

Human Capital Accumulation and Income Distribution in Urban China

: The Case of Shenzhen

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The goal of this paper is to study income disparity in Shenzhen, the first special economic zone and richest city in China using a new household survey dataset. We focus on the difference in human capital accumulation among working age adults and its influence on both income determination and income distribution. Our survey shows that the *Gini coefficient* in Shenzhen reached 0.56 making it the highest in urban China. Using the Mincer model we found that returns to education are as high as 10% per year of additional schooling. Further regression analysis shows that the higher the educational attainment, the higher the income of individuals. Compounding this, we also found that social characteristics such as gender and policy oriented factors that include the urban registration system and regional development priority (being a special economic zone) are also relevant. Taken together our findings indicate that human capital accumulation plays a very important role in income determination. Thus differentials in human capital and differentials in human capital accumulation can be used to explain an important part of income disparity. In light of such findings it would seem that increasing investment in education and equalizing educational opportunities are the most effective ways of reducing income disparity.

I. Introduction

There are a number of studies addressing income distribution in China. In this paper we focus on the determinants of income and income distribution in Shenzhen, China's first special economic zone (SEZ). Our purpose is to measure income disparity in the country's richest city and to find the factors causing disparity. We are particularly interested in analyzing the role of human capital accumulation and its influence on income determination as well as on income disparity.

Shenzhen, located in Guangdong province (in close proximity to the former British Crown colony of Hong Kong) had been a small fishing village with only 20,000 poor inhabitants in the 1970s. In 1980, Shenzhen was granted SEZ status. Today Shenzhen is one of the most important urban centers in mainland China having restructured its economy towards export-orientation. From the mid 1980s to the early 1990s, Shenzhen experienced rapid economic growth, a significant population increase, large inflows of foreign investment, expanding international trade and

concentration of manufacturing industries.

Now, seen as a manufacturing center, it is often referred to as of the *factory of China*.

Shenzhen is a migrant city. By the end of 2006, the city has 8.46 million permanent residents, 1.97 million of these are Shenzhen hukou households (with Shenzhen registration status) while 6.49 million are non-Shenzhen hukou households (one-third of them have rural registration status). The non-Shenzhen hukou households make up 77% of the total population.¹³ As Shenzhen has been ranked number one in GDP growth, foreign trade, foreign capital inflows, standard of living, economic and social dynamics etc., over a number of years, its success can be deemed remarkable. Chinese people, especially the young generation, cherish the prospect of working and living in Shenzhen, a phenomenon referred to as the *Shenzhen Dream*. At the same time, however we found that the city is facing an array of problems, increasing income inequality being one of the most serious.

In order to see *how* serious the disparity is, this paper estimates the Gini coefficient using a new household survey conducted in Shenzhen in 2006. In addition, we will compartmentalize the inequality by using the Theil index to describe *which* major factors are responsible for the disparity. Then, we will estimate returns to education using

the Mincer model to find evidence of human capital theory and its influence on income distribution. Hence, via this analysis we explore *why* disparity occurs and, in turn, try to give some policy advice for its reduction.

The paper is organized as follows: Section 2 provides a review of relevant literature relating to the theories of human capital and the issue of income distribution in China. Section 3 discusses the model and dataset used in this paper. Section 4 presents the main results of the analysis. Finally, section 5 summarizes our key findings and draws a number of conclusions.

II. Literature Review

The idea that individual human capital accumulation determines individual income can be traced back to human capital theory developed by Mincer (1958, 1962), Schultz (1960), Becker (1964, 1966) and Ben-Porath (1967). Here human capital accumulation is regarded as an investment decision. Hence, on an individual level as well as on the aggregate level, human capital is a decisive factor of income growth. Consequently, individuals with higher human capital or higher education can gain higher income. The theory can be transferred into an econometric model, namely the Mincer model, which calculates individuals' returns to

education. As formulated by Card (1999) and Harmon *et al.* (2003), the relationship between education and income in a regression analysis can be observed as positive and significant. Although the exact returns to education may differ within a wage distribution, the general consensus is that human capital, acquired through formal or informal education, is one of the most important determinants of income.

Starting with Ben-Porath (1967, 1970) and then G. Becker, human capital investment has been used to explain the shape of wage profiles over a lifetime. Typically, the wage profile shows an increasing trend for young workers, a decreasing trend for middle-aged workers and, eventually, a declining trend when workers reach retirement age. After the initial investment in education at the beginning of one's working life, human capital investment continues via formal and informal job training. Mincer (1974) labels this in his original equation as 'potential experience'.

In general, income determination and income disparity are affected by many factors including an individual's occupational status, marriage, gender, age, family background, profession, position, industrial sector, educational attainment and so on. Moreover, exogenous political and economic development also affects income distribution and income differentials,

something that is only too clear in the transformation of a political and economic system from a socialist command economy to a market oriented economy. As assumed by Cao and Nee (2005) and Shu (2005), a trend towards a market economy will affect the structure of earnings and cause pronounced wage differentials; and particularly it will induce individuals to capitalize on their education and experience. In addition Tanzi (1998) stresses the impact of globalization on the determinants of earnings, arguing that as a country experiences economic development human capital will replace social norms and attitudes as the main determinants of income and income inequality. Cao and Nee (2005) state that such a shift can induce the private sector's development, expand urban labor markets, and lead to an increase of competitiveness. Thus, institutional change will generate growing opportunities for more productive individuals, e.g. high-skilled workers and thereby contributes to income differentials. Fleisher and Wang (2005) argue that the recent increase of returns to education in China is closely linked to political and economic reforms, notably as prior social and educational equalization policies have boosted the importance of education.

Using the above theories and methodologies, many studies show that

human capital, social norms and attitudes as well as governmental economic policy are important factors which can explain income determination and differentials in China.

Migration is another factor that affects individual income determination. Chen and Coulson (2002) point out that migration to urban areas is mainly driven by the expectation of economic opportunities. Du et al. (2005), Lu and Song (2006) observe that such opportunities like higher income and access to better education, are extremely tempting to migrants compared to the reality of poverty, underemployment and restricted opportunities in their home towns. Lu and Song (2006) and Flesher and Wan (2006) focus on wage differentials between migrants and urban workers and suggest that such divergency is a consequence of varieties of human capital endowments. Meanwhile, Sicular et al. (2007) indicated in their new study that the rural-urban education gap contributes as much as 40% to the total inequality of earnings.

Concerning the non-economic reasons, Lu and Song (2006) indicate that wage differentials also originate from a number of non-productive discriminatory factors. These are mainly hukou-related (the urban registration system designed to control migratory movements) because the lack of an urban hukou negatively affects wage negotiations. Liu (2005)

concludes that urban resident status may be regarded as a crucial factor for income determination because it can grant access to better education or other social benefits. These factors, in turn, can be correlated to an individual's productivity. As suggested by Lu and Song (2006), the urban hukou status for migrants is closely correlated with their human capital endowment because a better educated person is more likely to be granted urban hukou status. Thus, wage gaps within migrant groups can be seen to stem from differences from both hukou and education related issues.

There are a number of studies that focus on the affect of education on personal income in China. Knight and Song (1991) detect a positive effect of education on wages using education dummy variables. Employing a household survey, Byron and Manaloto (1990) report a 4% returns to education in China while the same estimates made by Johnson and Chow (1997) are 3 to 4%. Li (2003) estimates a rate of 5% using a data set from 2003. Heckman and Li (2004) find that college graduation leads to an increase of 43% in lifetime earnings for a young person in urban China. Cao and Nee (2005), as well as Okushima and Uchimura (2006), show that differentials in education can account for the largest proportion of income differentials in urban China.

In summary, most studies show

that gender, party membership, age, migratory and urban resident registration to be some of the major factors determining income level and contributing to the income gap. Among them, human capital accumulation, namely educational attainment, is a decisive factor. It is shown that the overall importance of human capital accumulation for wage determination has been strongly amplified by political and economic reforms that have made it possible for individuals to capitalize on their educational endowments. Thus, as many studies (Knight and Song, 2002; Shu, 2005) show economic liberalization or marketization can increase labor mobility, induce high returns to education and improve the importance of human capital.

However, while most studies have focused on the relationship between human capital accumulation and income determination, the relation between education and income disparity had not been clearly verified. Due to this reason, this paper will measure returns to education and emphasize the role of human capital accumulation and its effect on income distribution in urban China using Shenzhen as a case study.

III. Income Disparities in Shenzhen

1. The Data

There have been only a few studies on

income distribution in Shenzhen due to the difficulties of conducting such a survey and the high costs. There are some official data published in the Shenzhen Statistics Yearbook, however, even though these data are based on a household survey, the survey size is rather small (there were only 600 household samples in 2005) and the data itself is in doubt. Hence, we have some concerns as to whether the official data provides a correct characterization of the situation. For example, the incomes of the highest groups are only 70,000 Chinese Yuan per household in 2005. With such a small sample size the average household income is simply too low to believe. That is one reason why we conducted our own household survey in Shenzhen.

In this paper we measure the Gini coefficient, the Theil index and calculate returns to education employing the Shenzhen household survey dataset. The survey was conducted in March 2006 reporting the data of 2005. We designed the Shenzhen Household Survey and set up the frame and sample distribution using the data published in the Shenzhen Statistics Yearbook 2005. According to the official data, the total population was 5.94 million in 2004; with one-third of the population being Shenzhen residents with registration status and two-thirds being non-Shenzhen residents with registration status. In terms of the resident

registration system, one-third were non-urban hukou resident (migrants from the countryside) with rural registration status, while two-thirds were urban hukou residents with urban registration.²⁾ The survey was conducted by random sampling taking into account the districts' geographical location and the population's components as described above.³⁾ We chose three of the six districts for our survey namely the old special economic zone (Luohu), the culture and educational area (Nanshan) and the new industrial park (Baoan, non-special-economic zone).

To estimate the *Gini coefficient* we use 2,946 samples of working-age adults from 16 to 65 years with earnings in 2005.⁴⁾ Among them, 1,563 individuals were urban residents and 1,383 were rural residents (migrant workers). Moreover, 809 were Shenzhen residents and 2,137 were non-Shenzhen residents. To exclude the bias of family size and its influence on household income, we weight income by using average family income (total income divided by the number of family members).

2. Estimates of the Disparity in Shenzhen

1) The Gini coefficient

To measure the disparity in Shenzhen, we use the Gini coefficient, a popular and widely used index for quantifying income disparity. There are many methods to

measure the Gini coefficient, for example by household or individual. We use the following equation based on the theory described by A. Sen (Sen, 1973).

$$G = 1 + n^{-1} - (2/n^2\mu) \sum_{i=1}^n (n+1-i)y_i,$$

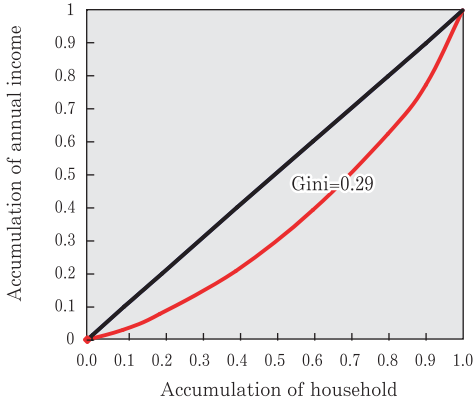
where G is the *Gini coefficient*, n is the cumulated proportion of the population arranged from lower to higher income group, μ is the average income and y is the cumulated proportion of the income arranged from lower to higher income group. Income is ordered by y_i ($y_1 \leq y_2 \leq \dots \leq y_n$).

Based on the definition given above, we estimate the *Gini coefficient*. Our results show that the Gini coefficient of Shenzhen reached 0.56 in 2005, the highest level in urban China. When we compare our results with the official data, the difference is quite considerable (see figures 1 and 2).

2) The Theil index

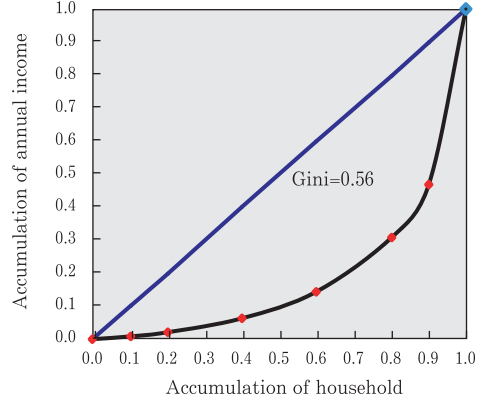
The Shenzhen household survey data show that households in the special economic zone (Nanshan and Louhu districts) have higher income than those in non-SEZ (Baoan district). Meanwhile, households with urban registration status (urban hukou) have much higher disposable income than those with rural registration status (migrant household). This means that institutional factors such as the *hukou* system and regional

Figure 1 Lorenz Curve for Shenzhen
(Calculated by Official Data, 600 households)



Source: Shenzhen Statistics Yearbook 2006.

Figure 2 Lorenz Curve of Shenzhen
(Calculated by survey data, 1,025 households)



Source: Shenzhen household survey 2006.

development policy (SEZ), have a strong influence on income levels. In addition, these factors contribute a lot to the urban-rural disparity and regional disparity.

In order to prove the above view and identify the factors causing disparity we use the Theil index to decompose the disparity. In so doing, we divide all samples into the following groups: 1) Shenzhen versus non-Shenzhen group, to reflect the policy differences in a SEZ; 2) Urban versus rural group, to reflect the urban-rural disparity and the policy effects of the urban registration system on income distribution; 3) Shenzhen urban versus non-Shenzhen urban group, to reflect disparity among urban residents; and 4) Non-Shenzhen urban versus Non-Shenzhen rural group, to reflect the urban-rural disparity. Based on the principle of the Theil measure and the division in groups, we use the

following equation to calculate the Theil index.

$$\sum_{i=1}^N y_i \log \frac{y_i}{1/N} = \sum_{g=1}^G Y_g \log \frac{Y_g}{N_g/N} + \sum_{g=1}^G \left[\sum_{i \in s_g} \frac{y_i}{Y_g} \log \frac{y_i/Y_g}{1/N_g} \right],$$

where N is the sample size, y_i is the income share of household i in total income, G is the number of groups, y_g is the income share of g groups in total income. The left part of the equation is the total Theil index, followed by the disparity between groups and the final part of the equation represents the disparity within groups.⁵⁾

Table 1 provides a summary of the Theil indexes and their composition. It shows that in relation to concerning the Shenzhen and the non-Shenzhen group, the *between group disparity* contributes 30.7% to the total disparity while the *between group disparity* of the urban-

rural group contributes 27.3% to the total. In contrast, the *between group disparity* of the non-Shenzhen urban vs. non-Shenzhen rural and the Shenzhen urban vs. non-Shenzhen urban group contributes only 16% to the total disparity respectively.

However, we found from Table 1 that income disparity mainly results from *within groups*, especially within urban households. This means the *between disparity* is less than the *within disparity* and the between group disparity can only explain about 30% of the total disparity. Therefore, we summarize that as well as policy related and institutional factors, there must be some other factors affecting income distribution. We will

explore these additional factors, such as differences in education, in the next session.

V. Human Capital Accumulation and Income Differentials

Based on the human capital theories, we processed the Shenzhen survey data to show the relation between education and income. Figure 3 shows the sample distribution by level of graduation. It shows that roughly 30% of working-age adults received an education up to the level of middle school, while 25% were educated to high school level and 26% were university graduates or postgraduates. Figure 4 illustrates the relationship

Table 1 Decomposition of Income Disparity by Hukou

	Total (sample=1025)	Shenzhen hukou (285)	Non-Shenzhen hukou (740)	Between group	Within group
	0.7604	0.2994	0.2279	0.2331	0.5273
Contribution ratio	100.0	39.4	30.0	30.7	69.3
	Total sample (1025)	Urban hukou (564)	Rural hukou (461)	Between group	Within group
	0.7604	0.5035	0.0496	0.2073	0.5532
Contribution ratio	100.0	66.2	6.5	27.3	72.7
	Non Shenzhen hukou (740)	Non-Shenzhen urban (285)	Non-Shenzhen rural (455)	Between group	Within group
	0.5780	0.3319	0.1249	0.1212	0.4568
Contribution ratio	76.0	43.6	16.4	15.9	60.1
	Urban hukou (564)	Shenzhen urban (279)	Non-Shenzhen urban (285)	Between group	Within group
	0.5913	0.3433	0.1537	0.0944	0.4970
Contribution ratio	100.0	58.1	26.0	16.0	84.0

Source: Shenzhen Household Survey 2006.

between educational attainment and income level. It shows that the higher the educational attainment is, the higher the income level will be. It is clear that education is one of the decisive factors in income determination.

Shenzhen is a young city with a large population that has an average age of 30 (in our survey the average age of samples are 30.4 years old). In addition, these young people are well educated, with a high level of education. This leads

Figure 3 Sample Distribution by Education Level (Samples=2,007, Age=16 and over)

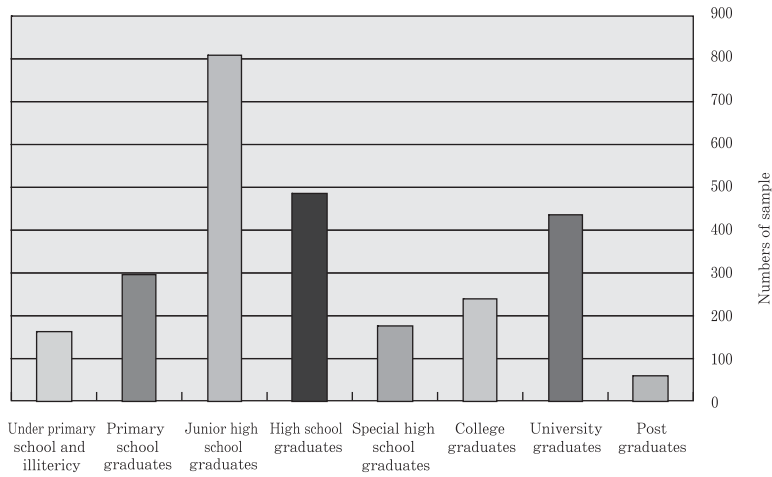
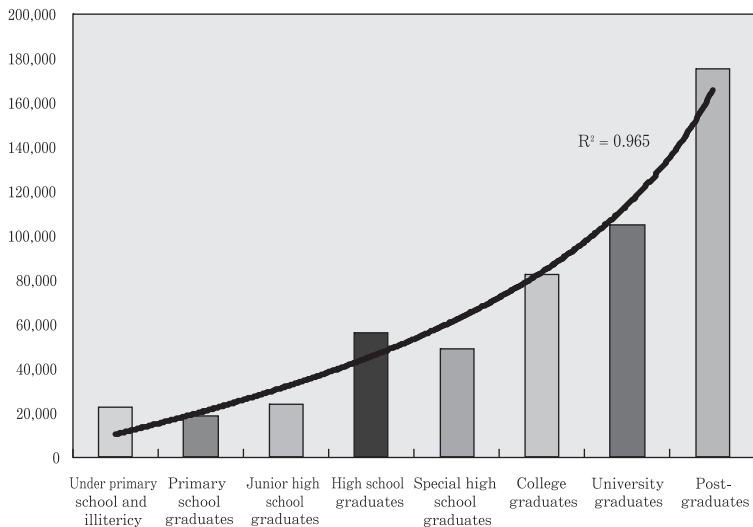


Figure 4 Educational Attainment and Income Level (Samples=2,007, Age=16 and over. Unit=Chinese Yuan)



to a hypothesis that high human capital accumulation is one of the decisive factors in income determination and income differentials. In order to test this hypothesis, we employ the Mincer model to estimate the returns to education. The basic Mincer equation is as follows.

$$\ln Y = X'\beta + \mu,$$

where $\ln Y$ is the logarithm of income, X is a series of variables describing levels of human capital, β is a vector determining the effect of human capital on income and hence reflects the returns to education, and μ is the standard error.

In order to study the case of Shenzhen using the Shenzhen household survey dataset, we modified the Mincer-Becker model by adding some dummy variables.

$$\ln Y = \alpha + \beta_1 \text{edu} + \beta_2 \text{age} + \beta_3 \text{age}^2 + \beta_4 \ln \text{workingtime} + \sum_{i=1}^n \lambda_i \chi + \mu.$$

where edu is education represented by the years of individuals' schooling, age is the average age of working age adults aged 16-65 with income in 2005, age^2 represents the life cycle earning idea, $\ln \text{workingtime}$ captures the logarithm of working hours per year, χ is a series of control variables (dummies) such as gender (male), rural registration status (rural), party membership, district characters (SEZ) and informal education

and μ is the standard error. Here we employ the age variable instead of working experience which can be calculated as the difference between age and education (age minus schooling years) as there are major differences in education among individuals and it is unknown when they start working. Among the variables, education, in terms of schooling years, represents human capital accumulation, age represents working experience, male represents gender, rural registration represents policy factors influencing income, and Luohu and Nanshan (combined into the SEZ dummy) districts are special economic zones reflecting the policy reference of regional development.

Table 2 shows the results of the regression. The returns to education are 10%, indicating that one extra year of schooling implies a 10% rise in income. This is very high compared to other Chinese cities.⁶⁾ Both age and age squared are significant at a high level of statistics which means age, representing working experience and labor skills, has large influence on income determination. However, age squared is negative which shows that to some extent, age has a negative effect on earnings. Meanwhile, the regression implies that *male*, *rural registration status*, *party membership*, *informal education* and the *SEZ dummy* are significant. This shows that gender, the registration system and the policy of

special economic zones are important factors determining income.

To analyze the effect of education on income by educational degree, we conducted another regression. In doing so, we modify and extend the above Mincer-Becker equation by using dummy variables for education levels i.e., *middle school graduates (junior high school)*, *high school graduates* (includes special school graduates with the same years of schooling), *college graduates*, *university graduates and postgraduates* in the vector χ (primary school graduates and persons without any schooling are taken as a basis in the regression). The following equation is our new model to conduct the regression analysis.

$$\ln Y = \alpha + \beta_1 \text{age} + \beta_2 \text{age}^2 + \beta_3 \ln \text{workingtime} + \sum_{i=1}^n \lambda_i \chi + \mu$$

The results in Table 3 show that all educational coefficients are significant at a high level of statistics. This means educational attainment has a strong influence on income determination. It also shows a clear trend that the higher the educational attainment is, the higher the income level will be.

Considering the real situation of job hunting, where academic attainment is counted as a standard element of wage negotiation, we conflate the years of schooling into three levels of education, i.e., primary education, secondary education and higher education, to highlight the income changes from one level to the other. The regression result shows that returns to education increase significantly as educational attainment increases from one level to the next. For example, returns to secondary education

Table 2 Returns to education of working age adults

Log income	Coefficient	Robust Std. Err.	t -value	P> t	95% Conf.	Interval
Age	0.1323	0.0143	9.2300	0.0000	0.1042	0.1604
<i>Age squared</i>	-0.0016	0.0002	-8.1300	0.0000	-0.0020	-0.0012
Schooling years	0.1009	0.0074	13.5800	0.0000	0.0863	0.1155
log Working time	0.1944	0.0611	3.1800	0.0010	0.0746	0.3143
Male	0.3565	0.0376	9.4900	0.0000	0.2829	0.4302
Informal Education	0.1640	0.0539	3.0400	0.0020	0.0583	0.2697
Party Member	0.2083	0.0668	3.1200	0.0020	0.0773	0.3392
Rural hukou	-0.7285	0.0553	-13.1700	0.0000	-0.8369	-0.6200
Shenzhen hukou	0.1340	0.0397	3.3700	0.0010	0.0561	0.2120
Constant	5.0441	0.5633	8.9500	0.0000	3.9393	6.1489
Number of obs.	1,879					
<i>R-squared</i>	0.507					

Source: Shenzhen household survey 2006.

are as high as 15% (income will increase 15% if a person's academic level rises from primary to secondary education), beyond the national level of 13.4% reported by Psacharopoulos and Patrinos (2002) and closer to the situation in some high income countries. Furthermore, returns for moving from secondary to higher education (say university graduation) jumps 22%. This simulation means that the major jump in coefficients for college, and even more for university, indicates that the level of education is important. In other words, returns to education, especially returns to higher education, are significant. This may be the core of the Shenzhen Dream and the secret of the success of Shenzhen's development.

In summary, all of this evidence would seem to indicate that Shenzhen is a rather well-developed urban centre where, in particular, highly educated people benefit from returns to education. The incentive, not to drop out of the educational system after the completing secondary schooling and to continue to accumulate more human capital, seems to be very large.

VI. Conclusion

This paper studies income disparity in Shenzhen, the first special economic zone and the richest city in China using a new household survey dataset. We focus on the difference in human capital accumulation among working-age adults

Table 3 Regression result of educational attachment and income level

Log income	Coefficient	Robust Std. Err.	t -value	P> t	95% Conf.	Interval
Age	0.11492	0.0144	7.9700	0.0000	0.0867	0.1432
<i>Age squared</i>	-0.00143	0.0002	-7.0700	0.0000	-0.0018	-0.0010
Middle school	0.22954	0.0600	3.8300	0.0000	0.1120	0.3471
High school	0.54681	0.0726	7.5300	0.0000	0.4044	0.6892
College	1.04004	0.0951	10.9400	0.0000	0.8535	1.2265
University	1.27274	0.0893	14.2500	0.0000	1.0975	1.4479
Post Graduates	1.72616	0.1150	15.0100	0.0000	1.5006	1.9518
Log Working time	0.21709	0.0595	3.6500	0.0000	0.1004	0.3338
Male	0.37090	0.0370	10.0100	0.0000	0.2982	0.4436
Informal Education	0.12587	0.0541	2.3200	0.0200	0.0197	0.2321
Party Member	0.14030	0.0675	2.0800	0.0380	0.0079	0.2727
Rural hukou	-0.64190	0.0557	-11.5200	0.0000	-0.7512	-0.5326
Constant	5.72459	0.5418	10.5700	0.0000	4.6620	6.7872
Number of obs.	1,891					
<i>R-squared</i>	0.528					

Source: Shenzhen household survey 2006.

and its influence on income disparity. Our survey shows that the Gini coefficient in Shenzhen reached 0.56, the highest in urban China. By decomposing the inequality via the Theil index, we found that the urban hukou system and the regional preferential policy of development (special economic zone), are the main institutional factors causing inequality in Shenzhen. In addition, we also found that the *between group disparity* contributed only 30% to the total disparity, in other words, there are an additional 70% of factors not yet clarified.

In order to explore the within disparity, we used an augmented Mincer model and found that returns to education are as high as 10% in Shenzhen, far beyond the national level (of 4-8%). Regression analysis of educational attainment shows that the higher the level of graduation, the higher the level of income. These findings indicate that human capital accumulation plays a very important role in income determination and that returns to education is a crucial incentive to invest in human capital. Meanwhile, working experience, measured by *age* in our regression, also has a significant influence on income levels. However, these factors, in rerun, become the main causes of income inequality.

In summary, social characteristics like gender and institutional factors such as

the urban registration system and special economic zone, are shown to be relevant to income determination as well as income disparity. These results allow us to conclude that differentials in human capital accumulation, measured by returns to education, can explain a large part of income disparity. Therefore we think that increasing investment in education and equalizing educational opportunities are the most effective ways of reducing income disparity.

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Notes

- 1) Shenzhen government online, http://english.sz.gov.cn/gi/200708/t20070824_229880.htm.
- 2) Population data and its composition in 2004 are quite different from that of 2006. This difference is due to the fact that the 2006 figure is estimated on the basis of the 2005 Economic Census which included migrant population data without urban hukou.
- 3) In total, the population of Shenzhen contained one-third Shenzhen residents with registration and two-third non-Shenzhen residents with registration. In terms of the resident registration system, one-third are

migrants from the countryside with rural registration status, while the other two-third are urban residents with urban registration.

4) We choose 975 households and 2,946 individuals as an effective sample for our income related analysis because of some missing data and uncertain information. A few samples with incomes over 1,250,000 Yuan per capita are deleted because of their large influence on our estimates.

5) To compare our results with the official data, we calculated the Theil Index by grouping households into several groups and using the total income of households as income variables.

6) Most studies show that average returns to education range between 2 to 8% for nationwide data and between 4 and 9% for cities (Zhang Juwei, 2006, p.59).

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