Regional Disparities of Educational Attainment in China[1]

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[1] We thank Jianfang Yang and Yuming Liu for their excellent work as research assistants. All the errors are our own.

Abstract

This paper studies regional disparities of educational attainment in China. It explores the causes of the regional inequality of the educational investment measured by the enrolment rate at various school levels. It finds that the return to education, the governmental support and the financial constraint play an important role in generating differences in educational investment across regions. The empirical analysis of the paper also identifies different impacts of the support for education at different levels of government. Specifically, an increase of one standard deviation in the support for education at the level of the central government will raise the enrolment rates of the college, the senior high school and the primary school by 6.1, 7.0 and 7.5 percentage points, which is an increase of 140%, 32% and 9% compared to the sample mean enrolment rate, respectively. Contrastingly, although the ratio of the local government's educational expenditure to the local GDP has a marginally significant positive impact on the enrolment rate of the primary school, it has a significant and negative effect on the enrolment rates of both the senior high school and the junior high school.

1. Introduction

During the past two decades, along with the persistently high economic growth, China has made tremendous progress in educational attainment. At the national level, the literacy rate increased from 69.4 to 91.4 over 1982—2000. The average educational attainment years rose from 5.33 years to 7.96 years. Moreover, the percentage of population with college or higher education increased by 400 percent from 0.9 to 4.5 over 1982—2000. However, regional disparities of educational attainment are prominent at higher levels of education[2]. For the year of 2000, in Beijing, the capital city, people who receive college or higher education account for 17.5 percent of the population; while in Yunan, a southwestern province, the percentage is only 2.2 (See Table 1). In 2000, the regional Gini coefficient of the percentage of population with college or higher education was 0.3170 (see Table 2), which was even slightly higher than the regional Gini coefficient of the real consumption expenditure per capita around the same time period (Kanbur and X. Zhang (2001)). Decomposition of the regional inequality of higher education among different geographical groups reveals similar patterns to that of the regional income inequality. Specifically, when we decompose the overall regional inequality of higher levels of education between the coastal group and the non-coastal group (see Table 3), we find that both the level and the percentage contribution of the between group inequality is high, even comparing to the coastal and non-coastal inequality of the real consumption expenditure per

[2] In this paper, higher levels of education refer to college or higher education.

capita (Kanbur and X. Zhang (2001)). The picture becomes more striking when we decompose the overall regional inequality of higher education between the group of mega cities (consisting of Beijing, Shanghai and Tianjin) and the rest of the country (see Table 4). Both the level and the percentage contribution of the between group inequality is now much higher than that of the costal and non-coastal gap. Furthermore, the contribution of the between group inequality has increased over years.

The prominent spatial inequality of educational attainment in China, which echoes the widening regional income inequality, has caused more and more concern. Educational attainment as a measure of human capital stock plays an important role in economic growth (See Barro and Sala-I-Martin (1995), Lucas (1988) and Aghion and Howitt (1995)). Using across country data to conduct empirical analyses, Barro and Sala-I-Martin (1995) and Benhabib and Spiegel (1994) find that educational attainment has a positive and significant impact on economic growth. The rapid progress of educational attainment has contributed significantly to economic growth in China. According to the growth accounting exercise by Y. Wang and Y. Yao (2003), during 1978—1999, the percentage contribution of human capital to GDP growth was 11, Considering that the total factor productivity (TFP) contributed 25.4 percent to GDP growth during the same period and that human capital helps improve the TFP, the overall contribution of human capital to GDP growth in China should be even larger. Furthermore, empirical evidence based on data across regions in China

show a significant and positive relationship between educational attainment and regional economic growth (e.g., Cai, Wang and Du (2002) and Demurger (2001). Chen and Fleisher (1997) find that higher education (measured by the ratio of college graduates to total population) contributes significantly and positively to both the level and growth of the total factor productivity. Their finding implies that the low level of educational attainment in poor regions may discourage the inflow of physical capital into those regions and thus worsen the regional income inequality in China. Heckman (2005) argues that the low level of educational attainment in rural China may slow down the urbanization process because emigrants from rural areas without enough education are not qualified for jobs in modern industry sectors. The aforementioned literature indicates that a further study on disparities of educational attainment has great importance to understanding the imbalanced economic growth across regions in China and the rising income inequality in China.

However, few works in the literature have explored the causes of the regional disparities of educational attainment in China in a systematic way. Gradstein, Nikitin and H. Zou (2005) make an exception. They argue that the marginal productivity of human capital may vary across regions according to the degree of access to the world technology represented by measures of regions' openness. Because the return to human capital depends on a region’s openness, the investment in education should also be influenced by the region’s openness. Their empirical analysis based on data across regions in China supports the view that educational

expansion is positively related to an economy's openness.

Our paper investigates the causes of regional disparities of educational attainment in China. In particular, we aim to find which factors generate the regional inequality of educational investment measured by school enrolment rates. Differences in educational investment lead to disparities of educational attainment across regions. It is worth to be noted here that in addition to differences in educational investment, certain patterns of labor migration may also lead to the uneven spatial distribution of human capital and regional disparities of educational attainment. To understand those migration patterns, one need study individuals' location choice regarding their job and career in response to changes in the economic environment and the government's migration policies. And this is beyond the scope of this paper.

Education is individuals' investment in human capital. As is typical of any other type of investment, educational investment depends on the return to education. It is important to distinguish the social return to education from the private return to education. The former is equal to the latter plus the spillover benefits of education. For example, a better-educated labor force is more capable of producing new ideas and knowledge and more capable of adapting to new technology. According to Heckman (2005), the spillover effects of education are likely to be quite large in China. Because the private return to education captures the direct benefits of education on individuals, and thus directly influences individuals' decisions on

educational investment, we focus on the private return in this paper. For the rest of this paper, unless specifically stated, return to education refers to private return to education. When the labor market is perfect, workers get paid according to the marginal productivity of labor. Thus the return to education is determined by the marginal productivity of human capital. When the labor market is imperfect, wage rates may not fully reflect the marginal productivity of labor. In this case, the return to education also depends on how the labor market is distorted.

There has been growing literature recently that studies the return to education in China. Suppose $w(s)$ is the earnings associated with education level *s*. Ignoring direct costs of education such as tuitions and fees, the rate of return to education is defined $(\partial w(s)/\partial(s))/w(s)$. The insight here follows Becker (1964) who specifies the opportunity cost of investment in human capital as earnings that would have been received in the absence of the investment. Following Mincer (1974), assume the logarithm of earnings is linear in the educational attainment. Namely, let

$$\ln w = \beta s + f(x).$$

Where s represents the educational attainment, x represents the vector of other variables that may affect the earnings, and β is the coefficient associated with the educational attainment. It is straightforward to show that β measures the rate of return to education. Assuming that market wages reflect the marginal productivity of labor and relating wages to levels of education, Chow (2002) finds that the rate of return to education is about 4% in China in the early 1990s. Heckman and Li (2004) find this rate to be 7% after controlling for selection bias. As Heckman (2005) points

out, those two numbers underestimate the contribution of education to productivity in China. This is because there are no well-developed labor markets in China and wages are not determined according to the marginal productivity of labor. By examining the productivity of education in the workplace in producing output instead of looking at the compensation wage, Fleisher and Wang (2004) estimate a production-based return to education, which is 30-40%. The huge difference between their estimation and the previous ones reflects how large the distortion of the labor market is in China. And this may greatly discourage the investment in education in China.

In this paper, we first investigate **the return to education** because it is crucial to individuals' educational investment. We study the determinants of the return to education across regions and their impact on school enrolment rates. Specifically, we examine factors that may generate differences in the marginal productivity of human capital. We also investigate different degrees of development of labor markets across regions, which determine how the compensation wage deviates from the marginal productivity of labor. Secondly, we investigate the role played by **government policies** in educational investment. In particular, we examine the effects of 1) the government expenditure on education across regions; 2) and the discriminatory college admission policies across regions. Thirdly, we examine **the financial constraint** that affects individuals' the ability to pay for education.

The major findings of our paper are: 1) the economic growth rate has a significant and

positive impact on the enrolment rate of senior high schools. Specifically, a one-standard deviation increase in the economic growth rate will raise the senior high school enrolment rate by 2.92 percentage points, which is a 13% increase compared to the sample mean. This is because when the economy is experiencing faster growth, people tend to form higher expectations on the economic performance in the future. This leads to higher expected return to education. Thus people have greater incentive to invest in education today. More discussion on this will be presented in Section 3. 2) The degree of labor market development has a significant and positive impact on the college enrolment rate. 3) Each region receives support for education from both the local government and the central government. Although the ratio of the local government's educational expenditure to the local GDP has a marginally significant positive impact on the primary school enrolment rate, it has a significant and negative effect on the enrolment rates of both the senior high school and the junior high school. Contrastingly, the ratio of the central government's educational expenditure to the local GDP has a significant and positive effect on the enrolment rates of all education levels except for the junior high school. Specifically, a one-standard deviation increase in the ratio of the central government educational expenditure to a region's GDP will raise the region's enrolment rates of the college, the senior high school and the primary school by 6.1, 7.0 and 7.5 percentage points, which is an increase of 140%, 32% and 9% compared to the sample mean enrolment rate, respectively. One explanation for the positive effect may be that the central government has a better- planned budget regarding the educational expenditure.

Another explanation may be that the central government can coordinate the costs and benefits of different regions and allocate resources in a more efficient way. The above results have important policy implications. They indicate the inefficiency of the educational expenditure at the local level, and calls for the expansion of the educational expenditure at an upper level. 4) The level of the rural income per capita contributes significantly to the enrolment rate at all levels of education except for the primary school. Specifically, a one-standard deviation increase in the rural income per capita will improve the enrolment rate of the senior high school by 16.6 percentage points, which is an increase of 76% compared to the sample mean. Moreover, the urbanization rate has a significant and positive effect on the enrolment rate of the college. In particular, a one-standard deviation increase in the urbanization rate will improve the enrolment rate of the college by 6.6 percentage points, which is an increase of 150% compared to the sample mean. Because there exists large rural-urban income gap in China and because the financial constraint on education is more likely to be binding in rural areas, our finding demonstrates the great potential of loosening the financial constraint on enhancing the investment in education in China. 6) Being a mega city raises the enrolment rate of the senior high school significantly, after other relevant factors are controlled for.

In Section 2, we provide evidences on regional disparities of educational attainment in China, where the Gini coefficient and the GE coefficient is used to measure the inequality. In addition to examining the average educational attainment years, we

also investigate the percentage of population for each level of education. In Section 3, we elaborate on the effects of various factors on educational attainment. Section 4 is the empirical analysis. In Section 5, we draw policy implications based on the empirical results in Section 4.

2. Measurement

2.1 Measurement of educational attainment in China

We consider six education levels: illiteracy, primary school, junior secondary school, senior secondary school, 3-year college and 4-year college and above. They correspond to 0 year, 6 years, 9 years, 12 years, 15 years and 16 years of educational attainment respectively. The compulsory education in China covers the primary school and the junior secondary school, which is 9 years in total. Because in China, a large portion of young people joins the labor force after finishing the junior secondary school at the age of 15, our paper studies educational attainment for the population aged 15 and over. This is similar to Barro and Lee (1996).

The Chinese census data gives the exact number of people aged 15 and over who has attained a certain level of education. We then calculate the percentage of population aged 15 and over whose highest education is at this particular level. We take the average of educational attainment years of different education levels weighted by this percentage. The index thus obtained is called the average educational attainment years. In addition, in order to fully understand the structure of educational

attainment in China, we also calculate the percentage of population aged 15 and over who has attained a certain education level and above. Table 1 lists, for each province and for the year of 2000, the average educational attainment years as well as the percentage of population (aged 15 and over) for each education level.

2.2 Evidences on regional disparities of educational attainment in China

How to measure the inequality in educational attainment? In this paper, we adopt a way similar to which is commonly used to measure the income inequality; namely, we construct both the Gini coefficient and the GE coefficient of educational attainment. Specifically, let e_i denote a certain educational attainment index of region *i*., let r_i denote the percentage of region *i*'s population (aged 15 and over) in the nation's total population (aged 15 and over). Suppose there are *I* regions in total. Then the Gini coefficient related to *e* is

$$(1.1) \qquad Gini_e = 2\frac{\sum_{i=1}^{I} r_i \sum_{j=1}^{i} e_j \times r_j}{\sum_{i=1}^{I} e_i \times r_i} - 1,$$

where $e_1 > e_2 > ... > e_{I-1} > e_I$. In addition to the Gini coefficient, we also calculate the GE coefficient, which is defined

$$(1.2) \qquad GE = \sum_{i=1}^{I} r_i \left[\log\left(\frac{\mu}{e_i} \right) \right]$$

where μ is the mean of *e* across all the *I* regions. A nice feature of the GE coefficient is that it is additively decomposable across groups. The GE coefficient

can be decomposed as, given that the total population is divided into *M* groups,

$$GE = \sum_{m=1}^{M} r_m GE_m + GE^{between}, \quad (1.3)$$

where r_m is the share of group *m*'s population in the total population, GE_m is group *m*'s GE coefficient. The first item on the RHS of the equation is the within-group inequality, while the second item is the between-group inequality.

As discussed previously, the educational attainment index may be the average educational attainment years. It may also be the percentage of population who has attained a certain education level and above. The latter type of indices enables us to study the inequality of educational attainment at different education levels.

Table 2 shows the Gini and GE coefficients related to different educational attainment indices over the years 1982, 1990 and 2000. From this table, we see that: 1) as the education level goes up, so does the regional inequality. 2) For the lower levels of education (primary and junior secondary), the regional inequality declined over the years 1982, 1990 and 2000. 3) For the higher levels of education (senior secondary, 3-year college and 4-year college), the regional inequality increased from 1982 to 1990, but decreased from 1990 to 2000. The decline may be due to China's expansion of college admission since the mid 1990s. 4) At the college level (4-year college), the regional inequality is remarkably high. In 2000, the Gini coefficient of college education was 0.3170, which was even higher than the regional Gini

coefficient of real consumption expenditure that was 0.30 around the same time period (Kanbur and X. Zhang (2001)).

To gain further understanding on the regional inequality of educational attainment, next we decompose the overall regional GE coefficient across subgroups. First, we divide all the provinces into two groups: the coastal group and the non-coastal group. Second, we pool the three eastern mega cities (Beijing, Shanghai and Tianjin) into one group while the rest of the provinces into the other group. The decomposition is shown in Table 3 and Table 4 respectively.

Table 3 shows the decomposition between the coastal group and the non-coastal group. We find that: 1) as the education level goes higher, the inequality between the coastal group and the non-coastal group increases as well as its percentage contribution to the overall regional inequality. 2) For all levels of education, the inequality between the coastal group and the non-coastal group increased from 1982 to 1990, but declined from 1990 to 2000. The percentage contribution of the inequality between the coastal group and the non-coastal group to the overall regional inequality exhibited a similar trend during the same time period. 3) As to the average educational attainment years, the percentage contribution of the inequality between the coastal group and the non-coastal group to the overall regional inequality was 19 in 2000, slightly higher than that of the between group inequality of the real consumption expenditure (Kanbur and X. Zhang (2001)). 4) At the 3-year college level, the

inequality between the coastal group and the non-coastal group was 0.0277 in 2000, higher than the between group inequality of the real consumption expenditure (Kanbur and X. Zhang (2001)). At the 4-year college level, the inequality between the coastal group and the non-coastal group was 0.0768 in 2000, almost three times the between group inequality of real consumption expenditure.

Table 4 is the decomposition of GE coefficients between the mega-city group (consisting of Beijing, Shanghai and Tianjin) and the rest of the country. The information revealed is striking. At all the education levels higher than the primary and the junior secondary, the between group inequality is much higher than the coastal and non-coastal inequality. Furthermore, the percentage contribution of the between group inequality to the overall regional inequality is higher than 75; moreover, this percentage exhibited an upward trend over 1982—2000. These findings may be explained by the growing agglomeration economy in these cities that stimulates the investment in human capital and attracts more and more human capital from all over the country. They may also be explained by China's discriminatory college admission policies that favor the mega cities. .

3. Causes for Regional Disparities of Educational Attainment in China

This section explores the causes for China's the regional inequality of educational investment measured by school enrolment rates. Differences in educational investment lead to disparities of educational attainment across regions. The

enrolment rate of a certain education level is defined as the number of enrolled students at schools of this level divided by the population of normal ages to attend schools of this level. Specifically, in China, the normal ages to attend primary schools, junior high schools, senior high schools and colleges are 6—12[3], 13—15, 16—18, and 19—24, respectively.

We study the causes for the regional inequality of educational investment from the following three major aspects: 1) the return to education; 2) government policies; and 3) the financial constraint.

Return to education. Three factors are examined here. The first is *the economic growth rate*. According to Bils and Klenow (2002), when the expected future economic growth rate is higher, the expected return to education is also higher. Thus individuals have more incentive to invest in education if the expected future economic growth rate is higher. To illustrate this point more clearly, let us consider labor-augmented technology growth. Suppose the technology growth rate is *g*. Let w_0 be the earnings each time per effective worker without education. Let w_1 be the earnings each time per effective worker with education. Let *r* be the time discount rate and *T* be the life expectancy. Suppose education takes one time period. Then the lifetime earnings per worker without education are $\sum_{t=0}^{T} w_0(1+g)^t/(1+r)^t$. And the

[3] In China, children start the primary school around age 6—7.

lifetime earnings per worker with education are $\sum_{t=1}^{T} w_1(1+g)^t/(1+r)^t$. The difference in the lifetime earnings between the educated and the uneducated reflects the return to education. It is straightforward to show that such a difference gets larger when the growth rate g increases. Since individuals form their expectation of the future economic growth based on the performance of the economy in the recent years, we use the average of the growth rate of the real GDP per capita in the past five years to measure the expected economic growth rate, denoted *ave_growth*. Figure 1 illustrates the relationship between this variable and the enrolment rates at various education levels across regions in 2000.

The second factor is *the initial human capital stock.* The initial human capital stock contributes to the improvement of technology and the total factor productivity and thus improves the return to human capital. Moreover, the higher the level of the initial human capital stock, the better the environment for making new investment in human capital. For example, children of well-educated parents are more likely to receive better education. Thus, the level of initial human capital stock should have a positive impact on educational investment. In this paper, we use the percentage of population aged over 15 with at least the senior high school education to measure the human capital stock, denoted *attainment_senior*. Figure 2 illustrates the relationship between this variable and the enrolment rates at various education levels across regions in 2000.

The third factor is ***the development of the labor market.*** China's labor markets are not well-developed. In the past, under central planning, wage rates are determined according to the fixed "wage-grid" that is largely based on seniority instead of on productivity (Meng and J. Zhang (2000)). Moreover, labor allocation across work units, occupations and regions was strictly under the control of labor bureaus facilitated by the system of *dangan* (personal file) and *hukou* (residence permit). Since the transition from the central planning economy to the market economy, things have been changed a lot and the labor market has been developed in China. However, evidences show that the labor market in China is far from well-developed. Wage rates are still not fully reflecting the marginal productivity of labor, especially in SOEs and collectively-owned enterprises. Using micro-data, Fleisher and Wang (2004) show that skilled workers are underpaid and their wage rate is far below their marginal productivity in China. The return to human capital estimated based on productivity (Fleisher and Wang (2004)) is much higher than other estimates based on wage compensation (Chow (2002) and Heckman and Li (2004)). Moreover, job mobility is still curbed by the system of *dangan* (personal file) and *hukou* (residence permit). The underdevelopment of the labor market should greatly discourage people from investing in education. In this paper, we use the average of the percentage of the employment of SOEs and collevtively-owned enterprises in total labor force in the past five years to measure the degree of the development of the labor market, denoted *ave_labormarket* . Figure 3 illustrates the relationship between this variable and the enrolment rates at various education levels across

regions in 2000.

Government Policies. We examined two factors here. The first factor is *the ratio of the government educational expenditure to GDP*. In China, government support for a region's education comes from both the local level and the central level. Because the local government expenditure and the central government expenditure may play different roles in educational investment, we investigate the local government educational expenditure and the central government educational expenditure separately. In this paper, we use the average of the ratio of the local (central) government educational expenditure to a region's GDP to measure the local (central) government's support for the region's education, denoted *ave_localexpend (ave_centralexpend)* . Figure 4 and 5 illustrates how the local and central government expenditure ratios are related to the enrolment rates respectively across regions in 2000.

The second factor is the *discriminatory college admission policy.* China's college admission policy favors certain regions such as Beijing, Shanghai and Tianjin while discriminates against other parts of the country. This paper examines to which extend such discrimination influences the spatial inequality of enrolment rates of schooling in China. We construct an index called *collegeadmission.* The higher the value of this index in a region, the more the government college admission policy favors the region. The index is defined as the region's college admission rate

divided by measures of the quality of the students in the region. The college admission rate is equal to the ratio of the number of admitted students to the number of students who take the national college entrance exam in the region. The quality of the students in the region is a little tricky to measure. In China, people who have not got an opportunity to go to a full-time regular college can register in a television college. After taking courses at such an institute, one needs to pass a certain exam in order to obtain a diploma. We use the pass rate of such an exam to measure the quality of the students in the region. Figure 6 illustrates the relationship between *collegeadmission* and the enrolment rates at various education levels across regions in 2000. It is worth to point out here that in our regressions in Section 4, due to the availability of data, we calculate *collegeadmission* for the year of 2000 by dividing the college admission rate in 2000 by the pass rate of the graduation exam of television colleges in 1999. For other years than 2000, because there is no data available, we use the *collegeadmission* of 2000 as a proxy. In doing so, we assume that any change in *collegeadmission* over time is taken care of by time effects (see Section 4).

Financial constraint. We specifically look at the level of the real rural income per capita. In the absence of a well-functioning financial market to support investment in human capital, it is likely that the low-income people could not afford education because of the financial constraint. In China, the rural-urban income gap is large. According to Kanbur and X. Zhang (2000), this gap accounts for 70% of the overall

income inequality. Education fees and tuitions, especially at the senior secondary school or higher levels, account for a large portion of the household income in rural areas on average, which would be a really heave burden for most households. Thus many young people in rural areas choose to join the labor force instead of pursuing further education after finishing primary schools or junior secondary schools. Therefore, we expect an increase in the level of the real rural income per capita to loosen the financial constraint and improve the enrolment rates of schools. In this paper, we use the average of the log of the real rural income per capita in the past five years to measure the level of the real rural income per capita, denoted *ave_ruralincome*. Figure 7 illustrates the relationship between this variable and the enrolment rates at various education levels across regions in 2000. In addition, the urbanization rate should also have a positive influence on the enrolment rates due to similar reasons. In this paper, we use the average of the ratio of non-agricultural population to total population in the past five years to measure the urbanization rate, denoted *ave_urbanization*.

4. Empirical Analysis

The empirical analysis of this section focuses on identifying the importance of the aforementioned factors to enrolment rates at various education levels.

4.1 Data and the regression model specification

Our data of educational variables is complied from the following sources: *1982*, *1990*,

2000 Population Census of Province, China Educational Finance Statistical Yearbook, Educational statistics yearbook of China. Data of other variables comes from *China Statistical Yearbook, Province Statistical Year Book, Data of Gross Domestic Product of China 1952-1995.* Data of the real rural income per capita is compiled from *China Yearbook Rural Household Survey.* In addition, data of the pass rate of television college graduation exam is from *China Educational Examinations Year Book.*

Our data set covers three years: 1982, 1990 and 2000. For 1982, there are 29 provinces. For 1990, there are 30 provinces. For 2000, there are 31 provinces. The summary of statistics is in Table 5.

We run four regressions, one for each education level. The regression model specification for the enrolment rate of college is as follows:

$$\begin{aligned} enrolment\_college_{it} = {} & \alpha + \beta_1 attainment\_senior_{it} + \beta_2 ave\_growth_{it} \\ & + \beta_3 ave\_labormarket_{it} + \beta_4 ave\_central\exp end_{it} \\ & + \beta_5 ave\_local\exp end_{it} + \beta_6 collegeadmission_{it} \\ & + \beta_7 ave\_ruralincome_{it} + \beta_8 ave\_urbanincome_{it} \\ & + \beta_9 ave\_urbanization_{it} + \varepsilon_{it}. \end{aligned} \tag{1.4}$$

Where *i* denotes region *i* and *t* denotes time *t.* The model specifications for the enrolment rates of the other education levels are similar to (1.4). Additionally, we incorporate two dummy variables in our regressions: one for the costal regions, called *coast*; and the other for the three mega cities, namely, Beijing, Shanghai and Tianjin, called *mega.* In all the regressions, we control for the fixed time effect. We also

control for the possible heteroskedasticity across regions.

4.2 Results

The regression results are reported in Table 6. The major findings of our empirical analysis are as follows: first, the economic growth rate has a significant and positive effect on the enrolment rate of the senior high school. Specifically, a one-standard deviation increase in the growth rate of real GDP per capita will raise the enrolment rate of the senior high school by 2.92 percentage points, which is a 13% increase compared to the sample mean. One explanation for this finding may be that higher economic growth rate raises the expected return to education.

Second, the degree of labor market development has a significant and positive impact on the college enrolment rate. Specifically, a one-standard deviation increase in the portion of the private sector employment in the labor force will raise the college enrolment rate by 3.5 percentage points, which is a 78% increase compared to the sample mean. This is because as the labor market develops wage rates get closer to the marginal productivity of worker. Thus the skilled workers get rewarded for their skills obtained from education. However, the portion of the private sector employment in the labor force has a negative and significant impact on the enrolment rate of the junior high school. The negative effect may be explained by the fact that many state-owned enterprises have their own affiliated junior high schools to accommodate the children of their own employees.

Thirdly, the ratio of the local government's educational expenditure to the local GDP has a significant and negative effect on the enrolment rates of both the senior high school and the junior high school. Because in China, the local government's appropriation accounts for a major part of each region's total educational expenditure typically, the inefficiency of the local government educational expenditure revealed by our analysis should cause concerns of the policymakers. On the contrary, the ratio of the central government's educational expenditure to the local GDP has a significant and positive effect on the enrolment rates of all levels of schools except for the junior high school. In particular, a one-standard deviation increase in the ratio of the central government educational expenditure to the local GDP will raise the region's enrolment rates of the college, the senior high school and the primary school by 6.1, 7.0 and 7.5 percentage points, which is an increase of 140%, 32% and 9% compared to the sample mean enrolment rate, respectively. One explanation may be that the central government has a better- planned budget regarding the educational expenditure. Another explanation may be that the central government can coordinate the costs and benefits of different regions and allocate resources in a more efficient way. The above results justify the expansion of the government educational expenditure at an upper level in China.

Fourthly, the level of the rural income per capita contributes significantly and positively to the enrolment rate of the senior high school. Specifically, A

one-standard deviation increase in the log of the rural income per capita will improve the enrolment rate of the senior high school by 16.6 percentage points, which is an increase of 76% compared to the sample mean, respectively. Moreover, the urbanization rate measured by the ratio of the non-agricultural population to total population has a significant and positive effect on the college enrolment rate. In particular, a one-standard deviation increase in the urbanization rate will improve the enrolment rate of the college by 6.6 percentage points, which is an increase of 150% compared to the sample mean. The above results demonstrate the great potential of loosening the financial constraint on enhancing educational investment in China. We include the log of the urban income per capita in the regressions as well. It does not influence the enrolment rate of any level of education in a significant way.

Fifthly, being a mega city raises the enrolment rate of the senior high school by 13.6 percentage points, which is an increase of almost 62% compared to the sample mean, after other relevant factors are controlled for. The three mega cities, Beijing, Shanghai and Tianjin play an important role in China both economically and politically. One explanation for the above finding may be that the mega cities are typically cultural centers that provide a nice environment for schooling. Another explanation may be that there are more schools in the mega cities so that people there have easier access to schooling. It may also be that the schools in the mega cities have better quality on average.

It is worth to be noted that the initial human capital stock measured by educational attainment where the new investment in education is built upon has only an insignificantly positive impact on the enrolment rates of the junior high school and the primary school after other relevant factors are controlled for. Moreover, it has a significant and negative effect on both the college enrolment rate and the senior high school enrolment rate. The above empirical findings contradict with what we expect. The reason may be that the measure of the initial human capital stock used in our regressions is closely correlated with other explanatory variables. It may also be that the decreasing returns to scale have set in so that the *rate* of return to education declines as the human capital stock increases.

According to our empirical results, the discriminatory college admission policy has an insignificantly positive effect (, which is equivalently to a negative effect of *collegeadmission*) on the college enrolment rate. We do not have an explanation for this counter-intuitive finding. Further research is needed to understand it.

5. Policy Implications

This paper finds that the return to education, government polices and the financial constraint plays an important role in generating regional variations in the educational investment and thus regional disparities of education attainment in China. The following policy implications are drawn from our empirical results and they center on: 1) how to finance education and 2) how to free up labor markets; and 3) reform of the

college admission policy.

Due to the inefficiency of the government educational expenditure at the local level, it is important to develop a centralized educational finance system to coordinate the benefits of different regions and to allocate government funds across regions. The current ratio of the central government educational expenditure to the local GDP is only 0.4% on average. It is thus essential to expand the central government educational expenditure, considering that this expenditure has a significantly positive impact on improving the school enrolment rates. Because remarkable improvement on educational investment can be obtained by loosening individuals' financial constraint, it is essential to develop and refine the educational loan system to help individual people finance their education. Meanwhile, the government should also encourage the flow of private funds, organizational funds and foreign funds into education; and encourage the connections between schools and industries.

Because the distortion in China's labor markets severely hurts individuals' incentive to invest in the higher education, it is crucial to free up labor markets. The government should allow people to move freely across jobs and region; develop labor market institutions and other institutions such as rental housing markets to facilitate job-search, matching and moving; and encourage the development of vocational schools and on-the-job training. A well-functioning labor market is necessary for workers to be paid according to their productivity.

The current college admission policy in China favors those regions that already possess higher percentage of college population. Such a policy exacerbates the regional disparities of educational attainment in China. It is thus important to reform the policy and give people across regions equal opportunity to receive the higher education.

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Table 1 Regional Educational Attainment in 2000

Region	primary and up	junior high and up	senior high and up	college and up	Attainment years
Beijing	0.950739	0.824537	0.46256	0.194863	10.34518
Tianjin	0.940407	0.736424	0.358321	0.108162	9.359329
Hebei	0.914063	0.640204	0.173997	0.034938	8.066733
Shanxi	0.943244	0.670532	0.200948	0.04607	8.458181
Neimenggu	0.884062	0.614616	0.222472	0.048436	8.009383
Liaoning	0.942109	0.687599	0.235148	0.075086	8.721237
Jilin	0.942575	0.653427	0.247061	0.060831	8.600238
heinongjiang	0.936738	0.663936	0.230101	0.05925	8.53954
Shanghai	0.937929	0.769546	0.386754	0.124678	9.595189
Jiangsu	0.921158	0.623407	0.210628	0.04875	8.224053
Zhejiang	0.914488	0.536784	0.169823	0.038998	7.762741
Anhui	0.865661	0.519504	0.132104	0.031025	7.272886
Fujian	0.903152	0.559626	0.175934	0.038537	7.779738
Jiangxi	0.930242	0.553627	0.165575	0.034902	7.878668
Shandong	0.892539	0.589245	0.180955	0.042128	7.83435
Henna	0.920907	0.644514	0.17122	0.036079	8.116959
Hubei	0.906933	0.605905	0.213222	0.050517	8.10105
Hunan	0.94014	0.587653	0.180357	0.037577	8.095176
Guangdong	0.948309	0.673198	0.217061	0.046866	8.548092
Guangxi	0.947021	0.560331	0.162044	0.0323	7.978449
Hainan	0.902834	0.636135	0.215921	0.043819	8.148448
Chongqing	0.911009	0.480562	0.145687	0.036062	7.489049
Sichuan	0.901292	0.470774	0.130388	0.031978	7.339151
Guizhou	0.801489	0.371366	0.108209	0.027418	6.357328
Yunan	0.845578	0.372905	0.115828	0.027183	6.648396
Xizang	0.52754	0.152046	0.070021	0.018639	3.905998
Shaanxi	0.901822	0.617764	0.220113	0.055976	8.148465
Gansu	0.803167	0.463438	0.171697	0.036629	6.870926
Qinghai	0.747893	0.443895	0.185456	0.045156	6.556038
Ningxia	0.842823	0.543273	0.203109	0.051537	7.502235
Xinjiang	0.922776	0.576173	0.23729	0.070491	8.259008

Data sources: *2000 population Census of Province* and Authors' own calculations.

Table 2 Regional Gini and GE Coefficients of Educational Attainment

	Gini			GE		
Year	1982[4]	1990	2000	1982	1990	2000
Primary and up	0.1232	0.0968	0.0682	-0.0041	-0.0201	-0.0203
Junior high and up	0.1664	0.1531	0.1223	0.059	0.0465	-0.0050
Senior high and up	0.2003	0.2167	0.1805	0.1588	0.1973	0.1048
3-year College and up	0.3227	0.3152	0.2481	0.4491	0.3836	0.2089
4-year college and up		0.3724	0.3170		0.5305	0.3357
Average attainment years	0.1353	0.1136	0.0906	0.0178	0.0059	-0.0064

Data sources: *1982, 1990, 2000 population Census of Province* and Authors' own calculations.

[4] There is no separate data on 3-year college and 4-year college for the year of 1982.

Table 3 Decomposition of GE coefficients between coastal and non-coastal groups

	$GE^{between}$			$\|GE^{between}\|/(\|GE^{between}\|+\|GE^{within}\|)$		
Year	1982	1990	2000	1982	1990	2000
Primary and up	-0.0016	0.0021	-0.0010	0.3784	0.0872	0.0515
Junior high and up	0.0010	0.0074	-0.0000	0.0175	0.1585	0.0010
Senior high and up	0.0096	0.0184	0.0083	0.0605	0.0934	0.0792
3-year College and up	0.0661	0.0764	0.0277	0.1471	0.1996	0.1327
4-year college and up		0.1280	0.0768		0.2413	0.2289
Average attainment years	-0.0008	0.0044	-0.0013	0.0409	0.7485	0.1986

Data sources: *1982, 1990, 2000 population Census of Province* and Authors' own calculations.

Table 4 Decomposition of GE coefficients between the mega-city group and the rest of the provinces

	$GE^{between}$			$\|GE^{between}\|/(\|GE^{between}\|+\|GE^{within}\|)$		
Year	1982	1990	2000	1982	1990	2000
Primary and up	0.0233	0.0125	0.0041	0.4593	0.2777	0.1436
Junior high and up	0.0594	0.0445	0.0260	0.9446	0.9571	0.4559
Senior high and up	0.1150	0.1015	0.0825	0.7243	0.5147	0.7869
3-year		0.2635			0.6887	0.7590
College and up	0.3072		0.1585	0.6841		
4-year college and up		0.3929	0.2795		0.7406	0.8325
Average attainment years	0.0378	0.0279	0.0173	0.6545	0.5590	0.4219

Data sources: *1982, 1990, 2000 population Census of Province* and Authors' own calculations.

Table 5 Summary of Statistics

Var.	Obs.	Mean	Std. Dev.	Min	Max
Enrolment_college	90	0.0436	0.0460	0.0089	0.2417
Enrolment_senior	90	0.2195	0.1218	0.0358	0.5474
Enrolment_junior	90	0.6939	0.2218	0.1080	1.1465
Enrolment_primary	90	0.8477	0.0930	0.4228	0.9862
Attainment_senior	90	0.1403	0.0724	0.0216	0.4300
ave_growth	93	0.0753	0.0231	0.0066	0.1357
*ave_labormarket_*	92	0.7226	0.1532	0.3120	0.8845
ave_centralexpend	53	0.0044	0.0085	0.00002	0.0411
ave_localexpend	82	0.0330	0.0471	0.0093	0.2953
collegeadmission	72	1.2818	0.2872	0.7810	2.0606
ave_ruralincome	87	5.7673	0.8066	4.2673	8.5100
ave_urbanincome	85	6.5889	0.8363	5.0101	9.6449
ave_urbanization	80	0.2428	0.1346	0.0993	0.7462

Table 6 Regressions of Enrolment Rates

	enrolment_college	*enrolment_senior*	*enrolment_junior*	*enrolment_primary*
*Attainment_*	-0.5075	-0.9381	0.8002	0.6694
senior	(-1.84)	(-2.62)	(0.67)	(0.92)
ave_growth	-0.0441	1.2652	1.3472	-1.7390
	(-0.12)	(1.73)	(0.86)	(--2.14)
ave_labor-	0.2232	-0.0758	-1.2090	-0.1214
market	(2.03)	(-0.42)	(-2.48)	(-0.42)
ave_central-	7.21	8.25	0.935	8.84
expend	(4.37))	(4.00)	(-0.14)	(2.10)
ave_local-	-0.664	-3.07	-10.53	3.29
expend	(-0.63)	(-2.46)	(-2.37)	(1.39)
college-	-0.0111	-0.1031	-0.1785	0.1064
Admission	(-0.40)	(-2.59)	(-1.19)	(1.03)
ave_rural-	0.0068	0.2054	0.1365	-0.0667
Income	(0.25)	(4.79)	(1.09)	(-0.77)
ave_urbani-	0.4897	0.1552	-1.2668	-0.3007
zation	(2.43)	(0.53)	(-1.92)	(-0.69)
Mega	0.0171	0.1357	0.0984	-0.0239
	(0.80)	(4.37)	(1.11)	(-0.44)
R-square	0.8358	0.9396	0.8373	0.4759

In parentheses are t-values.

Figure 1 Economic growth rate and enrolment rates of schools

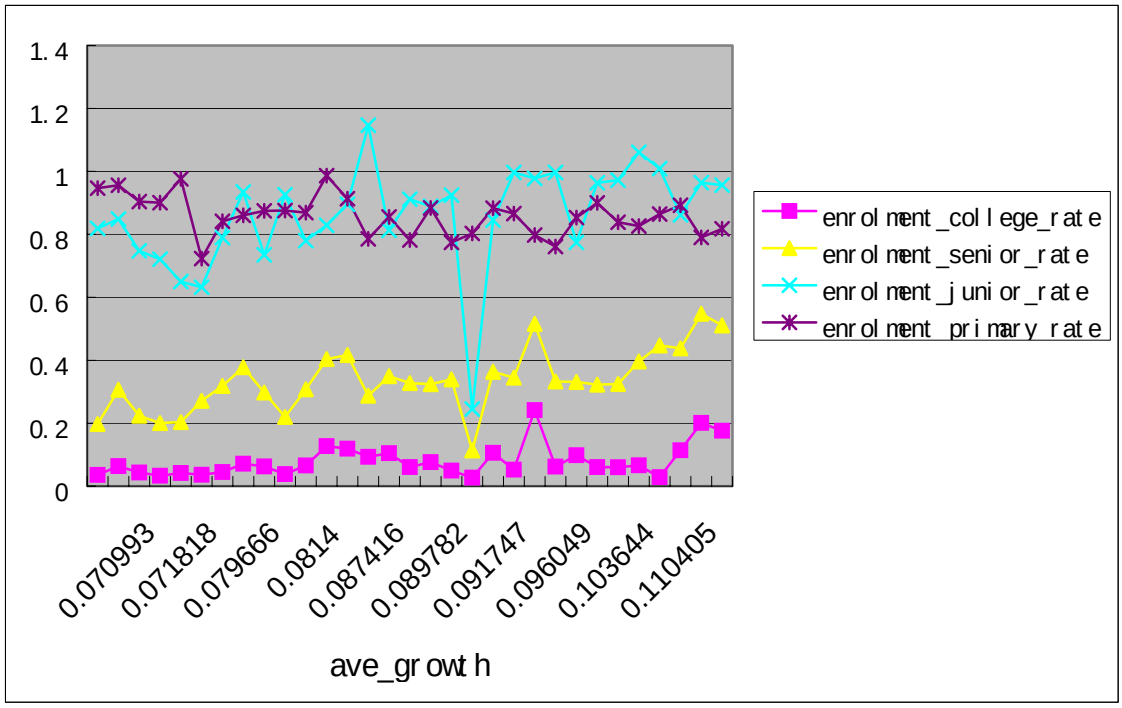

Figure 2 Initial educational attainment and enrolment rates of schools

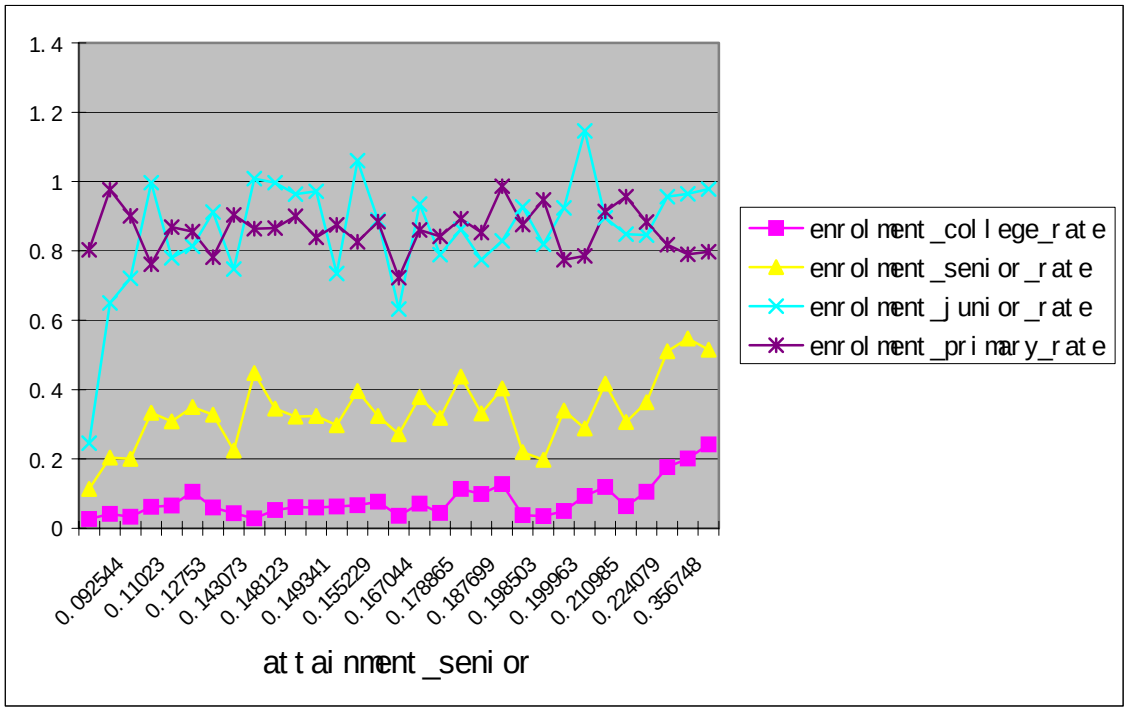

Figure 3 Labor market development and enrolment rates of schools

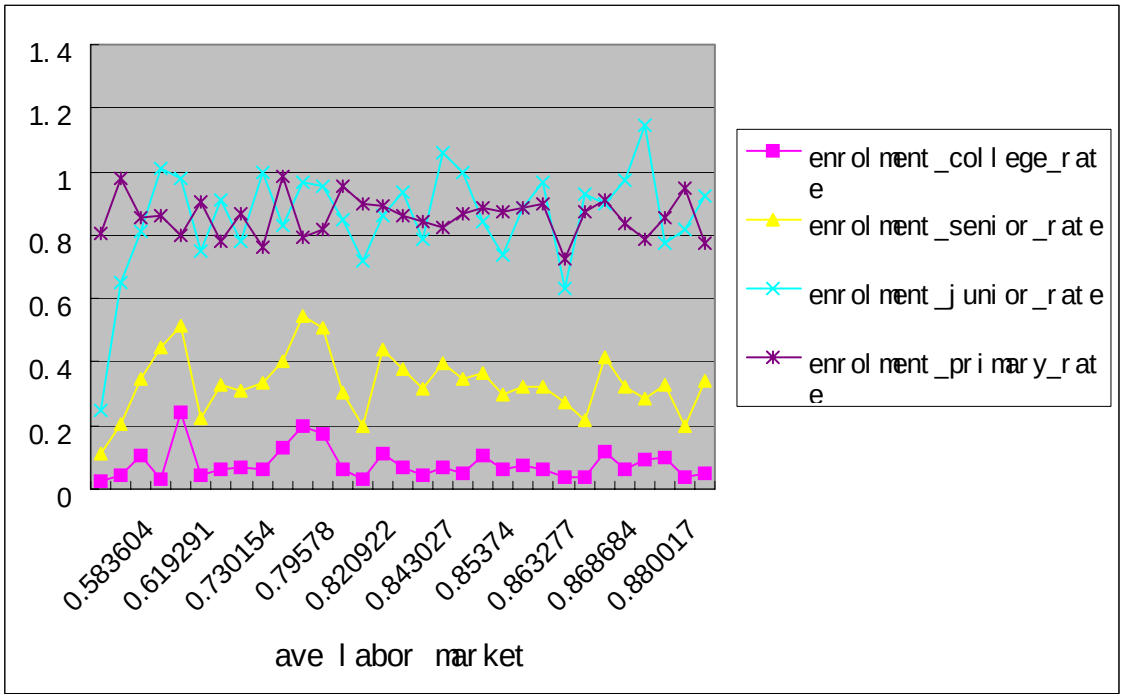

Figure 4 Local government educational expenditure and enrolment rates of schools

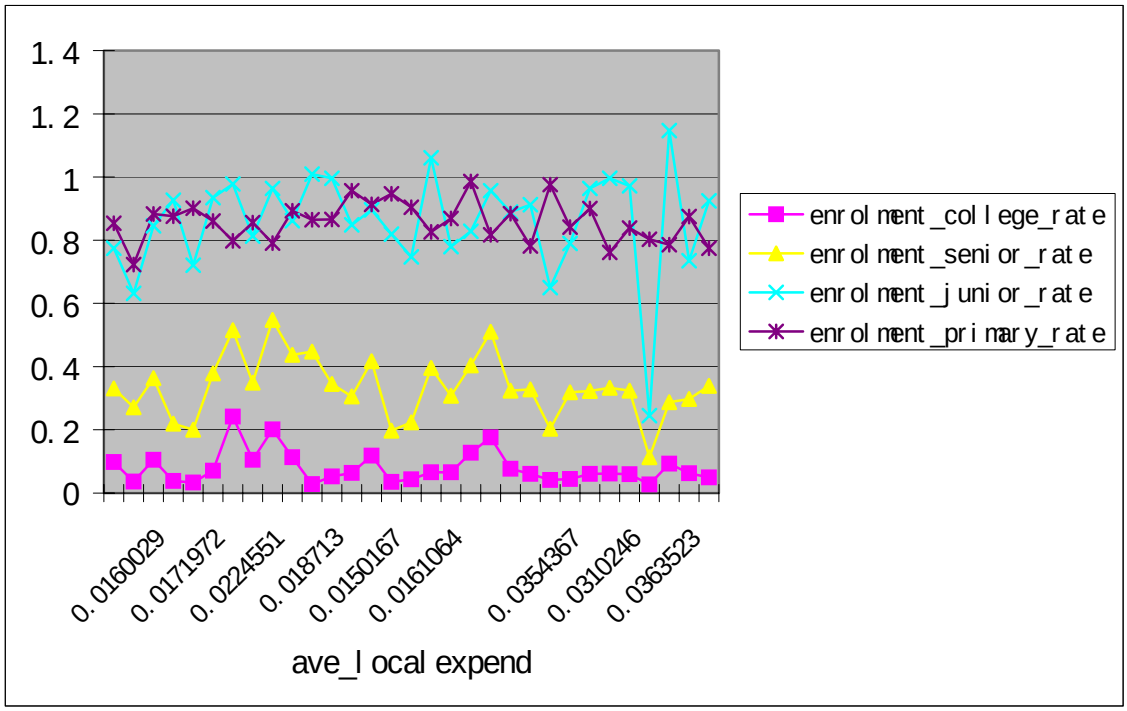

Figure 5 Central government educational expenditure and enrolment rates of schools

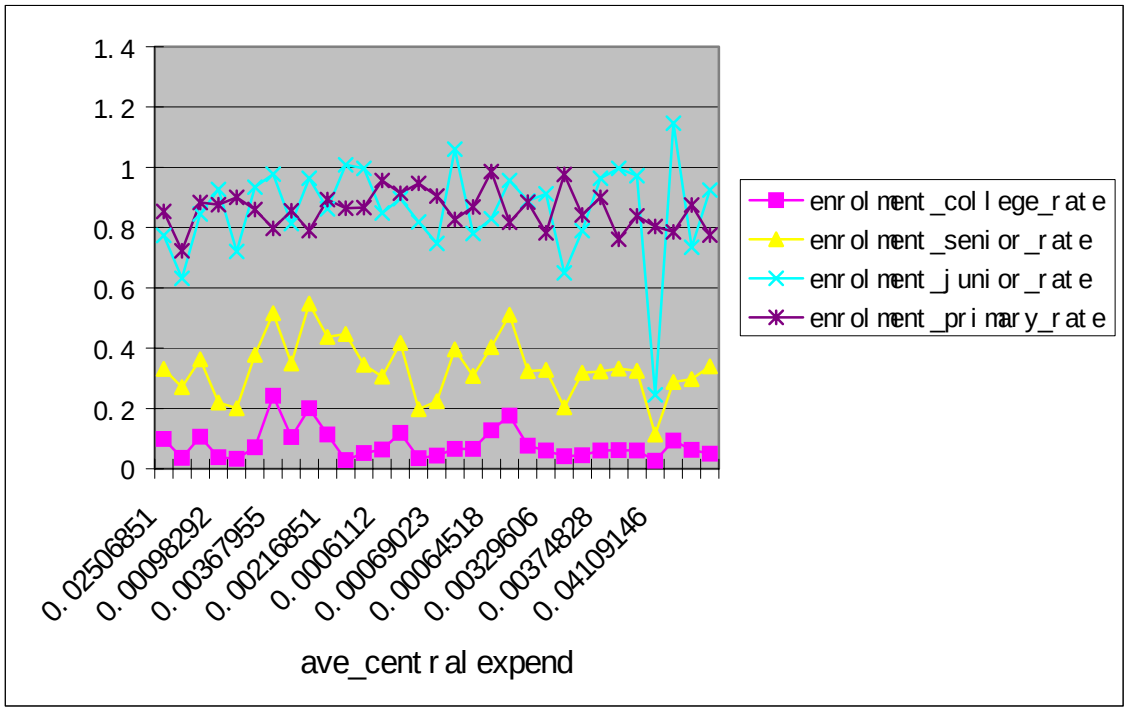

Figure 6 College admission policy and enrolment rates of schools

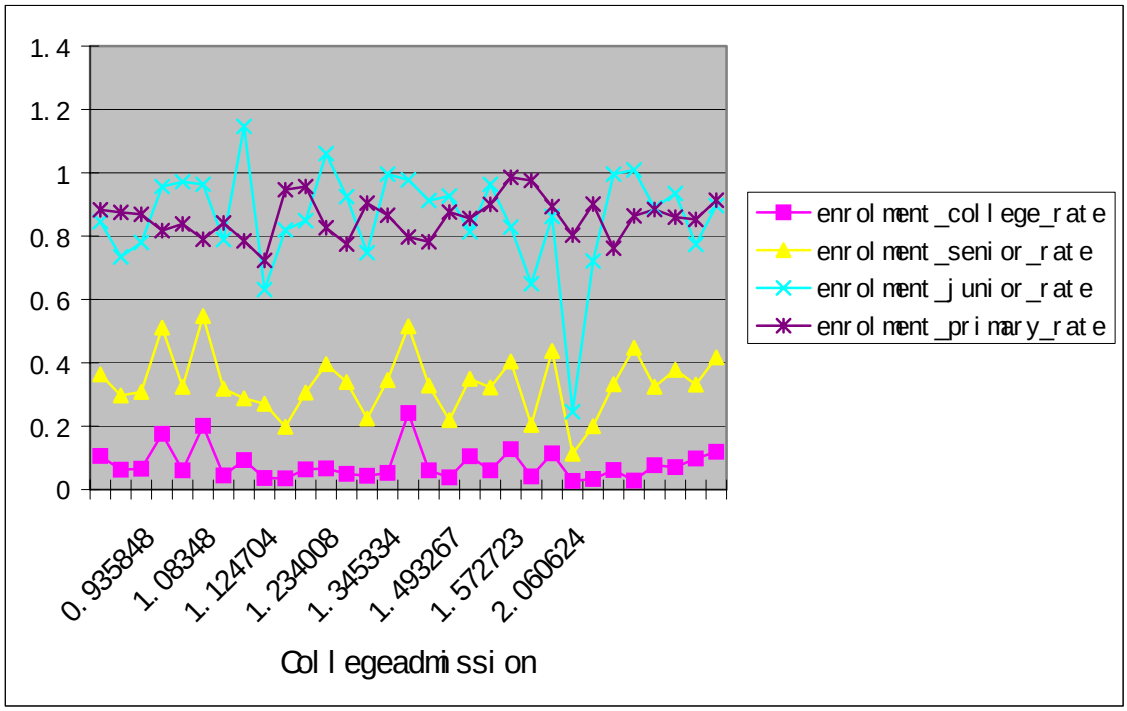

Figure 7 Rural income per capita and enrolment rates of schools