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GEOGRAPHICAL HETEROGENEOUS RETURNS TO EDUCATION IN CHINA AND ITS DETERMINANTS

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ABSTRACT

In this thesis, I examine the education returns in selected areas of China by using data from the Chinese Household Finance Survey (CHFS) in 2001. I use Mincer's human capital earnings equation to measure the education returns in selected provinces and cities. Facing the endogeneity of the earnings equation, I incorporate the instrumental variable (IV) method to correct the bias. However, we still confront heterogeneity of returns to education by looking at the empirical results. Comparing to western interior areas, eastern coastal line areas have higher returns to education. In order to understand this heterogeneity, I use human capital investment model based on Benabou's work (1996) and the intergenerational persistence model based on Checchi's work (2006) to examine the possible factors that contributing to the heterogeneity.

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Chapter 1

Introduction

Economists have long been interested in the existence of heterogeneity in education return in the relation to individual schooling time, gender, degree level and education institution. In this paper, I will examine the heterogeneity of education returns across regions and its possible determinants based on the context of China.

Beginning at the 21st century, China has witnessed a dramatically expansion of education: the number of college graduates tripled over 2003 to 2010 (Hu, 2012). Education is an important part in people's life of seeking job, getting promoted as well as obtaining higher social welfare more than any other era in China's history. However, whether college or high school graduates benefit from their schooling; and to what extent or how uniform they benefit from additional years of schooling remain unclear between regions.

Education return measures the effect of one additional year of schooling on earning. Individual education returns are different among people with same level of education as each individual has different ability, preference and budget constraint. By expanding individual education return to regional average education return, we find heterogeneity or cross-section disparities in returns to education with higher return in coastal region and lower return at interior region. This geographical distribution of education returns comes from different characteristics of regional economy, including regional average human capital stock, public resources towards

education, as well as average income level. By understanding the causes of heterogeneous return to education across country, we can obtain more perspectives on how the features of China's reform, migration during the economic transition period shape education choices made by people.

In this paper, I examine the cross-section disparities in returns to education for six provinces and cities located in west interior and east coastal areas of China in 2011, using data from the Chinese Household Finance Survey (CHFS). CHFS contains specific individual information on earnings, education level, and other demographic characteristics cross provinces. In order to investigate education returns, I use Mincer's (1958) earnings equation, plus an instrumental variable of regional unemployment rate to correct the ability biasness in Mincer's (1958) equation. Empirical result shows that, on average, cities or provinces located in east coastal line have higher returns to education, comparing to which located in west interior area.

This empirical finding leads to my hypothesis that there existing some potential heterogeneities cross regions within China that biased the average returns to education in east upward, and in west downward. In order to explore the determinants of this biasness, I first claim that there is a stratification formed between east and west areas of China; then, under each segregated area, I claim that family wealth, labor market condition are the two determinants of education return dispersions between inland and coastal China.

The reason that buttress my hypothesis of stratification are based on the facts that China has undergo a large amount of interprovincial migration flow from west interior to east coastal line for decades. From 1982 to 2009, the average annual *hukou* migrants, who are officially granted hukou status by destination's government, are approximately 19 million (Chan, 2008). And data from 2000 Chinese census shows that, during 1995-2000, the total migration amount is over 144 million, which is roughly 12% of average provincial population during that period; and most of

the migrants move to metropolitan coastal cities and Beijing (Bao et al., 2007). Based on the geographical migration preference, I use the Human capital investment model of Benabou (1996), which demonstrates how the differences in individual wealth, preference and public education finance can result in economic stratification, where people with high stock of human capital cluster together in one area, leaving people with low stock of human capital at another area.

Furthermore, based on the different economic characteristics within segregated areas, I incorporate the intergenerational persistence model of Checchi (2006) which analyzing next generation's education choice influenced by parents' ability, parents' financial heritage as well as market condition of labor supply and demand of skilled and unskilled workers.

The paper is organized in the following way: section 2 presents relevant literature review of heterogeneous returns to education. Section 3 describes an empirical model of human capital earnings equation, as well as the instrumental variable method to estimate education returns. Section 4 presents data description and results. Section 5 introduces theoretical models including Benabou's (1996) stratification model and Checchi's (2006) intergenerational persistence model. In section 6, I perform analyses on the determinants of the empirical results using the theoretical models presented in section 5. Section 7 concludes.

Chapter 2

Literature Review

The literature related to measuring education return is extensive. Many of them are based on the work of Mincer's (1958) earnings equation that derives education return as a coefficient of years of schooling. However, many economists argue this earnings equation faces endogeneity related to ability and heterogeneity regarding sample selection problem, which tends to generate biased estimator (Heckman et al., 2003). In order to solve the problems, many economists incorporate instrumental variable to correct ability bias; Heckman and Vytlacil (1999, 2001), Carneiro, Heckman and Vytlacil (2001) develop a marginal treatment effect method to estimate education return by avoid selection bias; Xie, Brand and Jann (2012) incorporate propensity score matching methodology to examine heterogeneous education return. Heckman and Li (2003) use a cross-sectional micro data from the China Urban Household Investment and Expenditure Survey (CUHIES) for the year 2000 to estimate the education return of four-year college attendance in China. The annually OLS, IV and MTE estimators of their result are 7.25%, 14% and 10.8% respectively. Notably, the higher IV estimator comparing to the OLS result indicates that there exist huge heterogeneity and selection bias (Heckman et al., 2003).

Recent papers on analyzing the determinants of dispersion in education return include Katz and Autor (1999) and Heckman et al. (2003), they focus on the role of labor supply and demand,

as well as taxes, costs of education. Considering the facts that in 1970's and 1980's, lots of western countries observed economic segregation, Benabou (1996) develops a socioeconomic stratification framework to understand the choice of human capital investment between parents and next generations. Under this stratification setting, Benabou (1996) is able to include neighborhood effects or peer effect, role models and norms of behaviors to coherently examine the determinants of individual education choices. In addition, he also gives special attention to education finance.

Other works that providing channels to understand the determinants of regional variations of returns to education are mainly focusing on parents' backgrounds since economists believe that there is a persistence of ability and wealth between parents and children. After Becker and Tomes (1986) first bring this up, other economists like Cameron and Heckman (2001) also notice this intergenerational persistence by saying parents' ability and wealth have impact on children's education choices. Checchi in the book, Economics of Education: Human Capital, Family Background and Inequality (2006) further developed an intergenerational persistence model by taking wide range of factors, including labor market condition, family's expectation of schooling returns etc. into consideration.

Most of the works related to estimating education returns in china are according to time and primarily focusing on income inequality and gender earnings gap (Yang, 2004). Seldom of them analyzing spatial dispersion of education returns in china. However, Yang (2004) conducts a cross-region analysis using panel data from 1988 to 1995 in 68 cities of China. Not only the national average rate of return to education increased from 3.1% to 5.1% over the seven years, but also the regional dispersion widened doubly from 0.011 to 0.02, measured by standard deviation. Thus, the equal cross-region return rates hypothesis is significantly rejected with a high F-value. Furthermore, Yang (2004) also analyzes some possible determinants of this regional dispersion in

return rates of education and tries to estimate to what extent these determinants, including size of state sector, the degree of openness in the labor market etc. by forming a product term of dummy variable and years of schooling variable. If the coefficient of this product term deviates from zero significantly, the corresponding determinants would have big effect on education return, and vice versa. In contrast to Yang (2004), this paper focuses more on theoretical explanations of determinants of the heterogeneity in geographical education returns, including parents' wealth, neighborhood effect and labor market condition etc.

Chapter 3

Empirical Model Specification

I begin with introducing an empirical model to specify the calculation of education return and analyze possible endogeneity of the model. Then I incorporate instrumental variable method to robust the estimators of previous estimators in order to correct the ability bias. Then I introduce the model based on Benabou's (1996) work to construct an economic stratification scenario through interprovincial migration. Then I use an overlapping generation model to analyze possible determinants, which strongly related to parents' background under each segregated areas.

3.1 Mincer Human Capital Earnings Equation

In order to measure the education returns in different provinces, consider the standard formed Mincer Human Capital Earnings Equation:

$$\ln Y_i = \beta_0 + \beta_1 \cdot S_i + \beta_2 \cdot Exp_i + \beta_3 \cdot Exp_i^2 + \sum_j^6 \gamma_i x_i + \varepsilon_i \quad (1)$$

where natural log of individual income is a component of years of schooling, denoted as S_i, potential labor market working experience, denoted as Exp_i, and a quadratic

potential experience term, denoted as Exp^2_i; X_i is an explanatory variable which represents other personal features: local *hukou* or not, rural or urban *hukou* status, professional title, gender and interaction terms. The interaction terms imply the relationships between male worker and their *hukou* status. β_1, as the coefficient of Schooling, measures the average education return to an additional year of schooling. (Card, 1999) In addition, the concave shape of this equation indicates that the earning of individual grows gradually as age increases; however, the growing speed will slow down and even reaches negative at the very old age stage. The human capital theory assumes that education could improve individual productivity, indicating $\beta_1 > 0$. Potential working experience which usually involves on-the-job training also has positive relationship with earning, implying $\beta_2 > 0$. However, since working experience subjects to diminishing returns to education, we would expect β_3 to be negative (Mincer, 1996). The coefficient of γ_j may vary according to the relationship between personal characteristic and earning.

3.2 Endogeneity of Mincer Equation

An issue that needs to be addressed in Mincer equation is the endogeneity of variable years of schooling, Y_i. Although we expect exogeneity of all independent variables in the equation, other factors like ability has inevitably influence on Y_i and can lead to a badly biased estimation result. Let's assume the omitted variable in earnings equation is Ability, denoted as A_i, and Cov (S_i, A_i) $\neq 0$, hence we construct a function of years of schooling respect to A_i:

$$S_i = r_i + r_i A_i \quad (2)$$

expressing A_i in terms of S_i and plug it back to the revised Mincer equation with A_i, it yields a new estimator of β_1, which expressed as

$$\beta_1 = \beta_1 + \frac{1}{r_i}, \quad (3)$$

therefore, we can say that the β_1 is upward biased in the Mincer equation by omitting Ai. The exact biasness can be derived as

$$Bias(\beta_1) = \frac{1}{r_i}, \quad (4)$$

In order to correct this bias, we incorporate instrumental variable (IV). This method constructs a new variable which related to S_i, but not correlated with A_i. Hence, the new variable could offset the correlation between S_i and the omitted variable A_i. The quality or how strong is the IV should be considered in order to make the correction valid. In order to test whether we can trust our instrumental variable Z_i, we need to test whether Z_i satisfied the two conditions: $Cov(Z_i, S_i) \neq 0$ and $Cov(Z_i, A_i) = 0$. If the two conditions hold, we are safely to say that Z_i is a valid IV.

Conventionally, IV includes minimum school leaving age, tuition costs for higher education or the distance from home to school. (Rosen, 1992) According to the data availability, I use the regional (ln) unemployment rate as my IV. By using common sense, the unemployment rate of one region is related to years of schooling since higher unemployment rate would lead more people staying at school; on the other hand, unemployment rate is uncorrelated to individual's ability since the economic depression would inevitably influence available job positions for all the qualified job candidate and give rise to the layoff of some equal-ability people. Thus, it is reasonable to use unemployment rate corresponding to the specific region as an instrumental variable.

Chapter 4

Data Set and Empirical Results

In this thesis, the data that I used is from the first wave of the China Household Finance Survey (CHFS) in 2011. The data was conducted by the Survey and Research Center of CHFS based on the Southwestern University of Finance and Economics (SWUFE) at Chengdu, China. The data include a sample size of 8,438 households and 29,324 individuals from 25 provinces of China. The data is categorized by provinces and conducted at both household and individual level. The 2011 survey contains 307 variables, however, only a few will be considered in this thesis, such as education levels, work years, after tax income, as well as dummy variables like rural or urban *hukou,* gender, local residence and professional title etc. In addition, the data randomly selects observations across the urban and rural area within province.

In order to conduct regional comparison, I select six regions include provinces and municipalities, each of them has relatively more observations which ensures wide sample representative: three of them are located at interior part of China with lower total GDP, including Anhui, Jiangxi and Yunnan; other three are located at east coastal line area of China with higher total GDP, including Beijing, Shanghai and Zhejiang. The sample that I used consists of 1886 individuals for 2001. Each of them has worked at least for one year with positive after tax income and specific information about gender, *hukou* status and professional working titles. Others with

omitted income are cleared out from the sample. These six regions may not be representative enough and the observations within each region may vary largely, but for simplicity, I will use these six regions.

Table 4 to 9 present the regional descriptive data giving specific mean, standard deviation, minimum and maximum value to each variable. As it suggested, the dispersions of average income among six provinces are significant. And provinces such as Jiangsu and municipality such as Shanghai and Beijing tend to have higher average income than regions located at interior China, including Anhui, Jiangxi and Yunnan. It implies one type of socioeconomic stratification which based on wealth.

In addition, we can observe that coastal regions have higher years of schooling than interior regions, with Beijing as the highest and Anhui as the lowest. Considering the mean distribution of local *hukou* variable, coastal areas have lower value, averaged to 0.74, which indicates that only 74% of population in these three coastal areas hold local *hukou.* While the three interior areas have average 95% population holding local *hukou.* In terms of professional working title variable, which distinguishes skilled and unskilled worker, the coastal regions share higher percentage of workers with professional title over the total sample population. It implies that coastal areas attract relatively more skilled workers while interior areas keep more unskilled worker. And the lower standard deviation of professional title in the interior also indicating that the distribution of workers' types within interior regions are more uniformly skewed to unskilled workers.

The OLS and IV results on returns to education of the six provinces and municipalities in 2011 are showed in Table 10 to 15. It suggest significant variation of education returns cross regions. In coastal line areas, the estimators of OLS range from 0.0073 to 0.0083, with Shanghai as the highest and Beijing as the lowest; in west interior areas, the estimators vary from 0.0021 to

0.0061, with Yunnan as the highest and Anhui as the lowest. Combined all the regions, the variation range rises, which are from 0.021 to 0.0083, showing that the returns gap between less economic developed areas and more economic developed areas are significant. In addition, Beijing has the lowest standard deviation in OLS estimation while Jiangxi has the highest one. All the estimators are relatively statistically significant. In addition, work experience variable are more statistically significant than years of schooling, which in some way indicates that experience exert more impact on earning comparing to education. One possible reason could be most of the job positions in the labor market are not high skill based and thus more emphasize on workers' working experience instead of knowledge. Especially for state-owned firms, earnings are more related to the years that workers spent on the firm rather his or her education background.

The IV estimators of returns to education are significantly higher than the OLS results for all provincial samples. In addition, the IV estimators are more statistically significant than the OLS results. After adjusting the endogeneity, the return rates become much higher than the OLS results, ranging from 0.51 to 0.67. This disparity between OLS and IV estimator significantly indicates the existence of ability biasness in the previous model. Comparing to Heckman and Li's (2003) results, my OLS estimators are lower, however, the IV estimators are very close to their results. Furthermore, the IV estimators are higher than OLS results both in Heckman and Li's (2003) and my estimation. However, the difference between OLS and IV estimation is more obvious in my results. It indicates some quality issues of my IV variable. Comparing to Heckman and Li's (2003) IV, which is the probability of going to college, my IV estimator: regional (ln) unemployment rate has less strong correlation with S_i for the reason that even though the unemployment rate in one region is high, people who subject to budget constraints are not able to attend school as long as they want. Hence, the unemployment rate and individual years of schooling are not strongly

correlated. On the other hand, Heckman and Li's (2003) IV: the probability of going to school, which is measured by parents' education, parental income, and the year of birth, considers several important factors and thus becomes more convincing regarding its positive correlation with years of schooling. More importantly, both OLS and IV results show that coastal line regions have higher returns to education than the interior regions.

Chapter 5

Theoretical Model and Specification

In order to investigate the determinants of the geographical dispersion of returns to education, I try to set up two segregated socioeconomic regions: interior and coastal, which based on the different economic characteristics within the two regions. To support this argument, I examine the four determinants of economic stratification in Benabou's (1996) paper. After analyzing the validity of this framework of two segregated regions, I use Checchi's (2006) intergenerational model, and based on the different characteristics of each segregated regions, to investigate possible determinants of the geographical dispersion of returns to education.

5.1 Community Formation and Human Capital Accumulation Model

Attempting to determine the causes of socioeconomic segregation observed in most Western countries, Benabou (1996) examine the roles that quality of neighborhoods, community spillovers, lifetime resources of individual and political mechanism played in formation of socioeconomic stratification. He also claims that the features of one segregated community would be consistently passed on through one generation to the next, which invokes my idea of using the intergenerational persistence model in 5.2 to continue the analysis.

Benabou (1996) first presents his theoretical model based on the classic works of Tiebout (1956) on local public goods, Schelling (1978) on segregation and externalities, and Kozol (1991) on school funding. He assumes same amount of families live in two communities. Parents are divided into two types (A and B) by measuring their stock of human capital ($h_A > h_B$). And the proportions of each type in one community are n and 1-n respectively. And the proportion of type A adults in each community is denoted as x. Parents maximize their utility with respect to two periods:

$$U(h) = \max U(c, c', h') \quad (5)$$

where c and c' denoted consumptions with respect to two periods, and h' is the human capital of next generation. The utility function subjects to three constraints. First two corresponding to the two periods' consumption and income:

$$c + p + t(h) = w(h) + d \quad (6)$$

$$c' + P(h, d) = y(h) \quad (7)$$

where LHS of (6) refers to agent's consumption c, house rent p, plus taxes t(h) that he pays for wage w(h) in period one; while on the RHS, d refers to his chosen level of debt. The LHS of (7) denotes the consumption in second period and debt payment for d in first period. On the RHS, y(h) denotes current income level. Additionally, parents' utility function also subjects to children's human capital accumulation:

$$h' = F(h, L, E) \quad (8)$$

where h reveals the persistence of human capital between parents and children. And L is the average human capital level which captures the social spillover of one community including peer effect, role models, unemployment rate, crime and welfare dependency according to Benabou (1996). The last factor devoted to human capital accumulation is decentralized school expenditures

denoted as E. Benabou (1996) argues that families pass their preference on school budgets through some local political mechanism by shaping tax schedules. Using this framework, finally, Benabou (1996) generates the equilibrium solution in land market and says: when $x^1 > x^2$, C^1 is more desirable than C^2 and p rises in C^1, rich people who are willing to pay the high rent outbid the poor people at C^1. This outbidding process ends until stratification forms.

Based on this structure, Benabou (1996) specifies several determinants of stratification through channels of the variables defined above:

1. The complementarity between family human capital and community average human capital can cause stratification:

   $$F_{hL} > 0 \tag{9}$$

2. Imperfection of capital market limit poor people's access to funds, hence can't afford high rent of land:

   $$P_{hd} + d'(h)P_{dd} < 0 \tag{10}$$

3. Disparity of personal income contributes to the stratification:

   $$W'(h) + y'(h)/(1 + r) > 0 \tag{11}$$

4. Political mechanism shapes education expenditure and affect stratification:

   $$F_{hE} > 0 \tag{12}$$

We will discuss these propositions specifically and use some of it in the analysis chapter.

5.2 Intergenerational Persistence Model

This overlapping generation model aims to examine how the educational choice made by one generation affects the next generation, or the probability of children whose parents with higher

ability and wealth gain higher education attainment. I am going to examine the effect from parents to children through several channels including ability and financial heritage based on Checchi's work (2006).

In the model, Checchi assumes each individual i lives for two period t and t+1 with ability A_{it} and receive financial heritage from parents X_{it}. Another assumption is that the human capital accumulation of the next generation (H_{it}) is determined through three factors: parent's ability, family financial support and public education quality, which is expressed as:

$$H_{it+1} = f(X_t, A_t, E_t) \quad (13)$$

With higher family wealth, parental ability and better public resources, one can obtain higher human capital accumulation than others. And individual income of the next generation is a proportion of his or her human capital accumulation, suggested as:

$$Y_{it+1} = \alpha H_{it+1} + \gamma_{it+1},\ \gamma \sim N(0,\sigma_{\gamma}^2) \quad (14)$$

where α is the proportion of human capital that contributes to income and γ is the residual term which represents unpredictable elements such as luck or job discrimination, however, we assume γ follows normal distribution with mean equals to zero in this setting.

Also, in this model, Checchi (2006) assumes that parents have perfect information on their children's talent through school screening, and the cost of obtaining this information equals the cost of going to school, denoted as S_t. And parents are aware that there is a proportional connection between their ability and children's ability, which is expressed as:

$$A_{it+1} = \rho + \varphi A_t + \omega_{t+1},\ \omega \sim N(0, \sigma_{\omega}^2) \quad (15)$$

where ω is the unpredictable term following normal distribution with mean zero.

Now Checchi (2006) incorporates the Cobb-Douglas production function to indicate individual's output or income as a function of labor input L and capital input K as:

$$Y_{it} = f(L_t, K_t) = (L_t)^{\tau}(K_t)^{1-\tau} = [(L_t^s)^{\beta}(L_t^u)^{1-\beta}]^{\tau} (K_t)^{1-\tau} \quad (16)$$

where we separate L_t into two kinds: one is skilled worker L_t^s, another is unskilled worker L_t^u with corresponding proportion τ and $1-\tau$.

Base on this set-up background, Checchi (2006) analyzes people's decisions by constructing an inequality indicating that people will choose more education if his or her expected returns on education are greater than the expected income of not acquiring education. The expected returns on education can be derived from expected income of skilled worker minus the cost of going to school. Also, the expected income is defined as a product of ability and corresponding wage, for example, skilled worker would expect income to be $A_{it}W_t^s$ while unskilled worker would expect $A_{it}W_t^u$ as his or her income. Correspondingly, the constraint of whether go to school or not can be expressed as:

$A_{it}W_t^s - S_t \geq A_{it}W_t^u$

we can rearrange it to be:

$$A_{it} \geq \frac{St}{W_t^s - W_t^u} \quad (17)$$

Hence, people with high ability which is bigger than $\frac{St}{W_t^s - W_t^u}$ would choose gain more education. On the other hand, if $\frac{St}{W_t^s - W_t^u}$ is low enough, more people would go to school even with relatively lower abilities. This situation conditions on either very low S_t or very high $W_t^s - W_t^u$.

Then Checchi (2006) considers the wage differential situation first. Firm will hire workers until the wage equals the marginal production of labor in order to maximize profits. Hence, we can generate the wage function of skilled worker and unskilled worker separately by doing partial differentiate with respect to different types of workers using equation (16):

$$W_t^s = \frac{\partial Yt}{\partial L_t^s} = (\beta\tau)\ (K_t)^{1-\tau}\ (L_t^u)^{\tau-\tau\beta}\ (\ L_t^s)^{\beta\tau-1} \quad (18)$$

$$W_t^u = \frac{\partial Yt}{\partial L_t^u} = (\tau\text{-}\tau\beta)\ (K_t)^{1\text{-}\tau}(\ L_t^u)^{\tau\text{-}\tau\beta\text{-}1}(\ L_t^s)^{\beta\tau} \quad (19)$$

In order to look at the disparity between skilled worker's wage and unskilled worker's wage, we can take ratio of them and obtain:

$$\frac{W_t^s}{W_t^u} = \frac{\beta\tau}{\tau-\tau\beta}\frac{(L_t^u)\tau-\tau\beta}{(L_t^u)\tau-\tau\beta-1}\frac{(L_t^s)\beta\tau-1}{(L_t^s)\beta\tau} = \frac{\beta}{1-\beta}\frac{L_t^u}{L_t^s} \quad (20)$$

Briefly speaking, if we expect $W_t^s - W_t^u$ to be big, we would need the gap between L_t^s and L_t^u to be big.

Now we can analyze the other way to lower $\frac{St}{W_t^s - W_t^u}$ through lowering S_t. Consider that the cost of going to school can be covered by parents' financial heritage X_t, let $\Delta = S_t - X_t$. Then equation (17) can be rewrite as:

$$A_{it} \geq \frac{\Delta}{W_t^s - W_t^u} \quad (21)$$

The best situation we can achieve is when the heritage from parents are being used to cover the entire schooling cost, expressed as $\Delta = 0$. Furthermore, assuming that financial heritage is persistent among generations, we can express X_t in terms of X_{t-1} as a sum of X_{t-1} into two discrete cases: one is when the parents' heritage (X_{t-1}) from their grandparents are less than the cost of going to school (B_{t-1}), parents would choose to be an unskilled worker instead of going to school, and choose to left a proportion φ of income ($A_{it-1}W_{t-1}^u$) to their children; however, if grandparents' left an amount of heritages to parents which exceeds the cost of schooling, parents would choose to go to school; and consequently left the same proportion of their income ($A_{it-1}W_{t-1}^s$) to children under the assumption that parents share same preference in giving what fraction of income to their children. Then X_t is described as:

$$X_t = \int_{-\infty}^{B_{t-1}}[c(A_{it-1}W_{t-1}^u)]\ d\ X_{t-1} + \int_{B_{t-1}}^{\infty}[c(A_{it-1}W_{t-1}^s - X_{t-1})]\ d\ X_{t-1} \quad (22)$$

It indicates that parents with wealthier grandparents are more likely to give higher heritage to their children. With higher X_t and lower Δ, more children, even with lower ability, can surpass the ability constraint and invest more in human capital.

Chapter 6

Descriptive Analysis

In this chapter, I first use facts of China to check the determinants of socioeconomic stratification formation in Model 5.1, and conclude that there is a stratification formed between interior and coastal regions. Secondly, based on the features of each segregated regions, I investigate possible determinants of the geographical dispersion in returns to education between the interior and coastal regions, including migration and Hukou policy ease, education cost, and labor supply and demand based on Model 5.2

6.1 Interprovincial Migration and *Hukou* System

Socioeconomic segregation has been a phenomenon observed in many western countries for a long time (Benabou, 1996). China, after the implementation of the reform in 1970s, has also witnessed socioeconomic stratification. Contrast to the segregation in the U.S. which happened between central city and suburban during 1960 to 1989 (Benabou, 1996), the segregation in China exists between interior and coastal line provinces. This socioeconomic segregation has lasting influence on China's labor market condition and social structure. In order to explore the determinants of the segregation happening in China, migration and *hukou* system, which served as channel and screening tools respectively, are worth examination.

The *hukou* (Household Registration) System, implemented in the 1950s by Chinese government, stipulates people's resident place determined by birthplace and distinguishes people from rural and urban area. It also helps examining and regulating migration in China. Notably, it divides migrants into two types: temporary and permanent. Temporary migrants refer to people who do not gain local *hukou* of the destination; permanent migrants are people who obtain local *hukou* of the destination. Permanent migrants usually possess higher education background or wealth, and tend to work at technology-oriented firms or commercial firms with higher earning than temporary migrants. Temporary migrants usually cannot enjoy same social benefits and job opportunities as local residents or migrants because of the *hukou* restriction. However, this paper will mainly focus on the determinants of stratification from the scope of permanent migrants as temporary migrants and their children do not share most of the social benefits and do not obtain education at destination by the restriction of *hukou* system.

After 1970s, central government eased their control over population flows; and many local governments at coastal regions begin attracting high ability people by granting local *hukou*. It accelerates the migration from interior to coastal provinces and makes *hukou* become a screening tool for coastal area governments to distinguish high ability and low ability people. I will discuss the reasons why people choose migrating in the following part.

Referring to equation (9), by taking partial differentiate of children's human capital function F with respect to h first, we separate the effect of parents' human capital influence on F from the effect of neighborhood effect L. Then the positive second partial differentiation of F with respect to L gives us a clue that neighborhood quality exerts positive influence on children's human capital accumulation. Parents in the interior would migrant to east if east region has better social

environment or higher average human capital stock. We can use education attainment to measure the average human capital within regions.

Education Degree	Eastern	Central	Western
Illiterate and Semi-illiterate	7.9	11.93	11.87
Elementary School	17.97	21.86	24.44
Middle School	31.19	34.26	33.84
High School	15.23	14.64	12.47
Vocational School	6.82	5.82	5.34
Junior College	8.99	5.82	6.8
Bachelor	10.3	5.35	4.9
Graduated School	1.61	0.32	0.34

Table 1. The Structure of Education Degree in Region (%)

Table 1 reports the education attainments in eastern, central and western China. Education attainment in the three areas is evenly distributed in terms of elementary, middle and high school level. However, the distribution becomes highly skewed towards eastern area starting from bachelor degree. Especially for Bachelor degree attainment, the percentage in east is as twice as the central and western areas. And the percentage gaps among the three areas become bigger with higher education attainment. Hence, parents who are more sensitive towards neighborhood quality prefer to migrate to east rather than staying at west.

Capital market imperfections and income level disparities have joint influence on people's choice of migrating, suggesting by equation (10) and (11). Specifically, it is harder for poor families to borrow money from bank than the wealthy families. In order to migrate to the wealthier area, poor families have higher opportunity costs than the wealth. Even though assuming the capital market is perfect and the interest rate is same for everyone, family wealth could sort people into different communities (Benabou, 1996). Wealthier people with more lifetime resources are

able to burden the cost of migrating to east. In general, capital market imperfection limits poor family's migration choice, and family wealth supports people with sensitive taste towards neighborhood quality migrating to east of China. Hence, we claim that there exist two segregated communities which located in east and west.

Once the stratification formed, we understand that stratification distinguishes the families' characteristics under these two areas. On average, east China possesses higher human capital stock and clusters wealthier people than west China in terms of permanent residents through migration and policy ease on *hukou* system.

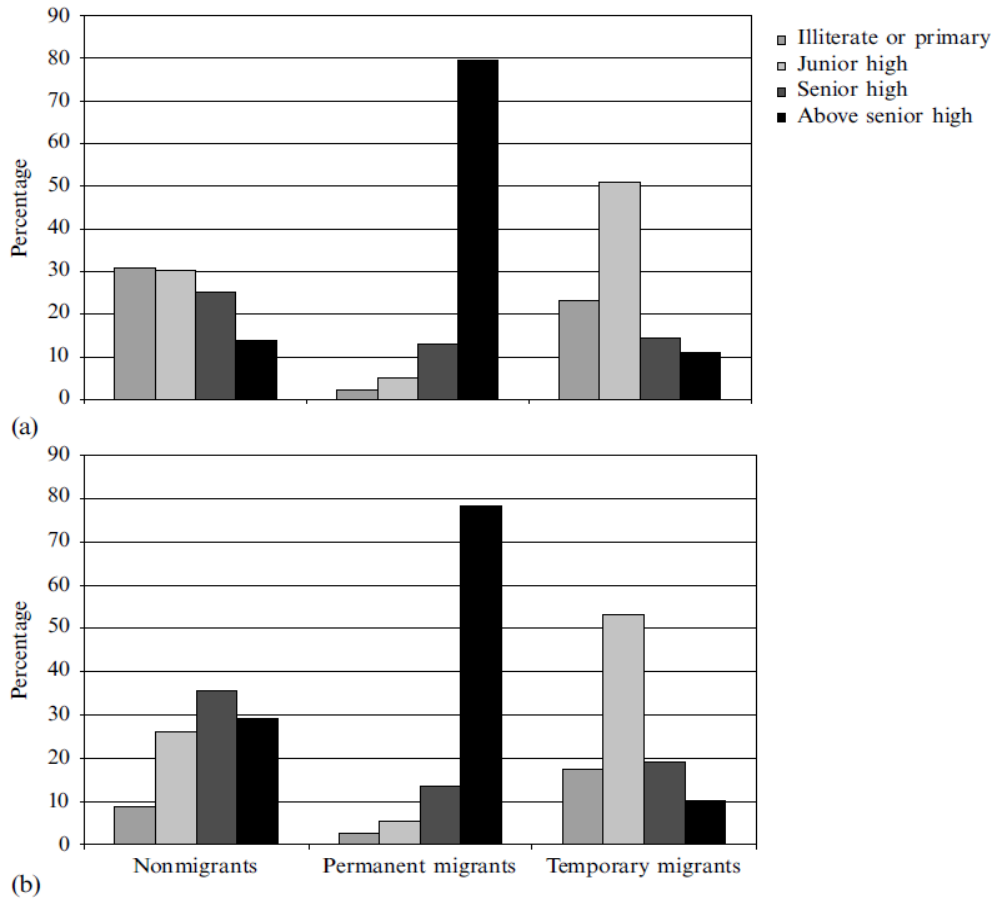

Figure 1. Education Attainment in Guangzhou

a) 1990 Census; (b) 1998 Guangzhou Survey

Let us take Guangzhou as an example. It is the capital city of Guangdong province which ranked at the first place of the quantity of interprovincial migration (Chan, 2003). It has attracted high volume of migration people for decades. Table 1 (Chan, 2002) reports that, from 1990 and 1998, permanent migrants in Guangzhou have extreme higher education attainment than nonmigrants and temporary migrants. In addition, Table 2 (Chan, 2002) suggests that the average monthly income of permanent migrants is almost tripled of the average monthly income of temporary migrants and nonmigrants.

	Nonmigrants	Permanent migrants	Temporary migrants
Mean monthly income (yuan)	1836	3654	1511
Benefits[a]			
free lodging (%)	0.8	16.9	59.5
medical (%)	60.0	71.1	8.2
retirement (%)	48.8	63.1	3.8

[a] Excluding the self-employed and those employed in agriculture.

Table 2. Income and benefits returns by resident status in Guangzhou

With the human capital stocks and income levels disparities between interior and coastal China coming from stratification, we will use these characteristics in intergenerational persistence model and combine other social features within China to analyze possible determinants of heterogeneous returns to education between interior and coastal regions.

6.2 Education Cost

Referring to equation (17), people choose education differently by considering two facts: cost of attending school and wage gap between skilled worker and unskilled worker. If the cost

of attending is low or the wage gap is big, people would choose gain more education even with lower ability.

Begin with the cost of attending school, if parents heritage are big enough to cover the education cost, $\Delta = S_t - X_t$ would be small. According to Checchi (2006), the level of parental heritage is determined by parents' income with the assumption that parents are willing to leave their children some heritage as a proportion of their income, denoted as $Y_t = C_t + X_t$. Hence, children with wealthy parents would gain more heritages and are able to attend school without limited by schooling cost. In contrast, children with poor parents have less financial support have less incentive of going to school.

Table 4 to 9 suggest that coastal areas of China have higher average income than interior areas. Beijing, as a representative of coastal region, has the highest mean income among the six regions while Yunnan, as a representative of interior region, has the lowest one. Accordingly, children in the coastal region who have higher parental heritage would choose more education than children who are in the interior region.

6.3 Labor Supply and Labor Demand

In equation (17), we discussed that if the wage gap $W_t^s - W_t^u$ is big, people would choose more education. Let's consider the wage of skilled workers within coastal and interior regions separately. In coastal region, which classified as a segregated community with higher average human capital, have more labor supply of skilled workers.

At the labor demand side, considering that technology-oriented firms usually located at coastal regions and cities like Beijing, Shanghai and Shenzhen, by taking advantage of the reform policy to attract more FDI.

Region	**Share of FDI** (percent)
Northern	11.02
Northeastern	6.42
Coastal	71.28
Southeastern	4.76
Southern	4.54
Western	1.98

Table 3. Regional foreign direct investment in China, 1985-1997

Table 3 (Graham et al., 2001) reports that coastal region of China has exceeding 2/3 share of the whole country's total FDI, with interior areas left behind. As FDI is an important resources for improving productivity. The firms supported by FDI usually prefer high skilled workers rather than low skilled workers. Hence, the labor demand for skilled workers are relatively higher at coastal region than inland region. Both increase in supply and demand push the wage of skilled worker in coastal region up. On the other hand, as we mentioned in the migration and *hukou* system section, the increasing flow of temporary migrants, who are less-educated, into coastal regions would drive down the wage of unskilled workers. Correspondingly, the wage gap between skilled worker and unskilled worker would become big in the coastal line.

Considering interior regions, the outflow of big volume of unskilled workers and skilled workers would shift the supply curves of both skilled and unskilled workers outward, making the

wages of both workers go up. Correspondingly, the wage gap between skilled and unskilled worker becomes small. Thus, according to our intergenerational persistence model, the small wage gap at inland region would make people choose less education comparing to the coastal region.

As people in the coastal region choose more education, they can obtain more knowledge and skills, as well as more job market information. All these advantages help them finding better job with higher wages than people in the interior region of China. Hence, the returns to education in coastal region of China are higher than the return rates at interior region of China.

Chapter 7

Conclusion

In this paper, I study the regional education returns in coastal and inland regions of China by selecting six provinces and municipalities in 2011. My hypothesis is to see a different education returns in both regions, with higher returns in coastal region and lower returns at interior region.

By using the data from CHFS in 2011, I conducted OLS and IV to generate education returns at the selecting six regions. From the results, I find the education returns at Beijing, Shanghai and Zhejiang are higher than Anhui, Jiangxi and Yunnan.

To understand this heterogeneity of education returns between inland and coastal regions, I adopt Benabou's (1996) work on stratification to analyzing the determinants of socioeconomic segregation and migration. From the analysis, I conclude that there are two segregated socioeconomic communities formed, which are coastal region and interior region. Also, each segregated community has its different economic features.

Based on the different characteristics of inland and coastal communities, I incorporated the intergenerational persistence model based on Checchi's work (2006) to analyze different people's choices on education between inland and coastal regions. By considering the effect of

parental heritage and labor market conditions, I conclude that people in the coastal region would choose more education while people at inland region would choose less education. This education decision disparity between the two major communities contributes to the heterogeneity of education returns in these two regions as people in coastal community with higher average education level are able to find better job and gain higher earning than people in interior community featured by lower average level of education.

Appendix A

Map of China

Figure 2. Map of China

Appendix B

Summary of Tables

Table 4. Regional Descriptive Data (Beijing, 2011)

Variable	Observation	Mean	Std. Dev.	Min.	Max.
ln_income	378	10.65097	.8293874	7.17012	13.98441
Years of schooling	378	6.216931	1.80789	1	9
Male	378	.5555556	.4975626	0	1
Experience	378	8.453968	10.59237	0	55
Local Hukou	378	.6798942	.4671353	0	1
Rural Hukou	378	0	0	0	0
School*Local Hukou	378	11.62689	8.348574	0	1
School*Rural Hukou	378	0	0	0	0
Male*Local Hukou	378	.3915344	.4887404	0	1
Male*Rural Hukou	378	0	0	0	0
Professional Title	378	.8174603	.3868007	0	1
Intercept	378				

Table 5. Regional Descriptive Data (Shanghai, 2011)

Variable	Observation	Mean	Std. Dev.	Min.	Max.
ln_income	458	10.3381	.8437352	2.639057	13.81551
Years of schooling	458	17.51965	4.399702	0	23
Male	458	.5960699	.4912203	0	1
Experience	458	7.693231	8.36436	0	40
Local Hukou	458	.7751092	.417967	0	1
Rural Hukou	458	.1462882	.3537814	0	1
School*Local Hukou	458	13.6441	8.211241	0	23
School*Rural Hukou	458	2.762009	6.881469	0	23
Male*Local Hukou	458	.4628821	.4991656	0	1
Male*Rural Hukou	458	.0895197	.2858045	0	1
Professional Title	458	.8034934	.3977904	0	1
Intercept	458				

Table 6. Regional Descriptive Data (Zhejiang, 2011)

Variable	Observation	Mean	Std. Dev.	Min.	Max.
ln_income	524	9.712213	1.432507	3.896052	12.88664
Years of schooling	524	16.95992	5.009009	0	23
Male	524	.5973282	.4909044	0	1
Experience	524	5.239122	8.263156	0	40
Local Hukou	524	.7671756	.4230351	0	1
Rural Hukou	524	.4274809	.4951858	0	1
School*Local Hukou	524	12.89313	8.244126	0	1
School*Rural Hukou	524	7.139313	9.051883	0	1
Male*Local Hukou	524	.4694656	.4995437	0	1
Male*Rural Hukou	524	.2671756	.4429076	0	1
Professional Title	524	.5973282	.4909044	0	1
Intercept	524				

Table 7. Regional Descriptive Data (Anhui, 2011)

Variable	Observation	Mean	Std. Dev.	Min.	Max.
ln_income	296	9.869262	.5918703	7.783224	12.0137
Years of schooling	296	17.13176	4.986715	0	23
Male	296	.6283784	.4840564	0	1
Experience	296	6.575338	9.30791	0	43
Local Hukou	296	.9358108	.2455047	0	1
Rural Hukou	296	.4662162	.4997022	0	1
School*Local Hukou	296	15.93919	6.440051	0	23
School*Rural Hukou	296	8.351351	9.921635	0	23
Male*Local Hukou	296	.597973	.4911377	0	1
Male*Rural Hukou	296	.3074324	.4622115	0	1
Professional Title	296	.5337838	.4997022	0	1
Intercept	296				

Table 8. Regional Descriptive Data (Jiangxi, 2011)

Variable	Observation	Mean	Std. Dev.	Min.	Max.
ln_income	167	9.645347	.8682758	5.991465	11.69525
Years of schooling	167	17.35928	4.872126	0	23
Male	167	.6047904	.490366	0	1
Experience	167	4.856886	8.390539	0	35
Local Hukou	167	.9700599	.1709347	0	1
Rural Hukou	167	.4431138	.4982474	0	1
School*Local Hukou	167	16.92814	5.678716	0	23
School*Rural Hukou	167	8.11976	9.847514	0	23
Male*Local Hukou	167	.5868263	.4938844	0	1
Male*Rural Hukou	167	.2874251	.4539226	0	1
Professional Title	167	.4670659	.5004147	0	1
Intercept	167				

Table 9. Regional Descriptive Data (Yunnan, 2011)

Variable	Observation	Mean	Std. Dev.	Min.	Max.
ln_income	63	9.619593	.7319615	7.272398	11.28978
Years of schooling	63	18.11111	4.607536	0	23
Male	63	.6825397	.4692271	0	1
Experience	63	10.15714	10.10407	.1	34
Local Hukou	63	.1111111	.316794	0	1
Rural Hukou	63	.7142857	.4553826	0	1
School*Local Hukou	63	1.936508	5.66504	0	23
School*Rural Hukou	63	13.34921	9.420566	0	23
Male*Local Hukou	63	.0793651	.2724789	0	1
Male*Rural Hukou	63	.5555556	.5008953	0	1
Professional Title	63	.2857143	.4553826	0	1
Intercept	63				

Table 10. Estimation Results (Beijing, 2011)

Id=1	Estimation Results in 2011 (Beijing)			
	OLS		IV	
Variables	Coef.	Std. Err.	Coef.	Std.Err.
Years of schooling	.0072944	.0173634	.6735859	.0181491
Male	.1542172	.1455145	.1095636	.4297527
Experience	.0253115	.0131772	.0180541	.0178323
Experience^2	-.0009127	.000338	-.0008105	.0004379
Local Hukou	-.015372	.1273531	9.986715	.2866824
Rural Hukou	0	(Omitted)	0	(Omitted)
School*Local Hukou	.0185754	.0257308	.5798753	.0226907
School*Rural Hukou	0	(Omitted)	0	(omitted)
Male*Local Hukou	.0729353	.1765935	.3507296	.4419366
Male*Rural Hukou	0	(Omitted)	0	(Omitted)
Professional Title	.1402367	.1328208	.5052648	.2455599
Intercept	10.04575	.3425473		

Table 11. Estimation Results (Shanghai, 2011)

Id=3	Estimation Results in 2011 (Shanghai)			
	OLS		IV	
Variables	Coef.	Std. Err.	Coef.	Std.Err.
Years of schooling	.0082994	.0156258	.6465173	.0354296
Male	.3230882	.1533305	.3966146	.759695
Experience	.0391842	.0148217	.0005657	.0619569
Experience^2	-.0010595	.0004373	-.000299	.0018785
Local Hukou	.7828613	.3595478	11.00842	.7202015
Rural Hukou	-.1395798	.3645777	1.279572	.5662142
School*Local Hukou	.046847	.0194068	-.6686518	.03599
School*Rural Hukou	.0482243	.0192553	-.1322505	.0555699
Male*Local Hukou	.1720357	.1433759	.8137786	.8445593
Male*Rural Hukou	.2010993	.1716695	-.4240643	.769889
Professional Title	-.3414187	.1087899	.8638603	.5163215
Intercept	10.56892	.2855095		

Table 12. Estimation Results (Zhejiang, 2011)

Id=4	Estimation Results in 2011 (Zhejiang)			
	OLS		IV	
Variables	Coef.	Std. Err.	Coef.	Std.Err.
Years of schooling	.0074062	.032832	.5118357	.0273051
Male	.4155777	.2180572	.5247363	.5564215
Experience	.0977966	.015708	.101697	.0292036
$Experience^2$	-.0022334	.0004769	-.0021953	.00085325
Local Hukou	.0352595	.2044257	7.783446	.8176414
Rural Hukou	-.3002386	.1865641	1.512023	1.5026537
School*Local Hukou	.0039478	.024555	.4450946	.0448111
School*Rural Hukou	-.0221075	.0240088	-.0819125	.0569245
Male*Local Hukou	.3755507	.257356	-.8775693	.7344309
Male*Rural Hukou	-.3349782	.2420247	-.0561918	.6190914
Professional Title	.6215941	.1497723	2.257025	.3165735
Intercept	9.000605	.3833409		

Table 13. Estimation Results (Anhui, 2011)

Id=2	Estimation Results in 2011 (Anhui)			
	OLS		IV	
Variables	Coef.	Std. Err.	Coef.	Std.Err.
Years of schooling	.0209613	.0443649	.5295845	.0351611
Male	.2253665	.30745	.4394448	2.179067
Experience	.0238353	.012852	.0108683	.0666054
Experience^2	-.00051	.0003469	-.0002224	.0019551
Local Hukou	.8993496	.889629	.2026344	.9385776
Rural Hukou	-.2469681	.2679377	-.1163194	.5138747
School*Local Hukou	.0352691	.0433402	.4959577	.0377319
School*Rural Hukou	-.0095636	.013094	-.0347565	.0186923
Male*Local Hukou	.117603	.3006752	-.5913529	1.698942
Male*Rural Hukou	.074138	.1136648	.1054009	.5664026
Professional Title	.0042541	.099088	.14017372	.1519037
Intercept	10.37161	.8515643		

Table 14. Estimation Results (Jiangxi, 2011)

Id=5	Estimation Results in 2011 (Jiangxi)			
	OLS		IV	
Variables	Coef.	Std. Err.	Coef.	Std.Err.
Years of schooling	.0577172	.0717529	.6712746	.05408216
Male	.8466004	.1553066	4.960206	.982262
Experience	.0544956	.0470467	.0755723	.1430983
Experience^2	-.0013339	.001682	-.0019331	.0045961
Local Hukou	.8548402	.3714626	9.390238	2.78063
Rural Hukou	-.464072	.5188559	-.1012607	.9318643
School*Local Hukou	-.0549934	.0703483	.6623939	.0578038
School*Rural Hukou	.0280691	.0324254	-.0127659	.0315005
Male*Local Hukou	.5702092	.1960589	.2203746	.9929294
Male*Rural Hukou	-.1978476	.2799594	-.2116711	.277408
Professional Title	-.5163723	.2211777	.5969358	.2237044
Intercept	8.707379	1.069273		

Table 15. Estimation Results (Yunnan, 2011)

Id=7	Estimation Results in 2011 (Yunnan)			
	OLS		IV	
Variables	Coef.	Std. Err.	Coef.	Std.Err.
Years of schooling	.006137	0268356.	.5233925	.0360548
Male	.3628025	.1967977	.5380273	.8548822
Experience	.019739	.0336377	.0182225	.0602213
Experience^2	.0008789	.0010199	-.0016377	. 0019944
Local Hukou	.1902668	.8202256	3.959347	1.812948
Rural Hukou	-.6729063	.6109055	8.432556	.5144347
School*Local Hukou	.0500481	.0507325	.2195854	.1097334
School*Rural Hukou	.0243223	.0311064	-.4956547	.0443387
Male*Local Hukou	2.163248	.4041173	1.400217	.8691423
Male*Rural Hukou	-.2743949	.297556	-.3594943	.8691423
Professional Title	.6114992	.2113709	1.021913	.3501628
Intercept	9.584702	.5712108		

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- Based on mathematical proving methods

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