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Abstract

Using annual urban household survey data from 6 provinces in different regions of China, we analyze the rapid increase in inequality of China's urban wages from 1988 to 2003. We describe overall and residual inequality trends and use quantile regression to address the relationship between education and wage inequality. Returns to education are higher for the low wage individuals in the first half of this period conditional on their observable characteristics. This suggests that education has a negative impact upon within-group wage inequality. But the situation is reversed during the recent half period. Using the Quantile-JMP decomposition technique we partition the observed distribution of wages into 'price' components (wage coefficients) and 'quantity' components (labor force composition) and calculate, through simulation, the impact of education on changes in overall wage dispersion. The decomposition shows the rise of male wage dispersion between 1988 and 2003 is almost entirely accounted for by prices rather than quantities and it attributes a large proportion to the overall effect of education. From 1988 to1997 education serves as the equalizing force to decrease wage inequality but it is the primary driving force which increases the wage inequality between 1997 and 2003. The empirical analysis also reveals that the overall effect of college and above education category on the growth of wage inequality is the most pronounced one.

Key words: Return to education; wage inequality; quantile regression

JEL: C29; J31; I21

1. Introduction

Since economic reforms began in 1978, China has experienced one of the fastest increases in income inequality ever recorded. [1] The rapid growth of wage inequality is not only a potential hazard to China's political stabilization and sustainable economic growth; it is also closely related to poverty reduction because an increase in inequality may increase poverty. Thus the inequality issues are of utmost importance to the policy makers.

Due to the positive relationship between education and wages, some Western decision-makers have portrayed schooling as the best tool to erode the supposedly globalization-related forces that increase wage inequality. As Ashenfelter and Rouse (2000, p. 111) put it, "the school is a promising place to increase the skills and incomes of individuals. As a result, educational policies have the potential to decrease existing, and growing, inequalities in income".

Although preliminary evidence[2] shows that rising returns to education is an important contributor to rising inequality and emerging evidence reveals that aggregate wage inequality is due not only to differences in educational attainment but also to disparities within each educational group. The effective impact of education upon inequality is not clear and it's the major aim of this paper.

Before we explicitly explore the relationship between education and wage inequality, we detailed depict the inequality trends in urban China. As we known, inequality trends in China reflect fundamental changes in the way labor is allocated and rewarded in China's transitional economy. China has moved from a socialist planned economy with fixed wage scales and virtually no labor mobility to a market-based system featuring a dynamic non-state sector and an increasingly open

[1] The World Bank (1997) finds that China's overall Gini coefficient grew from 0.288 in 1981 to 0.388 in 1995, from 0.176 to 0.275 in urban areas and from 0.242 to 0.333 in rural areas. Khan and Riskin (1998) report that the overall Gini coefficient grew from 0.382 in 1988 to 0.452 in 1995, from 0.233 to 0.332 in urban areas and from 0.338 to 0.416 in rural areas. Using National Statistical Bureau data covering 18 years from 1978 to 1995, Li, Zhao and Zhang (1997) found that the Gini coefficient increased from 0.16 to 0.28 in urban areas and from 0.21 to 0.34 in rural areas.

[2] Gustafsson and Li (2000), Knight and Song (2003), Zhang et al. (2005).

labor market. We show in this paper that one key aspect of this transition has been a rapid increase in the returns to skill. This is to be expected if socialist planners compressed wage scales while market reforms have increasingly rewarded labor based on productivity. Despite these changes, important institutional barriers to labor mobility remain in China. Thus, it may be inappropriate to think of observed wages as being purely market-determined. China's residential permit system continues to inhibit inter-region\al migration. Many state sector workers have been reluctant to switch jobs because the provision of non-wage benefits such as housing still tie them to their employers. Such forms of labor market segmentation have direct consequences for both inequality and the returns to skill.

In this paper, we use annual household survey data from six provinces collected by China's National Statistics Bureau to describe and evaluate the sources of growing wage inequality in China's urban areas from 1988 to 2003. We focus on wages rather than earnings in order to better evaluate the performance of the formal labor market. Despite some limitations which we discuss below, the large-sample repeated cross-sectional data make it possible to go considerably beyond existing studies in analyzing the sources and timing of wage inequality changes in post-reform China. In particular, we examine the importance of education, both the rising returns to schooling and the advances in educational attainments, to the patterns of wage inequality for male and female. To perform the analysis, we run OLS and Quantile regressions for men and women separately. Then we conduct the Quantile-JMP decomposition method which is proposed by Machado and Mata (2005) and extended by Autor, Katz and Kearney (2005) to identify the effects of education on rising wage inequality.

Our main results are as follows. Overall wage inequality has unambiguously risen in urban China during 1988-2003. Most of the inequality increase occurred in the top half of the wage distribution, with wage growth of the rich and highly educated growing particularly rapidly. The period of most rapid inequality increase was 1992 to 1994 when China substantially liberalized economic activity and experienced high

growth. The more recent period, 1997 to 2000, has also seen substantial increases in inequality. The most recent period, 2000 to 2003, has seen the slowing-down of the increases in inequality.

We find a dramatic increase in the returns to education and steadily decreasing returns to experience over years. There are systematic differences in the returns to education and experience by gender along the conditional wage distribution. Moreover, the patterns are remarkably stable from year to year.

Our analysis tested whether the education expansion of the urban China's labor force may have led to a mechanical (i.e., not due to price changes) rise in earnings dispersion in the sample period. We fail to confirm this hypothesis. Shifts in labor force composition have affected earnings inequality through 1988 to 2003. But these compositional shifts have primarily operated on the lower tail of the earnings distribution and, moreover, have primarily served to mute a contemporaneous, countervailing lower-tail price compression. The rise of male wage dispersion between 1988 and 2003 is almost entirely accounted for by prices rather than quantities.

Empirical evidence shows returns to education are higher for the low wage individuals in the first half of this period conditional on their observable characteristics. This suggests that education has a negative impact upon within-group wage inequality. But the situation is reversed during the recent half period, that is, education serves as the strength that increasing within-group wage inequality. The Quantile-JMP decomposition attributes a large proportion (20.6 versus 59.1 log points) to the overall effect of education. From 1988 to1997 education serves as the equalizing force to decrease wage inequality but it is the primary driving force which increases the wage inequality between 1997 and 2003. The empirical analysis also reveals that the overall effect of college and above education category on the growth of wage inequality is the most pronounced one.

The paper is structured as follows. Section 2 introduces the labor market reforms and broader economic changes likely to affect wage inequality. The following section

describes the dataset used and summarizes trends in overall and residual earnings inequality for 1988 to 2003. Section 4 introduces the analysis framework, that is, the Quantile-JMP (Autor, Katz and Kearney, 2005) decomposition techniques used in this paper. This method is to partition the observed distribution of earnings into 'price' components (wage coefficients) and 'quantity' components (labor force composition) and calculate, through simulation, the impact of each on changes in overall wage dispersion. This leads us to a formal decomposition analysis of the relative importance of these different factors to the changing of wage structure. Section 5 concludes and discusses policy relevance.

2. Economic reform and the labor market

In transition economies, the reform of labor market institutions has a profound effect on wage and inequality outcomes. Market-based reforms of the labor market are often implemented in combination with other major reforms that promote open product market competition, greater managerial autonomy, and restructuring of publicly owned enterprises. China introduced markets for outputs and inputs to most of the industrial sector in the mid-1980s, but nearly all urban jobs continued to be allocated by government labor bureaus until at least the early 1990s and in many areas until the late 1990s. Decentralization reforms in the mid-1980s gave greater decision-making autonomy and pay incentives to enterprise managers and allowed state firms to hire workers on a contract basis rather than provide permanent employment and provide a higher share of compensation in the form of bonuses (Groves et al., 1995). However, even by the early 1990s, state-owned firms were frequently prohibited from firing contract workers, and employment decisions within state-owned firms showed little responsiveness to changing market conditions (Benjamin, Brandt, and Yuen, 2001).

Substantial liberalization of the labor market occurred during the rapid growth episode that followed Deng's southern trip in 1992. During this period, many workers left state employment to jump into the ocean of the free market (xiahai) and many state-owned units expanded into a range of commercial activities. Finally, beginning

in 1997, the government moved forward with aggressive restructuring and privatization of state-owned enterprises, leading to substantial layoffs, retirements, and exits from the labor force (Giles, Park, and Cai, 2003). From 1997 to 2001, over 45 million laborers left state sector employment.

Overall, these reforms have made China's system of labor allocation increasingly market-oriented, which helps explain rising returns to skill and growing inequality. However, the reforms have been implemented in a gradual, halting fashion. And, as noted earlier there remain substantial barriers to labor mobility which may affect inequality outcomes. First, urban residents of one city cannot easily obtain permanent resident status in other cities, which is necessary for gaining access to public services such as education. In this case, it is the lack of market reform (to promote inter-regional labor mobility) that increases inequality by segmenting labor markets. Secondly, mobility between state and non-state sectors may be limited by hidden subsidies provided to workers by state enterprises and the slow progress of reforms intended to shift nonwage benefit provision (housing, pensions, health care) from employers to local governments or the market. If the non-state sector is more market-oriented, then such barriers to mobility could slow the overall development of the labor market. On the other hand, aggressive reforms within the state sector, especially in the late 1990s, could lesson the importance of state versus non-state employment.

In addition to labor market reforms, skill premiums in the labor market also depend on underlying supply and demand factors. In the U.S., explanations for rising wage inequality have focused on three factors: skill-biased technical change, international trade, and labor market institutions, especially unions (Katz and Autor, 1999). Evidence that rising inequality is associated with growing returns to skill, both observed and unobserved, even within relatively narrowly defined sub-sectors of the economy have led some to conclude that skill-biased technical change is the main culprit (Juhn, Murphy, and Pierce, 1993; Bound and Johnson, 1992).

China, like the U.S. in recent years, has seen rising skill premiums despite the fact

that the workforce has become more educated over time. Although labor market reforms have been of first order importance, China has also witnessed other dramatic, transformative changes that have influenced labor demand. New technologies have been introduced rapidly, with foreign direct investment in China accounting for a substantial share of fixed investment capital. During the 1990s, China saw a dramatic increase in trade's share of GDP, which would be expected to reduce skill premiums if China's exports are intensive in low-skilled labor. In the final section of the paper, we provide the first analysis of which we are aware of the importance of different demand and supply factors in explaining growing skill premiums.

3. Data sources and basic trends in overall and residual inequality

A. China's Urban Household Survey Data: 1988-2003

Data used in this paper come from 16 consecutive annual surveys, from 1988 through 2003. The survey provides detailed information on household size, employment status, income, consumption, savings, cash holdings, and demand for goods and housing. The respondents are chosen to be representative in over 220 cities and towns of various sizes and various regions in China. Urban Survey Organization of the National Bureau of Statistics; it covers 146 cities and 80 towns. The choice of cities and towns and also households is based on the principle of random and representative sampling. According to the 2002 Handbook of Chinese Urban Household Survey (the National Bureau of Statistics, 2001), the sampling method is consistent over all years under study.

The National Bureau of Statistics (2001) provides further details on the survey and data. To assess the representativeness of the data, we compare several variables that are both available in our data and in the Statistical Yearbook of China. For 1988, our sample averages for household size, the number of workers in a household, and the per capita household income are 3.7, 2.2 and 1,352, respectively, while the corresponding national averages are 3.6, 2.0 and 1,192 (Statistical Yearbook of China, 1989, p.726). For 2001, our sample averages for the three variables are 3.2, 1.8 and 7,763, whereas the national averages of 3.1, 1.7 and 6,907 (Statistical Yearbook of

China, 2002, p.321). Thus, the sample averages are reasonably close to those reported in the statistical yearbooks. To give a fair representation of the whole urban Chinese labor market, we choose the following six provinces:[3] Beijing, Guangdong, Liaoning, Shaanxi, Sichuan, and Zhejiang. These six provinces are roughly representative of China's different regions. Beijing is a rapidly growing municipality in North-Central China, Guangdong and Zhejiang are dynamic economic provinces, standing in the East-coastal and South-coastal areas. Liaoning is a heavy-industry province in the Northeast. Shaanxi and Sichuan are relatively less developed provinces in the Northwest and Southwest respectively.

The income and expenditure data are based on self-recorded diaries reported monthly, and so are likely to be more accurate than recall surveys. Wages are defined to include basic wages, bonuses, and subsidies and other labor-related income, and to exclude capital and transfer income. However, the NBS only includes annual wages in the data files and working hours are not reported before year 2002. This precludes the possibility of constructing hourly wage rates. So the wages we derived in the paper are annual data rather than hourly or weekly data. Although hourly data might be more accurate in reflecting the labor market behavior, we've conducted certain controls to rectify it. Another caveat is that we are not able to account for labor earnings in non-wage benefits such as housing, health care benefits and pension. If non-wage benefits are positively or negatively related to wage earnings, the omission is expected to under- or over-estimate the wage inequality. It is not obvious how this will affect observed trends.

To reduce bias from variation in labor hours worked and focus on how wages are determined in the labor market, we restrict our sample to workers engaged in wage employment. We exclude individuals who are likely to be part-time workers, including students, the disabled, re-employed retired workers. We also exclude employers, self-employed individuals and household workers who are likely to work more hours than the average full-time workers. We restrict the working to be older

[3] All members of the households are included in the survey. Although Beijing is a city, it enjoys the same administrative status as a province.

than 16 and younger than 60.[4] We further exclude all workers earning less than half of the minimum wage.[5] For prime-age adults in urban China, full-time work is the dominant form of employment and self-employment is relatively uncommon. Applying these criteria yields a sample of 118,846 workers over the 16 years. For each sample year there still more than 5,000 observations left.

All wages are adjusted by the CPI index of the six provinces (1988 as the base year), so that all wages reflect real wages. Where appropriate, we weight the sample based on the sampling rate for each province, i.e., sample size divided by urban labor force, and by the number of working-age adults in the household, to correct for bias from household rather than individual sampling. The education measure includes seven degree categories, ranging from below elementary school to college.

The data have several limitations which should be kept in mind in interpreting the results. First, the NBS urban survey is restricted to households that have urban residence permits (hukou), and so does not include migrants working in cities.[6] The survey also excludes workers residing in rural areas who are engaged in wage employment. This sampling approach results from China's unique administrative separation of urban and rural residents. NBS uses separate sampling frames and questionnaires for their urban and rural surveys. Nonetheless, since most wage employment is in urban areas and most wage workers are urban residents, the data should accurately capture main trends in wage inequality. Strictly speaking, however, the results apply only to China's registered urban residents.

Another limitation is that we do not have data before 1988, even though China's

[4] Age 60 is official retirement age for male managers. Female workers retire at 50 and male workers and female managers at 55.

[5] Juhn et al. (1993), Katz and Murphy (1992) and Katz and Autor (1999), among others, also apply this sample exclusion rule to secure a reasonabley strong labor force attachment. Although China started implementing a minimum wage system since 1995, we have information on minimum wages only since 1988. In this paper we use the minimum wage in the following four years to construct the minimum wage index, 1998, 1999, 2000 and 2001. Because China experienced rapid growth rate of real incomes in our data period, we discount the average of real minimum wage in these four years by the wage growth rate to derive the implied minimum wage in previous years.

[6] Because urban resident permits are under strict ration allocation in our data period, the survey effectively follows a relatively fixed group of people, which helps to rid of effects on inequality caused by changing composition of the population.

economic reforms began in 1978. NSB did not rejuvenate its national survey apparatus until the mid-1980s and 1988 is the first year for which the sample and questionnaire data were comparable to later years. We note that nearly all of the major changes to China's labor allocation system occurred after 1988, as did many other changes likely to influence returns to skill (e.g., trade and FDI growth). Thus, the data should capture the main period of wage inequality increase.

Table 1, Table 2 and Table 3 and Table 4 show the descriptive statistics of our sample which we will discuss in detail in section 5.

B. The Evolution of Overall and Residual Wage Inequality

The overall change in the distribution of wage is illustrated in Figure 1, which plots kernel density estimates for the years 1988, 1992, 1994, 1997, 2000 and 2003. It is clear from this figure that mean incomes have increased steadily, while the distribution around the means has widened considerably. The most noticeable change in both the mean and variance of the distribution occurred between 1992 and 1994. Table 5 reports summary wage inequality measures by year for our dataset (described in greater detail below). By any measure, wage inequality increased substantially from 1988 to 2003. The Gini coefficient increased from 0.238 to 0.364, the coefficient of variation from 0.476 to 0.767, the standard deviation of log wages from 0.445 to 0.665, and the Theil entropy index from 0.098 to 0.227.

Figure 2 describes the male workers' wages from 1988 to 2003 for different parts of the skill distribution. Real annual wages at the 10th percentile, the median, and the 90th percentile all increased during the past 16 years but the rates of increase were different. The 90th percentile more than tripled, increasing from 3,236 yuan in 1988 to 13,508 yuan in 2003 (in 1988 yuan), while earnings at the median more than doubled, increasing from 1,918 yuan in 1988 to 5,169 yuan in 2003. Earnings at the 10th percentile nearly doubled, from 1,122 yuan in 1988 to 2,210 yuan in 2003.

Figure 3 plots the annual percent growth in real wages from 1988 to 2003 for each percentile of the wage distribution. All percentiles experienced wage gains during the

period, but higher percentiles experienced larger wage gains. Thus, inequality has not been a story of the rich getting richer and the poor becoming poorer, but rather the rich getting richer faster than the poor. To put the magnitude of these differences in perspective, consider that Juhn et al. (1993) found that the difference in wage growth at the top and bottom of the U.S. wage distribution to be about 45 percent from 1964 to 1988, or less than two percent per year. Figure 3 shows that in China this annualized difference was about eight percent per year, or four times greater than that in the U.S.

Figure 4 depicts the trend of wage inequality by reporting log wage differentials between the 90th and 10th percentiles, the 90th percentile and the median, the 75th percentile and the 25th percentile, and the median and the 10th percentile. Using the 90th and 10th percentiles as an example, wage differentials are calculated as $\ln(W_{90}) - \ln(W_{10})$. By all of these measures, the rise in wage inequality was substantial. The 90th-10th percentile log wage differential increased from 1.06 in 1988 to 1.81 in 2003. Comparing the 90-50 and 50-10 differentials, we find that at the beginning of the period, the lower half of the income distribution had more dispersion than the top half, but this reversed after 1991. The 50/10 differential rose briefly in 1994 and again after 1997, approaching the level of dispersion in the top half of the distribution. In China, 1994 was a year of relative slowdown and monetary tightening, and 1997 saw the beginning of major state-owned enterprise restructuring.

From Figure 4, we see that inequality rose most rapidly from 1992 to 1994 but that the rising trend continued until the end of the period for which we have data. In Figure 5, we break down the percentile wage growth reported in Figure 3 into sub-periods, and see again that by far the most rapid increase in inequality occurred during the 1992 to 1994 period.

A main message of Table 6 and Table 7 is that wage inequality has increased significantly overall and within nearly every sub-group of the population. Table 6 presents additional measures of wage inequality for 5 different years: 1988, 1992,

1994, 1997, 2000, and 2003. Measured by the standard deviation of log annual wages, we find continuous increases in inequality, especially from 1992 to 1994 (from 0.48 to 0.61), when nearly all wage percentile differentials widen sharply. For example, the log wage differences between the 90th and 10th percentiles jump from 1.30 to 1.66 in these two years, accounting for 48 percent of the total increase from 1.06 in 1988 to 1.81 in 2003. There is little change in many of the percentile differentials from 1994 to 1997, but a resumption of divergence across the board from 1997 to 2003.

Table 7 presents the standard deviations of the residuals as well as various measures of residual inequality over time. The standard deviation increased substantially, from 0.96 in 1988 to 1.20 in 2003. As for overall inequality, the largest growth in residual inequality also occurred between 1992 and 1994. This suggests that unobservable factors are increasingly important in determining wages. Given the rapid changes in the labor market, this is not surprising since market mechanisms will increasingly reward workers by their productivity rather than just their observable credentials. This should not only be reflected in wage setting within firms, but also in employment choices, since more able, entrepreneurial workers are more likely to find employers that reward such characteristics.

4. Analysis Framework to account for rising wage inequality

In this section we introduce a multivariate framework to more clearly identify the contributions to growing inequality due to quantity (or composition) effects and price effects. The former arises because of changes in the distribution of attributes in the population of workers (e.g., greater inequality in educational attainment, and/or years of experience), the latter because of changes in the value attached to different characteristics, e.g., higher returns to education over time. We examine these two effects in turn and then decompose the overall changes in inequality into changes in quantities and prices.

4.1 Quantity (or Composition) effects

How have characteristics of the labor force changed over time, and can these changes help explain growing inequality? Table 1, Table 2 and Table 3, Table 4 provide summary information on key sample characteristics. The average age (and potential experience) of the population has increased over time, from 37.2 to 40.8, which could be due changing demographics associated with China's strict one-child family planning policy. Aging of the sample could also be a factor, although this is unlikely given NSB's periodic rotation of sampled households. With fewer young workers who make relatively less than older workers and so are at the tail of the wage distribution, this change is likely to reduce inequality.

There is a very dramatic increase in the educational attainment of the workforce. The share of male workers with college education or above increased from 17.8 percent in 1988 to 34.6 percent in 2003 while those with junior secondary and primary education fell from 39.9 and 8.8 percent to 22.8 and 2.2 percent over the same period. For female workers the share of those with college education or above increased from 7.1 percent in 1988 to 29.7 percent in 2003 while those with junior secondary and primary education fell from 43.7 and 13.8 percent to 20.3 and 2.4 percent over the same period. Female workers gained more during this period and the gender gap in education attainment narrowed during these 16 years. These changes shifted much more of the distribution to the higher end compared to previous periods when it was centered strongly around junior and senior high school education. This could widen inequality, especially if college premiums are high.

The gender and regional distribution changes relatively little over time and so are not expected to contribute substantially to inequality. The percentage of men increases slightly from 51.1 to 56.5 percent over the 16 years. There is slightly faster growth in the labor force size of richer provinces than poorer provinces, which would increase inequality. Finally, in terms of job types, in our sample we see only a small reduction in the size of the state sector, a decline in the collective sector, and an increase in the non-public sector. Since the non-public sector, which includes joint ventures,

generally has higher wages, this change should be in inequality-increasing. We defer discussion of occupation and sector changes to later.

4.2 Price effects

In addition to changes in quantities, changes in prices of skills can also influence inequality trends. The returns to education in urban China have increased dramatically from 1988 to 2003.[7] Due to the positive correlation between wages and education, this is likely to raise inequality. In this section, we compute the prices of education and other attributes, defining the prices as coefficients from wage regressions estimated for each year.

i) OLS regression: benchmark

As a benchmark, we first present the results obtained with the traditional OLS method. We estimate two specifications for log wages of two genders separately. The first includes educational dummy variables, potential experience, experience squared, and regional dummy variables as regressors. The second adds job-related dummy variables for ownership, occupation, and sector. To control for selection bias, we estimate Heckman selection correction models, where labor force participation is identified by marital status and number of children.

Results from both specifications show clearly that the returns to education have risen rapidly, with the largest increases for college education and above. We focus on the parsimonious specification in the discussions below. The major coefficients, or prices, in each year are listed in Table 8A1 and Table 8A2. With primary school education and below as the reference group, the coefficients for junior high school declined over time, those for senior high school increased slightly, those for technical school increased by 28.7 percentage points over the 16 years, and those for college and above increased by 45.1 percentage points for males. For female workers the coefficients for senior high school increased from 29.3 percent in to 56.8 percent, those for technical school increased by 52.7 percentage points over the 16 years, and

[7] See more detailed discussion in Zhang et al. (2005), who use the same data set but apply somewhat different sample restriction criteria.

those for college and above increased by 71.3 percentage points.[8]

In contrast to education, returns to potential experience declined over time (also see Table 8 series). The marginal return to a year of experience (evaluated at sample means) declined from 1.8% in 1988 to 1.2% in 2003. Age-earnings profiles (not shown) reveal that for both men and women, 2003 age-earning profiles were much more concave than those in 1988, with the largest wage increases occurring in the early period of work life, and wages flattening out as early as age 30.

Growing regional wage differences can be seen in Table 8B, which explicitly shows the coefficients of provincial dummy variables with Sichuan being the reference province. We can see that Guangdong is the richest province and leads other provinces in income growth. Guangdong is followed by Zhejiang and Beijing, which also gained relative to Sichuan in the 1990s. The northeastern province Liaoning stagnated relative to Sichuan, while the northwestern inland province Shaanxi fell behind.

We won't show the details of the second specification which adds job-related dummy variables for ownership, occupation, and sector due to the limited space. And it shows the similar trends for the returns to education and potential experience. Also for that in the following decomposition analysis we only use the parsimonious specification to avoid the endogeneity of these three factors in wage determination.

ii) Quantile Regression Basics

An ordinary least squares (OLS) regression is based on the mean of the conditional distribution of the regression's dependent variable. This approach is used because one implicitly assumes that possible differences in terms of the impact of the exogenous variables along the conditional distribution are unimportant. However, this may prove inadequate in some research agendas. If exogenous variable influence parameters of the conditional distribution of the dependent variable other than the mean, then an analysis that disregards this possibility will be severely weakened (see Koenker and

[8] Zhang et al. (2005) shows the rising returns to education are robust across experience cohorts, gender, and within regional and ownership groups.

Bassett, 1978).

Unlike OLS, quantile regression models allows for a full characterization of the conditional distribution of the dependent variable. Recent research on US wage structure (see Buchinsky, 1994, 1998) has revealed that education has a greater effect upon the wages of individuals at the top of the wage distribution than upon wages of individuals at the bottom of that distribution. In other words, more educated individuals experience more unequal wage distributions, and this seems to have been exacerbated during the 1980s.

In a wage equation setting, the quantile regression model can be written as:

$\ln w_i = x_i + u_{\theta i}$ with $Quant_\theta(\ln w_i | x_i) = x_i \beta_\theta$ (1)

where x_i is the vector of exogenous variables and β_θ is the vector of parameters. $Quant_\theta(\ln w | x)$ denotes the θ_{th} conditional quantile of ln w given x. The θ_{th} regression quantile, $0 < \theta < 1$, is defined as a solution to the problem:

$$\min_{\beta \in R^k} \left\{ \sum_{i:\ln w_i \geq x_i \beta} \theta \left| \ln w_i - x_i \beta_\theta \right| + \sum_{i:\ln w_i < x_i \beta} (1-\theta) \left| \ln w_i - x_i \beta_\theta \right| \right\} \quad (2)$$

This is normally written as: $\min_{\beta \in R^k} \sum_i \rho_\theta (\ln w_i - x_i \beta_\theta)$ (3) ,where $\rho_\theta(\varepsilon)$ is the check function defined as $\rho_\theta(\varepsilon) = \begin{cases} \theta\varepsilon & \varepsilon \geq 0 \\ (\theta - 1)\varepsilon & \varepsilon < 0 \end{cases}$ (see Koenker and Bassett 1978, Buchinsky 1994, Koenker and Hallock 2001) .

This problem does not have an explicit form but can be solved by linear programming methods. Standard errors are obtained by bootstrap methods. The least absolute deviation(LAD) estimator of β is a particular case within this framework. This is obtained by setting $\theta = 0.5$ (the median regression). As one increases θ from 0 to 1, one traces the entire distribution of y, conditional on x.

Summing up, quantile regressions provide snapshots of different points of a conditional distribution. The flexibility has been used in the returns-to-education

literature and it has addressed the possible impact of education upon inequality, through its within-group inequality component. If the education-related earnings increment were the same across the wage distribution, then education would not impact upon within-group wage inequality as distributions of wage conditional on different levels of education would differ only on their location and not on their dispersion. By using quantile regression, we test the possibility that these dispersions do indeed vary across educational levels, thus resulting in an impact of education upon the wage distribution, through its within-group channel.

iii) Quantile Regression Results

The quantile regression results are presented in greater detail in Table 9A for males and Table 9B for females. Coefficients of the median regression indicate that how the level of wages depends on covariates. The coefficients have generally the expected signs and are conform to previous studies. As expected, wages increase with education and this is true across the whole distribution.

To analyze the effects of characteristics on the dispersion of earnings, we pay attention to the difference between the quantile regression coefficients at the 90th percentile and the coefficients at the 10th percentile. If the difference between the 90th and 10th decile coefficient on a covariate is positive (negative), a higher value of this variable increases (decreases) within-group inequality. The results show that for more than half of the variables the interdecile difference is significantly different from zero.

From the two tables, we find that the effect of education on wages conditional on their observable characteristics is more important at the lower quantiles of the wage distribution than at the higher for male workers before year 1998, implying the education has a negative impact upon within-group wage inequality. We also observe that within-group inequality differs among different education categories. Thus, heteroscedastic inconsistent methods will yield biased results.

But the situation is reversed during the recent half period; returns to education

increase over the wage distribution. Or, to put it differently, the earnings increment associated to education is higher for those individuals whose unobservable characteristics place them at the top of the conditional wage distributions. Thus samples with more educated individuals show higher wage dispersion than samples of less educated people. In other words, education serves as the strength that increasing within-group wage inequality in the recent years (for female workers, the turning point is year 1997). This is qualitatively similar to comparable findings for the USA (Chamberlain, 1994; Buchinsky, 1994), Germany (Fitzenberger and Kurz, 1997), Uraguay (González and Miles, 2001) or Zambia (Nielsen and Rosholm, 2001) although the situation of the previous years seem different.

4.3 Decomposition of the changes in wage inequality

In this part we apply Quantile-JMP decomposition technique proposed by Machado and Mata (2005) and extended by Autor, Katz and Kearney (2005) to evaluate the role of education expansion and changing returns to education to the expansion of upper- and lower-tail inequality over the period 1988-2002.

Under the convenient (but economically unappealing) partial equilibrium assumption that aggregate quantities of skills in the labor market do not affect skill prices, we can use the conditional quantile model to simulate the impact of changing composition or prices on distribution of wages.

We define the coefficient vector $\hat{\beta}(50)$ as our measure of between-group inequality, and we refer to it as $\hat{\beta}^b \equiv \hat{\beta}(50)$ ($\hat{\beta}^b$ serves a role akin to $\hat{\beta}_{OLS}$ in a conventional Oaxaca-Blinder decomposition). Following this logic, we define a measure of within-group inequality as the difference between the estimated coefficient vector $\hat{\beta}(\theta)$ and the median coefficient vector $\hat{\beta}^b$: $\hat{\beta}^w(\theta) \equiv [\hat{\beta}(\theta) - \hat{\beta}^b]$, $\theta \in (0,1)$.

The (correctly specified) conditional quantile model provides a complete characterization of the distribution of w as a function of three components: the

distribution of covariates $g(x)$, the vector of between-group prices, $\hat{\beta}^b$, and the matrix of within-group (residual) prices $\hat{\beta}^w$. Then $f_t(\hat{w}_t) \equiv f(g_t(x), \hat{\beta}_t^b, \hat{\beta}_t^w)$.

The observed change in inequality between any two periods, t and τ can be decomposed into three components using the following sequential decomposition. Let $\Delta Q_\theta = Q_\theta(f_\tau(w)) - Q_\theta(f_t(w))$ equal the observed change in the θth wage quantile between periods t and τ.

We define: $\Delta Q_\theta^x = Q_\theta(f(g_\tau(x), \hat{\beta}_t^b, \hat{\beta}_t^w)) - Q_\theta(f(g_t(x), \hat{\beta}_t^b, \hat{\beta}_t^w))$ as the contribution of changing quantities (labor force composition) to ΔQ_θ. We define $\Delta Q_\theta^b = Q_\theta(f(g_\tau(x), \hat{\beta}_\tau^b, \hat{\beta}_t^w)) - Q_\theta(f(g_\tau(x), \hat{\beta}_t^b, \hat{\beta}_t^w))$ as the marginal contribution of changing between-group prices to ΔQ_θ. And, we finally define $\Delta Q_\theta^w = Q_\theta(f(g_\tau(x), \hat{\beta}_\tau^b, \hat{\beta}_\tau^w)) - Q_\theta(f(g_\tau(x), \hat{\beta}_\tau^b, \hat{\beta}_t^w))$ as the marginal contribution of changing within-group prices to ΔQ_θ.

Notice that this decomposition sums to the total observed change $\Delta Q_\theta^w + \Delta Q_\theta^b + \Delta Q_\theta^x = \Delta Q_\theta$. This is an important advantage over the JMP procedure, in which the "residual price and quantity component" must be estimated as a remainder term after the other two components are calculated.

The results from our decomposition are given in table 10 and table 11 for male and female workers separately. The first panel of these two tables gives the estimated log wage differentials at the various percentiles and the overall effects of each group of factors. The second panel shows the detailed decomposition results. Here we divide the entire period into two sub-periods 1988 through 1997 and 1997 through 2003.

It's interesting to compare these results with those in table 11. As shown in the first panel of these two tables, the rise of female wage dispersion between 1988 and 2003 is 22.1 log points larger than male wage inequality. This gap mainly comes from the dramatically expansion of the lower half of female wage distribution from 1988

through 1997. The most striking difference between the first panel of the two tables is the overall effect of education on female wage inequality is quite large than on male wage distribution, especially in the first period.

Of 59.1 log points rise in male 90/10 inequality over this period, the decomposition attributes a relatively small offsetting roll (-36.8 log points) to quantities, versus 34.0 points to between group prices and 61.9 points to within-group prices. When we reverse the order of the decomposition, we find that the estimated contribution of labor force composition to inequality is within rounding -3.3 points, versus 16.0 points to between group prices and 46.4 points to within-group prices. For female workers, the trend is similar. This denotes that changes in prices are the determinant forces of rising wage inequality.

When examining the role of education plays on the male and female wage inequality across years separately, the decomposition results give different stories.

For male workers, the effect of education is more important in recent years. In the first period (1988-1997), it serves to reduce wage inequality of high-wage male workers but in the second period it exerts much more great effects on both the upper and lower parts of wage distribution whereas increasing wage inequality. The negative effect of education on wage inequality comes from the quick drop of within-group price in the lower part of wage distribution from 1988 through 2003. For female workers, things are different. In the first period, the overall effects of education contribute to the rise of wage inequality. The most prominent forces are price effects, especially within-group price. In the second period, education has negative effect on the rising of upper part wage inequality which is contributed by the large and negative within-group price while it plays a positive role in the rising of wage inequality among low-wage female workers which is drived by the within-group price.

5. Conclusions and Policy Relevance

This paper sets out to evaluate the effects of education on wage inequality in urban China during the transition period. We explicitly identified the changing pattern of wage inequality. Overall wage inequality has unambiguously risen in urban China during 1988-2003. Most of the inequality increase occurred in the top half of the wage distribution, with wage growth of the rich and highly educated growing particularly rapidly. The period of most rapid inequality increase was 1992 to 1994 when China substantially liberalized economic activity and experienced high growth. The more recent period, 1997 to 2000, has also seen substantial increases in inequality. The most recent period, 2000 to 2003, has seen the slowing-down of the increases in inequality.

We find a dramatic increase in the returns to education and steadily decreasing returns to experience over years. There are systematic differences in the returns to education and experience by gender along the conditional wage distribution. Moreover, the patterns are remarkably stable from year to year.

Our analysis tested whether the education expansion of the urban China's labor force may have led to a mechanical (i.e., not due to price changes) rise in earnings dispersion in the sample period. We fail to confirm this hypothesis. Shifts in labor force composition have affected earnings inequality through 1988 to 2003. But these compositional shifts have primarily operated on the lower tail of the earnings distribution and, moreover, have primarily served to mute a contemporaneous, countervailing lower-tail price compression. The rise of male wage dispersion between 1988 and 2003 is almost entirely accounted for by prices rather than quantities.

Returns to education are higher for the low wage individuals in the first half of this period conditional on their observable characteristics. This suggests that education has a negative impact upon within-group wage inequality. But the situation is reversed during the recent half period, that is, education serves as the strength that increasing

within-group wage inequality. The Quantile-JMP decomposition attributes a large proportion (20.6 versus 59.1 log points) to the overall effect of education. From 1988 to1997 education serves as the equalizing force to decrease wage inequality but it is the primary driving force which increases the wage inequality between 1997 and 2003. The empirical analysis also reveals that the overall effect of college and above education category on the growth of wage inequality is the most pronounced one.

The above analysis shed light on the potential direction of policies that aim to slowing down or reverse the rapidly rising wage inequality. Considering the role education plays in the changing of wage structure, expanding educational opportunities for the public may be an important policy tool, especially for female workers. But more education chances and choices should be given to the disadvantaged, those living in the rural areas and in the poor families.

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Table 1: Sample Size and Regional Distribution for all Workers

Year	Total Observations	Beijing (%)	Liaoning (%)	Zhejiang (%)	Guangdong (%)	Shaanxi (%)	Sichuan (%)
1988	6,093	9.6	25.7	10.7	21.6	8.3	24.0
1989	5,624	8.5	25.2	10.7	22.7	8.6	24.3
1990	6,199	8.9	26.1	10.4	22.7	8.7	23.2
1991	6,225	9.1	24.6	10.7	23.4	8.6	23.6
1992	7,856	9.4	24.6	10.4	23.0	8.7	23.9
1993	7,017	9.4	24.4	10.3	24.1	8.4	23.4
1994	6,752	9.1	24.0	10.1	25.3	8.3	23.2
1995	6,831	8.9	23.3	10.2	25.4	8.5	23.7
1996	6,652	8.8	22.2	10.2	26.3	8.4	24.1
1997	6,644	8.3	22.0	10.3	26.8	8.3	24.3
1998	6,332	8.3	21.1	10.9	27.3	8.3	24.1
1999	6,094	8.3	20.0	11.0	28.7	8.1	23.9
2000	6,203	9.6	21.9	11.9	30.3	8.6	17.7
2001	5,412	9.9	22.2	12.0	30.1	9.3	16.6
2002	13,852	9.2	18.3	11.2	31.8	7.5	22.0
2003	15,060	7.4	17.1	11.0	37.4	6.5	20.6

Table 2: Sample Size and Basic Statistics for all Workers

Year	Total Observations	Age (year)	PEXP (year)	Male (%)	SOE (%)	COE (%)	NON-PUBLIC (%)
1988	6,093	37.2	20.8	51.1	74.6	24.7	0.7
1989	5,624	37.4	20.9	51.8	75.4	23.6	1.0
1990	6,199	38.0	21.3	51.7	76.1	22.8	1.1
1991	6,225	37.8	21.1	52.1	77.2	21.7	1.1
1992	7,856	38.0	21.0	52.0	76.6	20.6	2.8
1993	7,017	38.3	21.3	52.2	76.2	20.4	3.4
1994	6,752	38.3	21.1	52.6	76.8	17.8	5.4
1995	6,831	38.6	21.3	52.6	78.4	15.5	6.1
1996	6,652	39.1	21.8	52.9	78.5	15.2	6.3
1997	6,644	39.4	22.0	52.9	77.7	14.9	7.4
1998	6,332	39.5	21.9	53.5	77.2	14.3	8.5
1999	6,094	39.6	21.9	53.5	74.6	13.9	11.4
2000	6,203	39.9	22.1	54.7	72.6	11.3	16.1
2001	5,412	40.4	22.6	55.0	70.1	10.8	19.1
2002	13,852	40.9	23.0	56.3	69.3	8.0	22.7
2003	15,060	40.8	22.8	56.5	66.0	7.0	27.0

Table 3: Descriptive Statistics for Male Workers.

Year	Annual Earnings (yuan)[a]	Age (years)	College and above (%)	Special school (%)	Senior high (%)	Junior high (%)	Primary school (%)
1988	2081.9	38.7	17.8	11.7	21.7	39.9	8.8
1989	2011.8	38.9	18.7	11.5	24.1	37.3	8.2
1990	2190.2	39.5	18.9	11.8	23.9	37.7	7.6
1991	2340.0	39.4	20.6	11.8	23.0	36.5	7.9
1992	2879.3	39.4	22.7	12.8	24.5	33.4	6.5
1993	3170.7	39.7	23.3	12.1	24.5	34.5	5.5
1994	3634.5	39.7	25.7	12.6	24.9	31.6	4.9
1995	3754.9	40.0	26.5	12.1	26.9	29.6	4.9
1996	3891.5	40.5	27.2	12.2	26.1	29.8	4.6
1997	4077.0	40.8	27.1	11.7	26.6	30.0	4.4
1998	4396.8	40.8	28.5	12.3	27.4	27.7	4.1
1999	4947.7	40.9	30.4	12.9	27.5	25.8	3.4
2000	5363.8	41.2	32.6	10.5	28.1	24.9	3.9
2001	5770.9	41.9	31.1	10.2	28.5	26.7	3.5
2002	5938.8	42.4	33.7	11.7	27.1	24.9	2.5
2003	6848.6	42.4	34.6	11.6	28.7	22.8	2.2

Table 4: Descriptive Statistics for Female Workers.

Year	Annual Earnings (yuan)[a]	Age (years)	College and above (%)	Special school (%)	Senior high (%)	Junior high (%)	Primary school (%)
1988	1737.2	35.7	7.1	12.0	23.5	43.7	13.8
1989	1692.1	35.8	7.4	13.1	24.6	42.8	12.2
1990	1834.6	36.3	9.0	14.1	24.6	41.2	11.2
1991	1988.9	36.2	10.1	13.2	26.3	38.4	12.0
1992	2412.1	36.5	13.3	13.9	28.0	36.2	8.7
1993	2654.3	36.8	12.8	14.4	29.0	36.1	7.7
1994	3030.8	36.8	14.5	15.8	29.6	34.3	5.8
1995	3149.9	37.0	16.0	15.0	30.3	32.6	6.1
1996	3295.6	37.6	16.4	15.5	30.4	32.7	5.0
1997	3441.7	37.7	17.5	15.0	30.8	32.4	4.2
1998	3824.0	37.9	20.1	16.9	30.1	29.0	3.9
1999	4382.3	38.1	22.2	17.0	30.4	26.9	3.6
2000	4681.4	38.3	24.6	16.5	32.8	23.2	2.9
2001	5131.8	38.6	24.4	16.8	33.4	23.2	2.3
2002	4947.5	39.1	27.4	16.0	31.9	22.1	2.6
2003	5532.9	38.8	29.7	15.7	32.0	20.3	2.4

Table 5: Trends in Inequality, 1988 to 2003

Year	1988	1989	1990	1991	1992	1993	1994	1995
relative mean deviation	0.164	0.182	0.170	0.179	0.186	0.215	0.236	0.228
coefficient of variation	0.476	0.536	0.515	0.537	0.655	0.661	0.693	0.670
standard deviation of logs	0.445	0.494	0.456	0.466	0.472	0.539	0.601	0.580
Gini coefficient	0.238	0.262	0.247	0.258	0.268	0.305	0.332	0.321
Mehran measure	0.331	0.360	0.340	0.352	0.359	0.406	0.446	0.431
Piesch measure	0.191	0.213	0.200	0.211	0.223	0.254	0.276	0.266
Kakwani measure	0.053	0.064	0.057	0.062	0.068	0.085	0.098	0.092
Theil entropy measure	0.098	0.121	0.108	0.117	0.137	0.166	0.190	0.178
Theil mean log deviation measure	0.098	0.120	0.105	0.112	0.121	0.154	0.184	0.172

Year	1996	1997	1998	1999	2000	2001	2002	2003
relative mean deviation	0.240	0.239	0.246	0.248	0.250	0.252	0.247	0.261
coefficient of variation	0.711	0.723	0.755	0.726	0.762	0.750	0.722	0.767
standard deviation of logs	0.608	0.608	0.623	0.630	0.642	0.650	0.634	0.665
Gini coefficient	0.337	0.337	0.346	0.347	0.352	0.354	0.347	0.364
Mehran measure	0.450	0.449	0.460	0.464	0.470	0.474	0.466	0.486
Piesch measure	0.280	0.281	0.288	0.288	0.293	0.294	0.287	0.303
Kakwani measure	0.101	0.101	0.106	0.106	0.110	0.110	0.106	0.116
Theil entropy measure	0.196	0.199	0.211	0.206	0.218	0.216	0.205	0.227
Theil mean log deviation measure	0.190	0.191	0.201	0.202	0.211	0.213	0.203	0.224

Source: NBS, Urban household survey, 1988-2003.

Table 6: Wage Inequality for Selected Years.

	1988	1992	1994	1997	2000	2003
Standard deviation of log wages	0.45	0.48	0.61	0.63	0.66	0.67
Percentile differentials:						
90-10	1.06	1.30	1.66	1.64	1.74	1.81
90-75	0.28	0.44	0.47	0.47	0.46	0.48
90-50	0.52	0.75	0.90	0.89	0.92	0.96
75-50	0.24	0.30	0.42	0.42	0.47	0.48
75-25	0.50	0.59	0.82	0.82	0.88	0.92
50-10	0.54	0.56	0.76	0.75	0.81	0.85
50-25	0.26	0.28	0.39	0.39	0.42	0.44
25-10	0.27	0.27	0.37	0.35	0.40	0.41
Observations	3111	4091	3558	3533	3404	8593

Source: NBS, Urban household survey, 1988-2003.

Table 7. Inequality of Residual Wages, 1988-2003.

	1988	1992	1994	1997	2000	2003
Standard deviation	0.96	0.88	1.01	0.99	1.16	1.20
Percentile differential:						
90-10	1.80	1.63	2.01	2.07	2.40	2.89
90-75	0.98	0.79	0.92	0.83	0.87	0.86
90-50	1.38	1.16	1.38	1.34	1.48	1.65
75-50	0.41	0.37	0.46	0.52	0.62	0.79
75-25	0.65	0.62	0.81	0.92	1.16	1.52
50-10	0.41	0.46	0.63	0.73	0.92	1.24
50-25	0.24	0.25	0.35	0.40	0.54	0.73
25-10	0.17	0.22	0.28	0.33	0.37	0.51
Observations	3111	4091	3558	3533	3404	8593

Note: Residuals are calculated from regressions of logarithm of wages on a very flexible specification of education and experience. See footnote x for details.

Table 8A1: Wage regression coefficients for Male workers, selected variables, 1988 to 2003 (without standard errors). Dependent variable: log (annual wage)

Year	College and above (Ref: primary and below)	Technical school (Ref: primary and below)	Senior high (Ref: primary and below)	Junior high (Ref: primary and below)	Potential experience[a]	Potential experience squared
1988	0.252	0.151	0.148	0.069	0.048	-0.001
1989	0.339	0.231	0.202	0.141	0.039	0.000
1990	0.279	0.206	0.136	0.042	0.046	-0.001
1991	0.238	0.172	0.105	0.033	0.042	-0.001
1992	0.273	0.182	0.104	0.020	0.035	0.000
1993	0.336	0.204	0.167	0.058	0.037	0.000
1994	0.482	0.332	0.227	0.102	0.030	0.000
1995	0.466	0.320	0.252	0.130	0.032	0.000
1996	0.492	0.278	0.267	0.141	0.035	0.000
1997	0.333	0.197	0.181	0.034	0.034	0.000
1998	0.430	0.224	0.143	0.032	0.022	0.000
1999	0.534	0.326	0.202	0.055	0.036	-0.001
2000	0.581	0.380	0.232	0.083	0.032	0.000
2001	0.550	0.351	0.266	0.124	0.029	0.000
2002	0.604	0.354	0.268	0.102	0.033	0.000
2003	0.703	0.438	0.313	0.167	0.029	0.000

Table 8A2: Wage regression coefficients for Female workers, selected variables, 1988 to 2003 (without standard arrors). Dependent variable: log (annual wage)

Year	College and above (Ref: primary and below)	Technical school (Ref: primary and below)	Senior high (Ref: primary and below)	Junior high (Ref: primary and below)	Potential experience[a]	Potential experience squared
1988	0.493	0.351	0.293	0.157	0.046	-0.001
1989	0.500	0.406	0.322	0.161	0.048	-0.001
1990	0.537	0.431	0.303	0.164	0.056	-0.001
1991	0.513	0.379	0.287	0.174	0.041	-0.001
1992	0.522	0.367	0.261	0.154	0.041	-0.001
1993	0.554	0.385	0.287	0.169	0.037	-0.001
1994	0.784	0.617	0.448	0.286	0.027	0.000
1995	0.695	0.572	0.416	0.241	0.028	0.000
1996	0.617	0.506	0.318	0.139	0.040	-0.001
1997	0.682	0.560	0.376	0.185	0.025	0.000
1998	0.766	0.622	0.427	0.218	0.032	0.000
1999	0.975	0.720	0.503	0.227	0.040	-0.001
2000	0.917	0.654	0.529	0.298	0.003	0.000
2001	0.834	0.629	0.453	0.190	0.008	0.000
2002	1.088	0.783	0.513	0.181	0.060	-0.001
2003	1.206	0.878	0.568	0.265	0.061	-0.001

Source: NBS urban household survey, 1988-2003
Regression model also include regional dummy variables. Using Heckman selection criterion.
Parsimonious specification: Without controlling for occupation, industry and ownership
a: Defined as age minus years of school minus 6.

Table 8B: Wage regression coefficients for male workers, selected variables, 1988 to 2003 (With standard errors). Dependent variable: log (annual wage)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Beijing	0.147	0.080	0.119	0.006	0.060	0.162	0.278	0.338	0.410	0.374	0.336	0.339	0.307	0.244	0.362	0.496
	[0.026]***	[0.039]**	[0.028]***	[0.031]	[0.018]***	[0.022]***	[0.026]***	[0.027]***	[0.025]***	[0.027]***	[0.028]***	[0.030]***	[0.030]***	[0.038]***	[0.024]***	[0.025]***
Liaoning	0.057	0.021	0.048	-0.011	-0.015	-0.018	0.025	0.069	0.085	0.067	0.041	0.03	0.077	0.051	0.172	0.174
	[0.015]***	[0.021]	[0.016]***	[0.016]	[0.014]	[0.020]	[0.023]	[0.022]***	[0.023]***	[0.024]***	[0.025]	[0.026]	[0.026]***	[0.033]	[0.019]***	[0.019]***
Zhejiang	0.194	0.161	0.164	0.153	0.219	0.329	0.43	0.497	0.548	0.514	0.468	0.454	0.468	0.491	0.671	0.729
	[0.019]***	[0.022]***	[0.019]***	[0.019]***	[0.018]***	[0.023]***	[0.026]***	[0.026]***	[0.027]***	[0.026]***	[0.029]***	[0.030]***	[0.031]***	[0.039]***	[0.022]***	[0.021]***
Guangdong	0.482	0.469	0.557	0.647	0.778	0.822	0.945	0.957	1.012	0.971	1.003	1.029	0.918	0.902	0.825	0.856
	[0.020]***	[0.023]***	[0.022]***	[0.021]***	[0.022]***	[0.027]***	[0.028]***	[0.028]***	[0.028]***	[0.030]***	[0.030]***	[0.029]***	[0.031]***	[0.037]***	[0.023]***	[0.026]***
Shaanxi	-0.082	-0.027	-0.035	-0.043	-0.155	-0.151	-0.229	-0.151	-0.12	-0.185	-0.177	-0.173	-0.193	-0.127	0.143	0.04
	[0.019]***	[0.020]	[0.018]*	[0.017]**	[0.018]***	[0.024]***	[0.028]***	[0.025]***	[0.026]***	[0.029]***	[0.030]***	[0.030]***	[0.031]***	[0.039]***	[0.024]***	[0.028]
Potential experience	0.048	0.039	0.046	0.042	0.035	0.037	0.03	0.032	0.035	0.034	0.022	0.036	0.032	0.029	0.033	0.029
	[0.003]***	[0.009]***	[0.003]***	[0.003]***	[0.002]***	[0.003]***	[0.003]***	[0.004]***	[0.004]***	[0.005]***	[0.005]***	[0.005]***	[0.007]***	[0.007]***	[0.006]***	[0.007]***
Potential experience squared	-0.001	0	-0.001	-0.001	0	0	0	0	0	0	0	-0.001	0	0	0	0
	[0.000]***	[0.000]**	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]*	[0.000]***	[0.000]***	[0.000]**	[0.000]***	[0.000]***
College and above	0.252	0.339	0.279	0.238	0.273	0.336	0.482	0.466	0.492	0.333	0.43	0.534	0.581	0.55	0.604	0.703
	[0.025]***	[0.044]***	[0.029]***	[0.031]***	[0.032]***	[0.041]***	[0.048]***	[0.045]***	[0.050]***	[0.050]***	[0.051]***	[0.061]***	[0.055]***	[0.064]***	[0.062]***	[0.080]***
Special or technical school	0.151	0.231	0.206	0.172	0.182	0.204	0.332	0.32	0.278	0.197	0.224	0.326	0.38	0.351	0.354	0.438
	[0.026]***	[0.043]***	[0.031]***	[0.033]***	[0.033]***	[0.042]***	[0.049]***	[0.047]***	[0.052]***	[0.052]***	[0.051]***	[0.061]***	[0.060]***	[0.066]***	[0.058]***	[0.072]***
Senior high	0.148	0.202	0.136	0.105	0.104	0.167	0.227	0.252	0.267	0.181	0.143	0.202	0.232	0.266	0.268	0.313
	[0.026]***	[0.041]***	[0.031]***	[0.032]***	[0.033]***	[0.042]***	[0.049]***	[0.046]***	[0.051]***	[0.051]***	[0.051]***	[0.060]***	[0.058]***	[0.063]***	[0.053]***	[0.065]***
Junior high	0.069	0.141	0.042	0.033	0.02	0.058	0.102	0.13	0.141	0.034	0.032	0.055	0.083	0.124	0.102	0.167
	[0.023]***	[0.032]***	[0.028]	[0.030]	[0.032]	[0.040]	[0.047]**	[0.045]***	[0.049]***	[0.049]	[0.049]	[0.059]	[0.054]	[0.061]**	[0.050]**	[0.058]***

Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9A:. Quantile regression coefficients for male workers, selected variables, 1988 to 2003 (Without standard errors).

Dependent variable: log (annual wage)

year	college and above			Special/Technical School			Senior High School			Junior High School			Potential Experience			Potential Experience Squared		
	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90
1988	0.368	0.238	0.230	0.236	0.149	0.073	0.220	0.137	0.096	0.075	0.061	0.071	0.070	0.043	0.035	-0.001	-0.001	0.000
1989	0.467	0.317	0.282	0.319	0.211	0.179	0.279	0.222	0.167	0.177	0.115	0.134	0.064	0.043	0.037	-0.001	-0.001	0.000
1990	0.405	0.245	0.186	0.301	0.167	0.122	0.196	0.110	0.132	0.095	0.035	0.010	0.061	0.044	0.040	-0.001	-0.001	-0.001
1991	0.384	0.253	0.156	0.263	0.182	0.144	0.225	0.113	0.050	0.094	0.034	0.018	0.060	0.043	0.034	-0.001	-0.001	0.000
1992	0.375	0.290	0.186	0.274	0.197	0.087	0.169	0.153	0.045	0.057	0.060	0.003	0.046	0.033	0.024	-0.001	0.000	0.000
1993	0.385	0.321	0.290	0.298	0.192	0.128	0.219	0.172	0.171	0.068	0.073	0.069	0.051	0.034	0.026	-0.001	0.000	0.000
1994	0.558	0.470	0.444	0.417	0.315	0.262	0.251	0.244	0.248	0.084	0.133	0.156	0.051	0.030	0.016	-0.001	0.000	0.000
1995	0.600	0.400	0.392	0.474	0.236	0.265	0.341	0.218	0.207	0.196	0.093	0.152	0.058	0.024	0.017	-0.001	0.000	0.000
1996	0.556	0.388	0.413	0.367	0.208	0.251	0.337	0.183	0.225	0.181	0.073	0.120	0.055	0.028	0.026	-0.001	0.000	0.000
1997	0.467	0.328	0.212	0.349	0.247	0.095	0.250	0.197	0.051	0.064	0.060	-0.008	0.051	0.032	0.032	-0.001	0.000	0.000
1998	0.405	0.442	0.497	0.222	0.261	0.320	0.138	0.165	0.277	-0.057	0.068	0.144	0.045	0.029	0.013	-0.001	0.000	0.000
1999	0.575	0.591	0.645	0.365	0.402	0.400	0.248	0.283	0.350	0.043	0.127	0.231	0.050	0.030	0.028	-0.001	0.000	0.000
2000	0.651	0.620	0.738	0.384	0.466	0.491	0.251	0.330	0.380	0.067	0.163	0.206	0.057	0.028	0.016	-0.001	0.000	0.000
2001	0.564	0.636	0.674	0.308	0.427	0.434	0.246	0.346	0.304	0.103	0.189	0.152	0.069	0.035	0.039	-0.001	-0.001	-0.001
2002	0.791	0.752	0.670	0.403	0.493	0.438	0.337	0.382	0.338	0.155	0.165	0.173	0.051	0.043	0.039	-0.001	-0.001	-0.001
2003	0.809	0.821	0.728	0.502	0.539	0.497	0.353	0.416	0.374	0.173	0.222	0.226	0.044	0.041	0.028	-0.001	-0.001	0.000

Table 9B: Quantile regression coefficients for female workers, selected variables, 1988 to 2003 (Without standard errors).

Dependent variable: log (annual wage)

year	college and above			Special/Technical School			Senior High School			Junior High School			Potential Experience			Potential Experience Squared		
	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90	q=10	q=50	q=90
1988	0.646	0.494	0.361	0.535	0.342	0.232	0.368	0.286	0.222	0.188	0.146	0.119	0.060	0.048	0.040	-0.001	-0.001	-0.001
1989	0.619	0.560	0.336	0.524	0.401	0.265	0.396	0.333	0.203	0.181	0.168	0.087	0.071	0.050	0.034	-0.001	-0.001	-0.001
1990	0.625	0.526	0.383	0.531	0.385	0.295	0.340	0.287	0.223	0.153	0.152	0.138	0.075	0.051	0.039	-0.001	-0.001	-0.001
1991	0.779	0.489	0.409	0.598	0.387	0.309	0.397	0.258	0.217	0.241	0.160	0.171	0.066	0.045	0.025	-0.001	-0.001	0.000
1992	0.698	0.490	0.435	0.544	0.358	0.291	0.342	0.280	0.266	0.248	0.143	0.161	0.064	0.044	0.028	-0.001	-0.001	0.000
1993	0.736	0.516	0.457	0.567	0.383	0.338	0.398	0.288	0.294	0.242	0.181	0.184	0.062	0.041	0.021	-0.001	-0.001	0.000
1994	1.034	0.843	0.596	0.836	0.638	0.434	0.530	0.484	0.379	0.414	0.344	0.204	0.049	0.037	0.015	-0.001	-0.001	0.000
1995	1.000	0.651	0.500	0.797	0.532	0.454	0.562	0.384	0.346	0.381	0.208	0.178	0.061	0.032	0.009	-0.001	0.000	0.000
1996	0.643	0.666	0.511	0.592	0.565	0.451	0.270	0.389	0.348	0.125	0.218	0.143	0.056	0.033	0.030	-0.001	-0.001	-0.001
1997	0.658	0.688	0.782	0.564	0.599	0.658	0.293	0.372	0.582	0.049	0.190	0.377	0.050	0.032	0.029	-0.001	0.000	0.000
1998	0.772	0.821	0.893	0.649	0.709	0.743	0.333	0.467	0.575	0.128	0.266	0.368	0.049	0.034	0.034	-0.001	0.000	-0.001
1999	0.944	0.982	0.945	0.691	0.769	0.704	0.394	0.536	0.548	0.144	0.233	0.283	0.061	0.032	0.035	-0.001	0.000	0.000
2000	0.898	1.072	0.992	0.593	0.813	0.740	0.414	0.608	0.606	0.220	0.307	0.361	0.018	0.025	0.028	0.000	0.000	0.000
2001	0.673	0.985	0.797	0.464	0.751	0.601	0.223	0.546	0.381	0.096	0.207	0.045	0.015	0.021	0.007	0.000	0.000	0.000
2002	0.762	1.039	0.962	0.552	0.736	0.731	0.317	0.491	0.558	0.132	0.194	0.252	0.033	0.033	0.028	-0.001	0.000	0.000
2003	0.788	1.110	0.965	0.579	0.827	0.715	0.300	0.562	0.466	0.167	0.332	0.315	0.027	0.031	0.035	0.000	0.000	-0.001

Table 10: Quantile-JMP Decomposition of Male Wage Inequality into Price and Quantity Components, 1988-1997-2003

(100×log point changes)

Wage differentials:	90-10		90-50		50-10		90-10		90-50		50-10		90-10		90-50		50-10	
Periods:	1988-2003						1988-1997						1997-2003					
Log wage points	59.1		40.3		18.8		54.5		47.9		6.6		4.6		-7.6		12.2	
Constant	9.2		33.8		-24.7		31.5		23.1		8.4		-22.3		10.8		-33.1	
Region	27.5		4.9		22.6		38.2		22.1		16.1		-10.7		-17.2		6.4	
Education	20.6		3.6		17		-7.3		-7.3		0		27.9		10.8		17.1	
Experience	1.9		-2		3.8		-7.8		10		-17.9		9.7		-12		21.7	
Sequence	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X
Quantity changes	-36.8	-3.3	-4.4	4.8	-32.3	-8.1	-20.5	-5.3	4.9	8.5	-25.4	-13.8	-23.5	-9.4	-17.4	-9.2	-6.1	-0.2
Constant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Region	-7.0	3.6	-5.2	0.5	-1.8	3.2	4.2	13.2	3.9	7.7	0.2	5.4	-20.7	-12.7	-16.9	-9.9	-3.8	-2.7
Education	1.3	8.5	1.5	4.8	-0.2	3.7	-0.6	-1.4	0.9	0.8	-1.5	-2.2	2.2	6.4	0.2	1.1	2.0	5.2
Experience	-31.0	-15.4	-0.7	-0.4	-30.3	-15.0	-24.0	-17.0	0.1	0.0	-24.1	-17.0	-5.0	-3.1	-0.7	-0.4	-4.3	-2.7
Between Group Prices	34.0	16.0	21.1	10.3	12.9	5.7	30.9	15.7	22.6	15.5	8.2	0.2	8.7	0.9	3.3	-1.7	5.3	2.6
Constant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Region	22.4	16.4	15.5	10.2	6.9	6.2	32.3	22.7	22.3	16.2	10.1	6.5	-1.9	-5.7	-1.4	-5.0	-0.5	-0.6
Education	12.3	4.5	5.7	0.5	6.6	4.1	1.5	1.1	1.0	0.0	0.6	1.1	10.0	5.5	4.5	3.0	5.5	2.4
Experience	-0.8	-4.9	-0.1	-0.4	-0.6	-4.5	-3.0	-8.0	-0.6	-0.7	-2.4	-7.4	0.5	1.1	0.2	0.3	0.4	0.8
Within Group Prices	61.9	46.4	23.7	25.2	38.2	21.1	44.2	44.1	20.4	23.9	23.8	20.2	19.4	13.1	6.5	3.3	13.0	9.7
Constant	9.2	9.2	33.8	33.8	-24.7	-24.7	31.5	31.5	23.1	23.1	8.4	8.4	-22.3	-22.3	10.8	10.8	-33.1	-33.1
Region	12.1	7.5	-5.4	-5.7	17.5	13.2	1.7	2.4	-4.1	-1.9	5.8	4.3	11.9	7.6	1.2	-2.2	10.7	9.8
Education	7.0	7.6	-3.6	-1.7	10.6	9.3	-8.2	-7.0	-9.1	-8.0	1.0	1.0	15.7	16.1	6.1	6.7	9.7	9.4
Experience	33.6	22.2	-1.1	-1.2	34.7	23.3	19.2	17.2	10.6	10.7	8.6	6.5	14.1	11.7	-11.5	-11.9	25.6	23.6

Table 11: Quantile-JMP Decomposition of Female Wage Inequality into Price and Quantity Components, 1988-1997-2003

(100×log point changes)

Wage differentials:	90-10		90-50		50-10		90-10		90-50		50-10		90-10		90-50		50-10	
Periods:	1988-2003						1988-1997						1997-2003					
Log wage points	81.2		48.0		33.1		78.0		49.2		28.8		3.1		-1.2		4.3	
Constant	-14.1		16.8		-30.9		10.3		6.1		4.2		-24.4		10.7		-35.1	
Region	40.3		17.5		22.8		44.6		23.8		20.8		-4.2		-6.2		2.0	
Education	42.4		7.4		35.0		44.8		25.0		19.8		-2.3		-17.6		15.2	
Experience	12.4		6.3		6.2		-21.6		-5.6		-16.0		34.0		11.9		22.2	
Sequence	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X	X-B-W	W-B-X
Quantity changes	-30.1	9.8	-10.6	-1.2	-19.6	11.1	-13.0	12.2	-1.0	11.0	-12.0	1.2	-21.3	-6.8	-18.8	-9.0	-2.6	2.3
Constant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Region	-6.3	9.4	-6.5	-0.6	0.2	10.1	7.3	19.8	5.4	11.0	1.8	8.8	-18.6	-10.8	-21.0	-13.5	2.4	2.8
Education	-3.3	11.7	-0.3	3.3	-3.0	8.4	-0.4	7.3	0.0	4.3	-0.4	3.0	-2.2	3.9	0.6	2.4	-2.8	1.5
Experience	-20.6	-11.3	-3.8	-3.9	-16.8	-7.4	-19.9	-14.9	-6.4	-4.3	-13.5	-10.6	-0.5	0.1	1.7	2.1	-2.1	-2.0
Between Group Prices	43.9	22.3	24.1	13.4	19.7	8.9	40.3	23.3	26.0	17.6	14.2	5.6	10.8	0.9	5.4	-2.9	5.4	3.8
Constant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Region	29.6	16.9	15.7	9.3	13.9	7.6	35.0	23.3	23.4	16.3	11.6	7.0	1.8	-6.4	-0.1	-6.4	1.9	0.0
Education	15.3	9.7	9.1	4.6	6.2	5.1	5.9	4.8	2.5	2.2	3.5	2.6	9.3	7.3	5.7	3.8	3.5	3.5
Experience	-1.0	-4.3	-0.6	-0.4	-0.4	-3.9	-0.6	-4.9	0.2	-0.9	-0.8	-4.0	-0.2	0.0	-0.2	-0.3	0.0	0.3
Within Group Prices	67.4	49.0	34.4	35.8	33.0	13.2	50.8	42.6	24.2	20.6	26.6	22.1	13.6	9.0	12.1	10.7	1.5	-1.7
Constant	-14.1	-14.1	16.8	16.8	-30.9	-30.9	10.3	10.3	6.1	6.1	4.2	4.2	-24.4	-24.4	10.7	10.7	-35.1	-35.1
Region	17.0	14.0	8.3	8.9	8.7	5.1	2.3	1.5	-5.0	-3.5	7.3	5.0	12.7	12.9	14.9	13.7	-2.2	-0.8
Education	30.4	21.0	-1.4	-0.5	31.8	21.5	39.2	32.7	22.5	18.4	16.7	14.2	-9.4	-13.6	-23.9	-23.8	14.5	10.3
Experience	34.1	28.0	10.7	10.6	23.3	17.5	-1.1	-1.8	0.6	-0.4	-1.6	-1.4	34.7	34.0	10.4	10.1	24.3	23.9

Source data: UHS, 1988-2003.

Xbw and wbx denote the sequence of decomposition which is Quantity-Between Price-Within Price and Within Price -Between Price-Quantity relatively.

Figure 1: Kernel density estimates of log real annual wages for selected years.

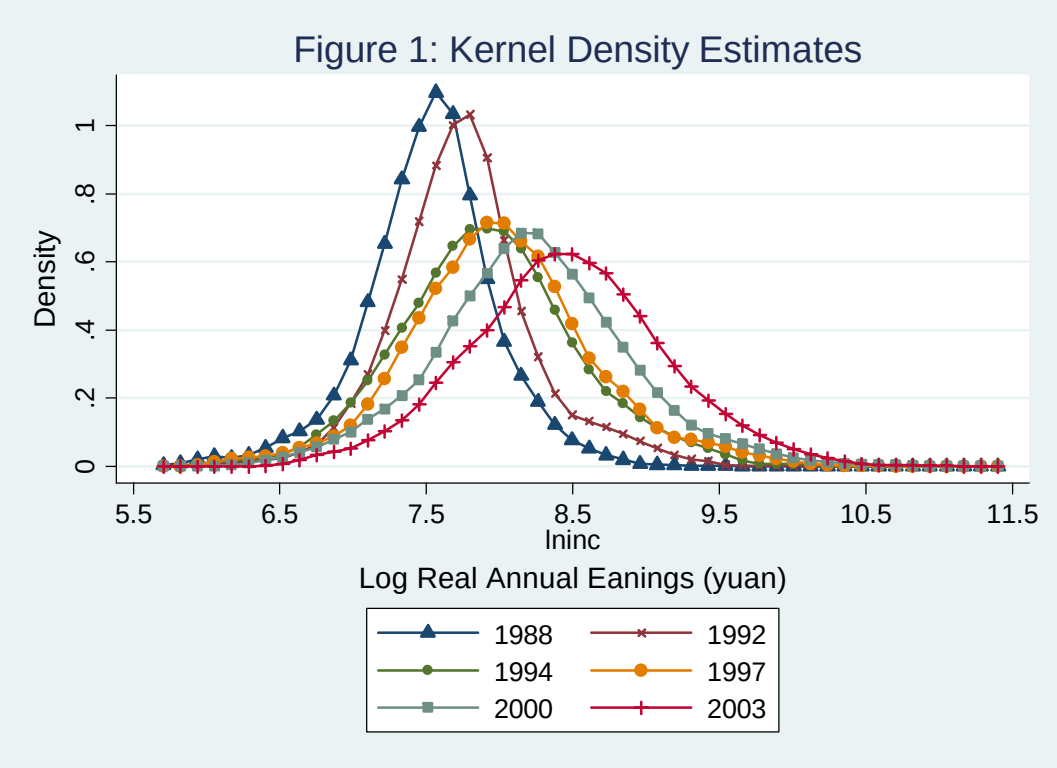

Figure 2: Real Annual Wages by Percentiles for male workers, 1988-2003.

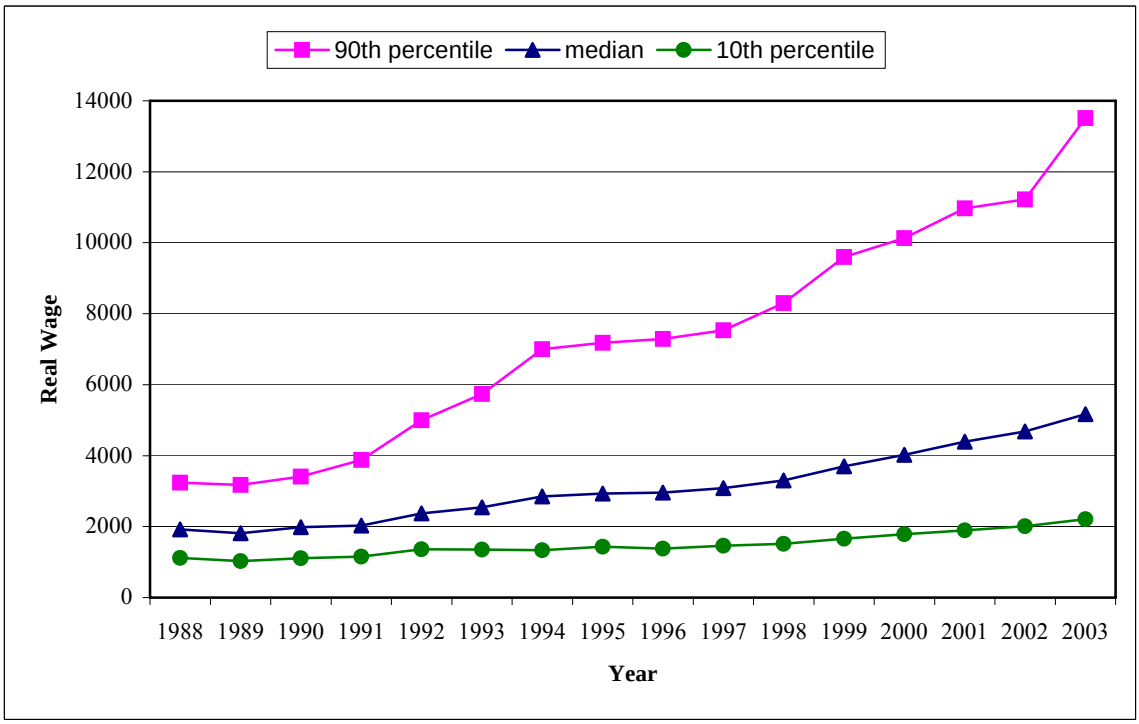

Figure3: Log Real Wage Changes by Percentile, 1988-2003.

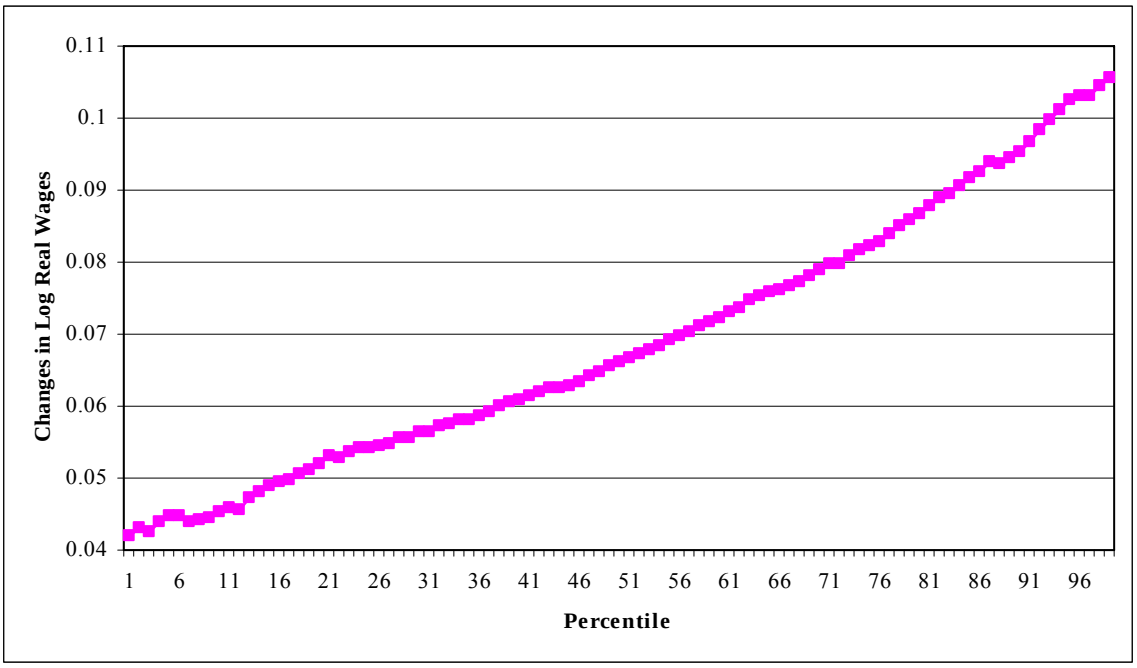

Figure 4: Log Wage Differentials by Percentile, 1988-2003.

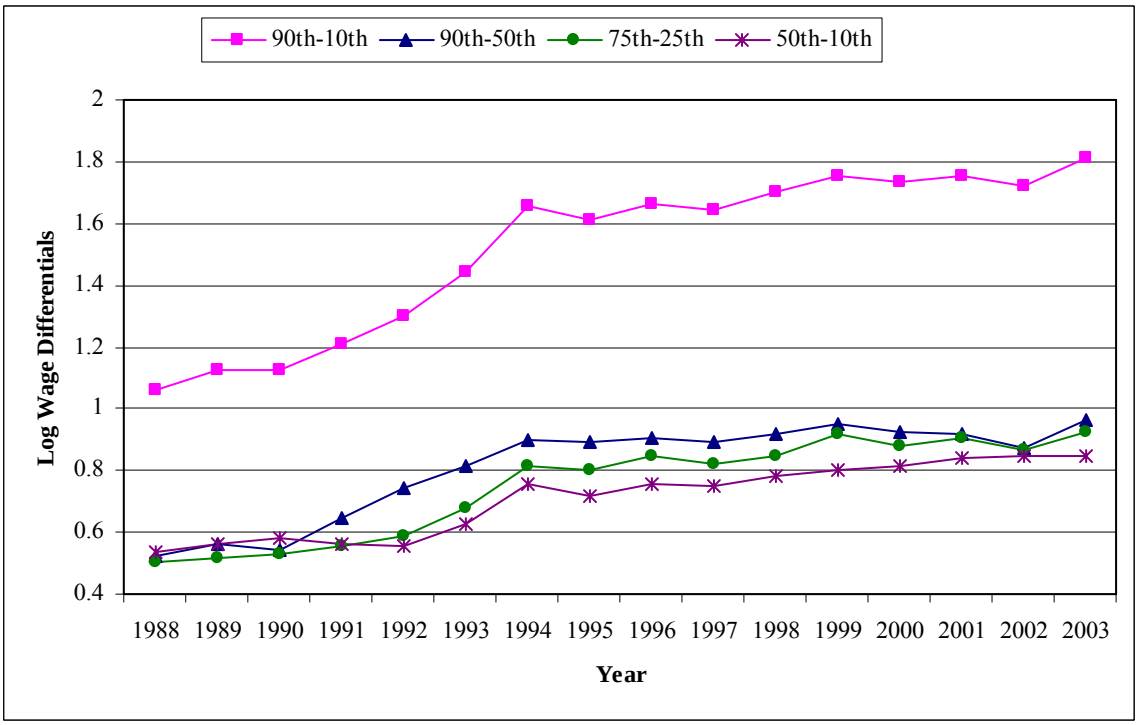

Figure 5: Annual Average Wage Growth by Percentile.