1987	36.22	44.41	27.23
1988	34.05	41.61	25.62
1989	33.22	40.39	25.07
1990	37.11	44.98	27.98
1991	39.24	47.76	29.55
1992	40.14	49.07	30.14
1993	38.59	47.51	28.77
1994	34.13	42.26	25.33
1995	32.19	40.02	23.85
1996	33.56	41.75	24.77
1997	37.20	46.34	27.31
1998	42.71	53.35	31.16
1999	48.89	61.06	35.57
2000	55.10	68.90	39.86
2001	59.95	75.26	43.27
2002	67.00	84.50	48.18
2003	73.77	93.30	52.90
2004	78.38	99.38	56.03
2005	84.94	107.79	60.67
2006	93.05	118.52	65.84
2007	98.63	125.51	69.75
2008	103.91	131.96	73.56
2009	117.96	149.75	83.31

Note: The results are based on five education categories.

Table C.14 Urban Per Capita Real Labor Force Human Capital, 2000-2009

Unit: Thousand Yuan

Year	Total	Male	Female
2000	**54.37**	**68.07**	**39.30**
2001	**59.38**	**74.60**	**42.83**
2002	**66.62**	**84.07**	**47.87**
2003	**73.72**	**93.28**	**52.82**
2004	**78.78**	**99.86**	**56.35**
2005	**85.43**	**108.38**	**61.06**
2006	**93.64**	**119.23**	**66.30**
2007	**99.32**	**126.33**	**70.29**
2008	**104.69**	**132.89**	**74.18**
2009	**118.92**	**150.90**	**84.08**

Note: The results are based on six education categories.

Table C.15 Rural Per Capita Real Labor Force Human Capital, 1985-2009

Unit: Thousand Yuan

Year	Total	Male	Female
1985	18.50	20.78	15.97
1986	19.48	21.99	16.71
1987	20.54	23.30	17.48
1988	19.60	22.34	16.57
1989	18.37	20.98	15.44
1990	19.62	22.50	16.39
1991	21.28	24.53	17.65
1992	22.49	26.06	18.51
1993	21.94	25.62	17.87
1994	19.58	23.02	15.79
1995	18.37	21.72	14.70
1996	18.92	22.49	14.98
1997	20.56	24.57	16.12
1998	23.12	27.80	17.92
1999	25.97	31.34	19.94

2000	28.89	35.01	21.96
2001	31.39	38.22	23.75
2002	34.56	42.29	25.97
2003	37.50	46.07	28.06
2004	39.17	48.31	29.16
2005	42.17	52.16	31.30
2006	47.26	58.71	34.73
2007	50.83	63.18	37.23
2008	53.86	66.96	39.33
2009	60.96	75.91	44.28

Note: The results are based on five education categories.

Table C.16 Rural Per Capita Real Labor Force Human Capital, 2000-2009

Unit: Thousand Yuan

Year	Total	Male	Female
2000	**28.89**	**35.01**	**21.96**
2001	**31.40**	**38.22**	**23.75**
2002	**34.56**	**42.30**	**25.97**
2003	**37.51**	**46.08**	**28.06**
2004	**39.17**	**48.32**	**29.16**
2005	**42.17**	**52.17**	**31.30**
2006	**47.27**	**58.73**	**34.74**
2007	**50.84**	**63.20**	**37.24**
2008	**53.88**	**66.98**	**39.34**
2009	**60.98**	**75.94**	**44.29**

Note: The results are based on six education categories.

Appendix D: Calculation and selection of growth rate and discount rate

According to the income-based approach, human capital is computed from the discounted lifetime income.[114] In order to evaluate the lifetime income of a country, we need to estimate the lifetime income and adjust it by the survival rate. The future income of an individual with known gender and educational level is based on the average income of the group with the identical personal characteristics as this particular individual, and we must take into account the annual growth rate of real income.[115] We then convert the future income into current value according to the discount rate. Since we build the human capital indices for urban and rural areas separately, we use different growth rates and discount rates for urban and rural areas.

1. Growth rates

1.1 Growth rate of real income

The growth rates of real annual income are reported in the series of the *China Statistical Yearbook* published by National Bureau of Statistics of China. For urban areas, the average wage index divided by 100 is the growth rate of real wage. The wage only includes labor wage, which is defined as the average labor wage adjusted by inflation rate. 'Labor' refers to 'those who work in or get paid from business firms of varying ownership

[114] Jorgenson, Dale W. and Barbara M. Fraumeni (1992b), "The Output of the Education Sector," in Z. Griliches, T. Breshnahan, M. Manser, and E. Berndt (eds.), The Output of the Service Sector, Chicago, NBER, 1992, pp. 303-341

[115] Jorgenson, D. W. and K - Y. Yun (1990). "Tax Reform and U.S. Economic Growth", *Journal of Political Economy*98: pp.S151-193.

types, including the state-owned, urban collective, joint venture, joint-stock, foreign and Hong Kong, Macao and Taiwan invested in other units and its subsidiary bodies.' The average wage index 'reflects the relative change of real wage, indicating the degree that the level of real wage increases or decreases.[116] The calculation of the average growth rate of real wage is given in Table D.1. Table D.1 shows the average growth rate is 7.22% over the period of 1978 – 2009. The annual growth rates are plotted in Figure D.1.

For rural areas, we adopt, in general, the net income to evaluate the income status of farmers. According to the *China Statistical Yearbook*, 'net income' refers to 'the sum of income from all sources deducted from the corresponding expenses'. The 'net income is equal to total income – tax and fees – household operation expenses – depreciation of fixed assets used in productive activities – gifts to relatives.' The average net income of farmers is 'the level of net income with regards to the population, indicating the mean income of a region or a resident in a rural household.[117] Netting out the rate of inflation, we arrive at the growth rate of net per capita income in rural areas from 1978 - 2009.

The above estimations of urban and rural income growth rates have obvious shortcomings. For urban areas, because the wage is only one of many possible sources of income, the income estimates may not be very comprehensive. For rural areas, the net income per capita includes all the family members in the household regardless their employment status. As a result, it is not an accurate measure of the growth rate of productivity.

[116] All definitions here come from National Statistical Yearbook.

[117] National Bureau of Statistics of China, China Statistical Yearbook 2008, Website: http://www.stats.gov.cn/tjsj/ndsj/2008/indexch.htm.

1.2 Growth rate of labor productivity

The Harrod-Neutral production function is:

$$Y=F(K, A(t) L(t))$$

$$A(t)=A_0e(\theta t)$$

$$L(t)=L_0e(nt)$$

where A(t) is the measure of technology level, A>0 and dA/dt>0. θ is the growth rate of technology and n is the population growth rate. At the steady state, the growth rate of labor productivity (Y/L) and of real wage (w) equal to θ. Thus, under the assumption that technological changes are Harrod-Neutral, income and labor productivity grow at the same rate.[118]

The real GDP is calculated as follows:

Real GDP = 1978 Nominal GDP * Real GDP Index (base = 1978)

Thus, the growth rate of labor productivity is calculated as follows:

Labor productivity = (1978 Nominal GDP * Real GDP Index)/ Employment Growth rate of labor productivity for year *t* = ln (Labor productivity for year *t*) - ln (Labor productivity for year *t*-1)

According to the above method, the growth rate of labor productivity is 7.09% (Table D.1).

To calculate the rural and urban growth rate of labor productivity, we use primary industry GDP for rural areas and secondary and tertiary industries GDP for urban areas.

Labor productivity the rural sector is calculated as follows:

Labor productivity of the rural sector = Real GDP of Agriculture/Employment of Agriculture

Labor productivity of the urban sector=Real GDP of secondary and tertiary industries/Employment of secondary and tertiary industries.

---

[118] http://homepage.newschool.edu/het/essays/growth/neoclass/solowtech.htm

The rural and urban growth rates of labor productivity are 4.33% and 6.14%, respectively.

Some studies use the growth rate of GDP per capita as the urban growth rate of labor productivity,[119] which is far greater than our estimation. Since they use population instead of employment, their estimates are less accurate.

Figure D.1 shows the annual growth rates of labor productivity and real wage at the national level. Figure D.2 shows the annual growth rates of labor productivity for the urban and rural sectors. As shown in Figure D.1, although the mean values of the growth rate of labor productivity and real wage are close, the annual growth rate of real wage varies dramatically. In Figure D.2, we notice that the rural growth rate is mostly lower than the urban growth rate. One possible reason is that the service and industry sectors have grown faster than the agriculture sector during the past thirty years.

We choose 4.33% and 6.14% as the rates of income growth for individuals in rural and urban areas respectively. After thirty years of economic transition, China's average growth rate is close to steady-state. In future research, we will apply time-varying growth rates to better reflect structural changes in the Chinese economy.

1.3 International Comparison

According to the Bureau of Labor Statistics of the United States, the estimated annual growth rates of labor productivity over the period 1979-2007 are 1.5% for U.S., 2.0% for Japan, and 4.3% for South Korea. OECD, using GDP per hour worked to measure labor productivity, reports estimates of 1.62% for U.S. from 1979 to 2007, 2.61% for Japan, and 5.29%

[119] Xu Xunchuan (2008), "The analysis of labor productivity's impact on employment." *Contemporary Finance & Economics* 10: pp.17-22

for South Korea (Data for 1978 and 1979 are missing). In addition, the labor productivity of Taiwan increased significantly from 7.38% during the period of 1953 – 1961 to 9.15% during the period of 1962 – 1971, and fell to 3.84% during the period of 1972 -1981.[120] The United States Bureau of Labor Statistics also published annual data on labor productivity in the non-agriculture sector, which indicate labor productivity grew 1.4%-1.5% per year from 1979-1995 and 2.5% per year from 1995-2008.[121]

2. Discount Rate

Discount rate reflects the time value of currency and is derived based on the return on long-term investments. The discount rate of 4.58%, used in Jorgenson and Yun (1990) and Jorgenson and Fraumeni (1992a), is based on the rate of return on long-term investments in the private sector of the U.S. economy. This is also the rate adopted by the OECD consortium (OECD 2010). We adopt it as well.

[120] Zhang Yushan(1987), "The comparison of labor productivity of Taiwan and South Korea." *Asia-pacific Economic Review* 6

[121] http://data.bls.gov/PDQ/servlet/SurveyOutputServlet and http://www.bls.gov/fls/#tables

Tables and figures of appendix D

Table D.1 Growth Rate in China, 1978-2009

Year	Nominal GDP （100 million）	Real GDP indices (1978 =100)	Real GDP （100 Million Yuan）	Employed person (10 thousand)	Labor productivity (Yuan per person)	National labor productivity growth rate	National average real wage growth rate
1978	3645.22	100.00	3645.22	40152	907.85		
1979	4062.58	107.60	3922.25	41024	956.09	0.0518	0.0660
1980	4545.62	116.01	4228.75	42361	998.26	0.0432	0.0610
1981	4891.56	122.09	4450.47	43725	1017.83	0.0194	-0.0120
1982	5323.35	133.15	4853.54	45295	1071.54	0.0514	0.0130
1983	5962.65	147.60	5380.29	46436	1158.65	0.0782	0.0150
1984	7208.05	170.00	6196.81	48197	1285.72	0.1041	0.1480
1985	9016.04	192.89	7031.28	49873	1409.84	0.0922	0.0530
1986	10275.18	209.95	7653.29	51282	1492.39	0.0569	0.0820
1987	12058.62	234.27	8539.80	52783	1617.91	0.0808	0.0090
1988	15042.82	260.70	9503.13	54334	1749.02	0.0779	-0.0080
1989	16992.32	271.29	9889.27	55329	1787.36	0.0217	-0.0480
1990	18667.82	281.71	10268.92	64749	1585.96	-0.1195	0.0920
1991	21781.50	307.57	11211.50	65491	1711.91	0.0764	0.0400
1992	26923.48	351.37	12808.09	66152	1936.16	0.1231	0.0670
1993	35333.92	400.43	14596.65	66808	2184.87	0.1208	0.0710
1994	48197.86	452.81	16506.00	67455	2446.96	0.1133	0.0770
1995	60793.73	502.28	18309.27	68065	2689.97	0.0947	0.0380
1996	71176.59	552.55	20141.76	68950	2921.21	0.0825	0.0380
1997	78973.03	603.92	22014.35	69820	3153.01	0.0764	0.0110
1998	84402.28	651.23	23738.81	70637	3360.68	0.0638	0.0720
1999	89677.05	700.85	25547.66	71394	3578.40	0.0628	0.1307
2000	99214.55	759.95	27701.66	72085	3842.92	0.0713	0.1140
2001	109655.17	823.02	30000.98	73025	4108.32	0.0668	0.1519
2002	120332.69	897.77	32725.69	73740	4437.98	0.0772	0.1545
2003	135822.76	987.78	36006.57	74432	4837.51	0.0862	0.1199

Year	Nominal GDP （100 million）	Real GDP indices (1978 =100)	Real GDP （100 Million Yuan）	Employed person (10 thousand)	Labor productivity (Yuan per person)	National labor productivity growth rate	National average real wage growth rate
2004	159878.34	1087.39	39637.85	75200	5270.99	0.0858	0.1045
2005	184937.37	1210.38	44120.90	75825	5818.78	0.0989	0.1280
2006	216314.43	1363.81	49713.90	76400	6507.06	0.1118	0.1267
2007	265810.31	1556.96	56754.58	76990	7371.68	0.1248	0.1359
2008	314045.43	1706.97	62222.70	77480	8030.81	0.0856	0.1100
2009	340506.87	1862.53	67893.10	77995	8704.80	0.0806	

Data Source：

1. Total employed person and average real wage growth rate of 1978-2009: 60-year statistic data of New China, Department of Comprehensive Statistics of National Bureau of Statistics of China, Beijing, China Statistics Press
2. Other data: National Bureau of Statistics of China, China Statistical Yearbook 2010.

Note:

1. Indices of Gross Domestic Product (1978=100)：Real GDP index is the multiple of nominal GDP based on base GDP, which is calculated based on constant price. Here the base year indicates 1978.
2. Employed Persons refers to persons aged 16 and over who are engaged in gainful employment and thus receive remuneration payment or earn business income.
3. Average real wage growth rate equals to indices of average real wage growth rate (preceding year=100) divided by 100. Average real wage of staff and workers refers to the average wage of staff and workers after removing the effects of the price changes. Average real wage indices of staff and workers refers to the change of real wage, which reflects the relative increasing or decreasing level of real wage of staff and workers. Here wage only indicates wage of staff and workers; staff and workers refer to persons working in, and receive payment from units of state ownership, collective ownership, joint ownership, share holding ownership, foreign ownership, and ownership by entrepreneurs from Hong Kong, Macao, and Taiwan, and other types of ownership and their affiliated units.
4. Real GDP=Nominal GDP of 1978 * Indices of GDP(1978=100)
5. Labor Productivity Growth Rate= Ln (Labor Productivity of year *t*) - Ln (Labor Productivity of year *t*-1).

Table D.2 Growth Rate of Labor Productivity of Urban and Rural Sector

Year	Labor productivity growth rate in rural sector				Labor productivity growth rate in urban sector			
	Real GDP of primary industry (100 million)	Total employed persons of primary industry (10 thousand)	Labor productivity of primary industry（Yuan per person）	Labor productivity growth rate of primary industry	Real GDP of secondary and tertiary industry (100 Million)	Total employed persons of secondary and tertiary industry (10 Thousand)	Labor productivity of secondary and tertiary industry (Yuan per person)	Labor productivity growth rate of secondary and tertiary industry
1978	1027.53	28318	362.86		2617.68	11835	2211.81	
1979	1090.21	28634	380.74	0.0481	2829.36	12391	2283.40	0.0319
1980	1074.39	29122	368.93	-0.0315	3141.99	13239	2373.29	0.0386
1981	1149.41	29777	386.01	0.0453	3285.95	13948	2355.86	-0.0074
1982	1281.93	30859	415.42	0.0734	3550.37	14436	2459.38	0.0430
1983	1388.66	31151	445.78	0.0706	3978.19	15285	2602.68	0.0566
1984	1567.53	30868	507.82	0.1303	4624.06	17329	2668.39	0.0249
1985	1596.43	31130	512.83	0.0098	5475.72	18743	2921.47	0.0906
1986	1649.41	31254	527.74	0.0287	6072.21	20027	3032.01	0.0371
1987	1727.00	31663	545.43	0.0330	6918.75	21121	3275.77	0.0773
1988	1770.94	32249	549.15	0.0068	7888.05	22085	3571.68	0.0865
1989	1825.40	33225	549.41	0.0005	8231.92	22105	3724.01	0.0418
1990	1959.16	38914	503.46	-0.0873	8467.07	25835	3277.37	-0.1278
1991	2006.18	39098	513.12	0.0190	9482.73	26393	3592.90	0.0919
1992	2100.49	38699	542.78	0.0562	11189.03	27453	4075.70	0.1261
1993	2199.24	37680	583.66	0.0726	13114.80	29128	4502.47	0.0996
1994	2287.22	36628	624.45	0.0675	15207.21	30827	4933.08	0.0913
1995	2401.60	35530	675.94	0.0792	17122.74	32535	5262.87	0.0647
1996	2524.11	34820	724.90	0.0699	19053.79	34130	5582.71	0.0590
1997	2612.44	34840	749.84	0.0338	21064.22	34979	6021.96	0.0757
1998	2703.85	35177	768.64	0.0248	22906.61	35460	6459.84	0.0702
1999	2779.56	35768	777.11	0.0110	24853.24	35626	6976.15	0.0769
2000	2846.27	36043	789.69	0.0161	27220.98	36042	7552.57	0.0794

Year	Labor productivity growth rate in rural sector				Labor productivity growth rate in urban sector			
	Real GDP of primary industry (100 million)	Total employed persons of primary industry (10 thousand)	Labor productivity of primary industry（Yuan per person）	Labor productivity growth rate of primary industry	Real GDP of secondary and tertiary industry (100 Million)	Total employed persons of secondary and tertiary industry (10 Thousand)	Labor productivity of secondary and tertiary industry (Yuan per person)	Labor productivity growth rate of secondary and tertiary industry
2001	2925.97	36513	801.35	0.0147	29670.32	36512	8126.18	0.0732
2002	3010.82	36870	816.61	0.0189	32643.08	36870	8853.56	0.0857
2003	3086.09	36546	844.44	0.0335	36457.69	37886	9623.00	0.0833
2004	3280.52	35269	930.14	0.0967	40391.58	39931	10115.34	0.0499
2005	3452.11	33970	1016.22	0.0885	45289.87	41855	10820.66	0.0674
2006	3624.72	32561	1113.21	0.0912	51457.34	43839	11737.80	0.0814
2007	3760.43	31444	1195.91	0.0717	59352.91	45546	13031.42	0.1046
2008	3962.68	30654	1292.71	0.0778	65311.04	46826	13947.60	0.0679
2009	4128.46	29708	1389.68	0.0723	71679.22	48287	14844.41	0.0623

Data Source:

Data Source：

3. Total employed person and average real wage growth rate of 1978-2009: 60-year statistic data of New China, Department of Comprehensive Statistics of National Bureau of Statistics of China, Beijing, China Statistics Press
4. Other data: National Bureau of Statistics of China, China Statistical Yearbook 2010.

Note:

1. Because of data accessibility and statistical accuracy, we use labor productivity of primary industry to measure labor productivity of rural sector, and use labor productivity of secondary and tertiary industry to measure labor productivity of urban sector, although there exists some primary industry in urban sector, secondary and tertiary industry in rural sector. Primary industry refers to agriculture, forestry, animal husbandry and fishery and services in support of these industries. Secondary industry refers to mining and quarrying, manufacturing, production and supply of electricity, water and gas, and construction. Tertiary industry refers to all other economic activities not included in the primary or secondary industries.

2. Indices of Gross Domestic Product (1978=100)：Real GDP index is the multiple of nominal GDP based on base GDP, which is calculated based on constant price. Here, the base year indicates 1978. Real GDP=Nominal GDP of 1978 * Indices of GDP (1978=100)
3. Labor Productivity Growth Rate= Ln (Labor Productivity of year *t*) -Ln (Labor Productivity of year *t*-1).
4. In some years, the sums of employed person in three industries in table 2 are more than total employed person in table 1; in some other years, it is the opposite. The reason might be round off.
5. The article calculates the real GDP in the form of multiplication of real GDP indices and base GDP. The Statistical Bureau publishes the national and industrial real GDP indices (base year=1978) in the yearbook. It is possible that the summation of three industries' real GDP is unequal to the national real GDP due to the inconsistent GDP growth in different industries.

Figures of appendix D

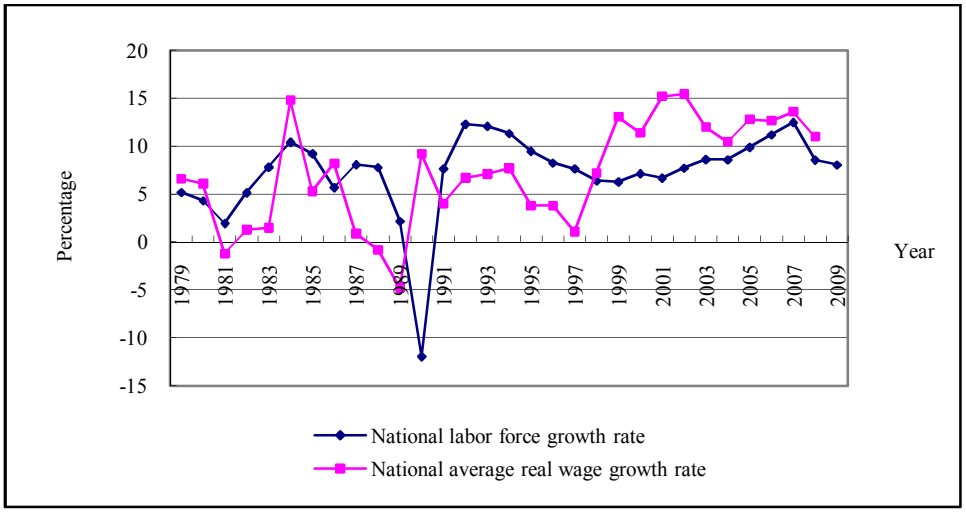


Figure D.1 Growth Rate of National Labor Productivity and Average Real Wage

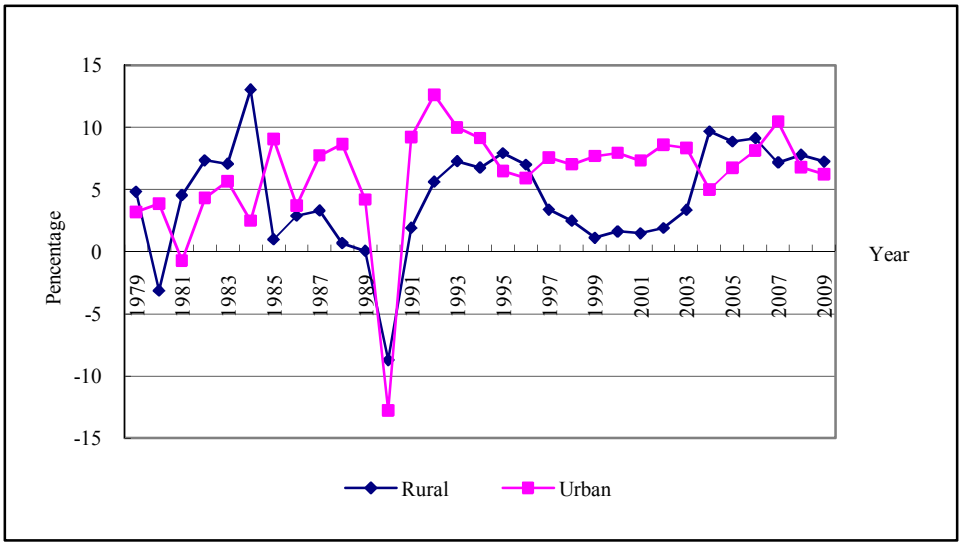


Figure D.2 Growth Rate of Labor Productivity in Urban and Rural Sectors

Appendix for provincial human capital calculation

See the Chinese version report.

Reference List

Abraham, Katharine G. June (2010), Survey of Current Business, Accounting for Investments in Formal Education, pp. 42-53.

Abraham, Katharine (2005), Beyond the Market: Designing Nonmarket Accounts for the United States, National Academies Press, Washington, D.C.

Ahlroth, Sofia, A. and Bjorklund, A. Forslund (1997), "The Output of the Swedish Education Sector", *Review of Income and Wealth* Volume 43, Number 1, pp.89-104.

Ashenfelter, Orley and Krueger, Alan (1994), "Estimates of the Economic Return to Schooling from a New Sample of Twins", *American Economic Review* 84, December, pp.1157-73.

Becker, G. (1964), *Human Capital*, 2nd edition, Columbia University Press, New York.

Brandt, Loren, Holz, Carsten (2006), Spatial price differences in China: estimates and implications. Economic Development and Cultural Change 55, 43–86.

Bureau of Statistics of China (2008), China Population Statistical Yearbook 2008, China Statistics Press, Beijing.

Cai Fang and Wang, Dewen(1999), "The Sustainability of China's Economic Growth and Labor Contributions", Economic Research (Chinese) 10, pp.62-68.

Christian, Michael (2010), "Human Capital Accounting in the United States, 1994-2006", Survey of Current Business, June 2010, pp. 31-36.

Coleman, J. (1990), Foundations of Social Theory, Belknap, 304.

Démurger, Sylvie (2001), "Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China?" Journal of Comparative Economics 19, pp.95-117.

Ederer, Peer (2006). "Innovation at Work: The European Human Capital Index", The Lisbon Council Policy Brief, in conjunction with Deutschland Denken! and Zeppelin University, Brussels, October 12.

Ederer, Peer, Philipp Schuller, and Stepham Willms (2007), "Innovation at work：The European Human Capital Index", The Lisbon Council Policy Brief, Volume 2, Number 3, Brussels.

Fleisher, Belton., and Chen, Jian (1997), "The Coast-Noncoast Income Gap, Productivity and Regional Economic Policy in China", Journal of Comparative Economics 252: pp.220-236.

Fleisher, Belton., Sabirianova, Klara., and Wang, Xiaojun (2005), "Returns to Skills and the Speed of Reforms: Evidence from Central and Eastern Europe, China, and Russia.", Journal of Comparative Economics 33, issue 2, pp.351-370.

Fleisher, Belton and Wang, Xiaojun (2004), "Skill Differentials, Return to Schooling, and Market Segmentation in a Transition Economy: the Case of Mainland China", Journal of Development Economics 73, pp.315-328.

Fleisher, Belton, Li Haizheng and Zhao Minqiang (2009), "Human Capital, Economic Growth, and Regional Inequality in China", *Journal of Development Economics*, forthcoming.

Fraumeni, Barbara M. (2006), "A Human Capital Approach to Measuring Government Education Output", presentation at the OECD/ONS/Government of Norway Workshop on the Measurement of

Non-market Output and Health, London, England, UK, October 4.

Fraumeni, Barbara M. (2008a), "Human Capital and Investment in Education: A Streamlined Approach", presentation at the Fondazione Giovanni Agnelli/OECD Workshop on the Measurement of Human Capital, Turin, Italy, November 3.

Fraumeni, Barbara M. (2008b), "Human Capital: From Indicators and Indexes to Accounts," paper presented at the Fondazione Giovanni Agnelli/OECD Workshop on the Measurement of Human Capital, Turin, Italy, November 4.

Fraumeni, Barbara M. (2009), "Further Comments: Results by Country and Future Efforts" presentation at a China Center for Human Capital and Labor Market Research seminar at the Central University of Finance and Economics, Beijing, China, June 19.

Greaker, Mads and Liu, Gang (2008) "Measuring the Stock of Human Capital for Norway: A Lifetime Labour Income Approach," paper presented at the Fondazione Giovanni Agnelli/OECD Workshop on the Measurement of Human Capital, Turin, Italy, November 3.

Griliches, Zvi, "Estimating the Returns to Schooling." *Econometrica* 45, 1977, pp.1-22.

Gu, Wulong and Wong, Ambrose (2008), "Human Development and its Contribution to the Wealth Accounts in Canada," paper presented at the Fondazione Giovanni Agnelli/OECD Workshop on the Measurement of Human Capital, Turin, Italy, November 3.

Gu, Wulong and Wong Ambrose (2009), "Human Development and its Contribution to the Wealth Accounts in Canada," paper presented at the Canadian Economic Association Annual Conference, May 29.

Heckman, James J. (2005), “China's Human Capital Investment”, China Economic Review 16, pp.50-70.

Holz, Carsten A. (2006), “New Capital Estimates for China”, China Economic Review 17, pp.142-185.

Hou,Yafei and Cao Yin(2000), ”Analysis of the Quality of Human Capital Stock”, Chinese Journal of Population Science(Chinese) 6, pp.43-48.

Hu,Angang(2002), ”From the Most Populous Country to A Country with Great Power of Human Capital:1980-2000”, Chinese Journal of Population Science(Chinese) 5, pp.1-10.

Hu,Yongyuan(2005), ”Human Capital and Economic Growth: A Co-integration Analysis”, Science and Technology Management Research(Chinese) 4, pp.88-90.

Jorgenson, Dale W. and Fraumeni, Barbara M. (1989), “The Accumulation of Human and Non-Human Capital, 1948-1984,” in R. Lipsey and H. Tice eds., *The Measurement of Saving, Investment and Wealth*, Chicago, University of Chicago Press, NBER, pp. 227-282.

Jorgenson, Dale W. and Fraumeni, Barbara M. (1992a), “Investment in Education and U.S. Economic Growth,” *Scandinavian Journal of Economics,* Vol. 94, supplement, pp. S51-70.

Jorgenson, Dale W. and Fraumeni, Barbara M. (1992b), “The Output of the Education Sector,” in Z. Griliches, T. Breshnahan, M. Manser, and E. Berndt eds., *The Output of the Service Sector*, Chicago, NBER, 1992, pp. 303-341.

Jorgenson, Dale W. and K – Y. Yun (1990),“Tax Reform and U.S. Economic Growth.” Journal of Political Economy 98:pp. S151-193.

Jorgenson, Dale W. , Mun S. Ho, and Kevin J. Stiroh (2005), Information Technology and the American Growth Resurgence, volume 3 of Productivity,

Harvard University Press, Cambridge, MA, 2005.

Joseph E. Stiglitz, Joseph E., Amartya Sen, and Jean-Paul Fitoussi (2009), Report by the Commission on the Measurement of Economic Performance and Social Progress, September 14.

Keeley, Brian (2007), *Human Capital, How What You Know Shapes Your Life*, OECD Insights, Paris.

Kendrick, J. (1976), The Formation and Stocks of Total Capital, NBER, Columbia University Press, New York, N.Y.

Koman, R., and Marin, D. (1997), "Human Capital and Macroeconomic Growth: Austria and Germany 1960-1997. An Update." IAS Economics Series No. 69.

Laroche, M. and Merette, M. (2000), "Measuring Human Capital in Canada." Ministry of Finance of Canada.

Le, Trinh Van Thi, Gibson, John, and Oxley, Les (2005), "Measuring the Stock of Human Capital in New Zealand," *Mathematics and Computers in Simulation*, Volume 68, Issue 5-6, May, pp. 485-98.

Le, Trinh, Gibson, John, and Oxley, Les (2003), "Cost- and Income-Based Measures of Human Capital." *Journal of Economic Surveys* 17, 3: pp.271-307.

Le, Trinh, Gibson, John, and Oxley, Les (2005), "Measures of Human Capital: A Review of the Literature." New Zealand Treasury Working Paper 05/10.

Li, Haizheng (2003), "Economic Transition and Returns to Education in China." *Economics of Education Review* 2 317-328.

Liu, Zhiqiang (1998), "Earnings, Education, and Economic Reforms in

Urban China." *Economic Development and Cultural Change* 46, pp.697-725.

Liu, Zhiqiang (2007), "The External Returns to Education: Evidence from Chinese Cities", Journal of Urban Economics 61 (3), pp.542-564.

Maurer-Fazio, Maggie (1999), "Earnings and Education in China's Transition to a Market Economy: Survey Evidence from 1989 and 1992." China Economic Review 10, pp.17-40.

Mincer, Jacob (1974), Schooling, Experience and Earnings. Columbia University Press. New York.

Mira, M. and Liu, G. (2010), "The OECD Human Capital Project: Progress Report," paper prepared for the 31st General Conference of the International Association for Research in Income and Wealth, St. Gallen, Switzerland, August 22-28 to the bibliography.

Mulligan, C. B., and Sala-i-Martin, X. (1997), "A Labor Income-based Measure of the Value of Human Capital: An Application to the States of the United States". *Japan and the World Economy* 9, 2: pp.159-191.

OECD (2001), *The Well-being of Nations: The Role of Human and Social Capital*, OECD, Paris.

Qian,Xuya, and Liu,Jie(2007), "Empirical Study of Human Capital in China", Statistic Research(Chinese) 3, pp.39-45.

Schultz, T. (1961), "Investment in Human Capital", *American Economic Review* 51, 1: pp.1-17.

Stroombergen, A., D. Rose and Nana, G. (2002), "Review of the Statistical Measurement of Human Capital", Statistics New Zealand working paper.

Wang,Dejin and Xiang,Rongmei(2006), "Estimates of Human Capital Stock

in China",Statistics and Decision (Chinese) 5, pp.100-102.

Wang, Xiaojun, Fleisher, Belton, Li, Haizheng, and Li, Shi (2009) "Access to Higher Education and Inequality: A Chinese Experiment." IZA Discussion Paper No. 2823.

Wei, Hui (2008) "Developments in the Estimation of the Value of Human Capital in Australia," paper presented at the Fondazione Giovanni Agnelli/OECD Workshop on the Measurement of Human Capital, Turin, Italy, November 3.

World Bank (1997), "Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development," Environmentally Sustainable Development Studies and Monographs Series No. 17, Washington, D.C.

World Bank (2006) *Where is the Wealth of Nations, Measuring Capital for the 21st Century*, The International Bank for Reconstruction and Development/The World Bank, Washington, DC.

Yang, Dennis (2005), "Determinants of Schooling Returns during Transition: Evidence from Chinese Cities." *Journal of Comparative Economics* 33, pp.244-264.

Yu,Shujing(2008), "Comprehensive Evaluation and Dynamic Analysis on China's Provincial-level Regional Human Capital", Modern Management Science(Chinese) 4, pp. 36-37.

Zhang Fan(2000), "Estimates of Physical Capital and Human Capital in China", Economic Research (Chinese) 8, pp.66-71.

Zhang Jun, Wu, Guiying, and Zhang Jipeng (2004), "Compilation of China's Provincial Capital Stock Series Using Perpetual Inventory Method, 1952-2000", Economic Research (Chinese), October.

Zhang, Junsen, Zhao, Yaohui, Park, Alberb, and Song, Xiaoqing (2005),

“Economic Returns to Schooling in Urban China, 1988-2001.” Journal of Comparative Economics 33, pp.730-752.

Zhou,Delu,(2005), ”Population-based Indicators of Human Capital Accounting Theory and Empirical Study”, Chinese Journal of Population Science(Chinese) 3, pp. 56-62.

Zhou Ya(2004), “Study on the Distribution Differences of China's Human Capital”, Education & Economics(Chinese) 2, pp.17-20.

Zhu,Pingfang, and Xu,Dafeng(2007), ”Estimation of Human Capital in Chinese Cities”, Economic Research (Chinese) 8, pp.84-95.

Prepared for

The Fourth International Symposium on Human Capital

Beijing, China

December 2012