Gender Earnings Inequality in Reform-era Urban China

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Abstract:

This paper examines the trend in gender earnings inequality in reform-era urban China. Given the lack of longitudinal data, we analyze the 0.1% sample data of the population mini-census in 2005, along with prefecture-level statistics, to approximate the temporal trends with variations between sectors and regions. At the region-level, we explicitly differentiate between the effects of marketization and the effect of economic development on gender inequality. Using OLS regression and multi-level models, we show that the gender earnings gap between is smallest in government and institutions, but increases as the sector is more marketized. Moreover, the forces of marketization and economic development affect gender inequality in different ways. While economic development tends to decrease gender earnings inequality, marketization is the dominating force that increases gender earnings inequality in China

Key words: China, Earnings Inequality, Economic Development, Marketization

Introduction:

Since the 1980s, China's economic reform has experienced profound transformation. This significant economic boost spurred the interest of many scholars on income inequality, especially gender-earning inequality in China. (Shu & Bian, 2003; Bian & Logan, 1996; Griffin & Zhao, 1993; Khan et al., 1992; Nee, 1989, 1991, 1996, 2001; Parish & Michelson, 1996; Xie & Hannum, 1996; Zhou, 2000). As far as we know, most literatures tend to focus on the changing effects of political capital and human capital on economic inequality (e.g., Nee 1989; Bian & Logan 1996; Wu & Xie 2003; Xie & Hannum 1996) , whereas gender inequality as an important dimension of social stratification has largely been neglected, especially in China. Shu and Bian (2003) were among the few who attempted to examine the trends in gender earnings inequality in context of China's market transition and they found little change over time. These findings remain puzzling given the fact that substantial changes in inequality patterns that are well documented on the increasing effects of human capital on earnings (e.g., Wu 2002; Wu and Xie 2003).

The impact of the economic reform is multifaceted, and the force behind it is multidirectional. Some researchers argue that the economic reform transformed economic structure of China from the planned economy to the market-oriented economy, where profit and efficiency are highly valued, and under which women are discriminated against by the labor market, thereby engendering or even intensifying the gender-earning inequality. In contrast, the intervening force—— economic development boosted the demand for educated labor force, facilitated the expansion of tertiary industry, and brought a myriad of opportunities to society, especially women, thereby lowering gender inequality (Entwisle et al., 1995; Matthews & Nee, 2000; Michelson & Parish, 2000).

Thus far, empirical research on how the market transition affects gender inequality remains far from satisfactory. First, most research often neglect the diverse processes behind the economic reform and only attribute the temporal trend to one force, mainly economic development, while ignoring the other——marketization;

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Second, there are no explicit measures for either force which makes the operationalization even more difficult (Walder, 1996, 2002); Third, previous studies of the consequences of gender-earning inequality during China's economic reform period typically treat China as a homogeneous entity and disregard heterogeneous regional variations; thence, these studies are only suitable when the data used are limited to small regional scale (Linge & Forbes, 1990).

In this paper, I attempt to interpret the ever-increasing gender earnings ratio under the economic reform in China by differentiating the effect of economic development and marketization. Further, with the heterogeneity of the pace of reforms in different regions in China, I approximate regional variations to temporal trends in these two dimensions, given the lack of longitudinal data. (Nee, 1996; Parish & Michelson, 1996; Xie & Hannum, 1996). Throughout the analysis, data from the 2005 China Census and additional city-level information collected by National Bureau of Statistics are used to answer the following fundamental questions:

1. How does economic liberalization (or market transition) affect gender earning inequality?

2. How does economic development affect gender earnings inequality?

Theoretical Framework

In many Western societies, gender inequality in education, employment, and earnings has been widely documented (Reskin, 2003). When it comes to the impacts of market transition in China, "whether the market is an equalizing force" is largely a subject of debate. This perspective addresses the expected gains from the transformation for those who participate in the actual production and distribution of products and those with human capital. (Nee & Matthews, 1996). The heated topic——gender inequality on earnings under the process is also related to this issue. However, with regard to the impact of economic reform on gender inequality, different forces could have affected the trends in different ways.

Marketization Theory

Market transition theory argues that the transition from state socialism to market capitalism would yield profound impact on gender inequality. One of the principal structural changes following the post-socialist transformation is the gradual replacement of the state by the market as the principal agent of social stratification. An increase in the importance of market credentials and a decrease in the importance of political attributes as determinants of earnings were predicted in transition economies (Cao & Nee, 2000; Nee, 1989, 1991, 1996; Nee & Matthews, 1996).

During the period of state socialism, virtually all productive assets and capital were public property. Most organizations were classified as either state-owned or collective, and only a negligible fraction of private ownership existed. State ownership held a more central position in the national economy, whereas its collective counterpart was relegated to a peripheral role (Whyte & Parish, 1984). All labor resources were planned and distributed by the state. Work was collectivized; people in both rural and urban areas became increasingly subjected to state control (Henderson & Entwisle, 2000). Throughout the period, "egalitarianism" was highly emphasized. The institutional transition to a market economy since 1978 make the government largely retreated from the provisions of housing, education, health care, and other social services. As China progresses further towards economic marketization, the private sector has experienced an exponential growth. In 1982, only 0.74% of private and hybrid organizational forms existed as a share of the total industrial output, whereas in 2005, private and hybrid organizational forms accounted for 1/3 of total industrial output in China. During that period, the proportion of the labor force employed in the private/hybrid sector rose from 1.29% to 19.8% (Nee, 2004; China's Economy & Trade Yearbook 2006). Private and hybrid property forms have become an increasingly significant, and perhaps the most dynamic, component of the national economy. This change prompted enterprises to place greater emphasis on economic efficiency in hiring and rewarding workers, thereby placing women, traditionally considered as weak and incapable, in a very disadvantaged situation in the labor markets. (Nee, 1996; Nee & Matthews, 1996; Zhang, Hannum, & Wang, 2008)

Economic Development Perspective

The process of marketization is often intertwined with economic development in China. Some studies have pointed out that developed countries have higher gender equality than developing countries.[1] Economic reform spurred economic development in China and phenomenally boosted economic growth since 1992, when Deng Xiaoping called for further economic reforms during his famous tour to southern China. Thence, the market economy has been fully legitimized by the Chinese Communist Party's ideology, and had begun playing an increasingly important role in the economic growth of China. The proportion of service industry was enlarging rapidly which boosted the demand for educated labor force, intrigued the expansion of education, and brought a myriad of opportunities to the society. During this period, the education level and labor participation rate in China has been largely increased, especially for women (Bauer et al., 1992; Lavely, 1990; Hannum, 2005). And the rise of female education also leads to employment in more high-status, nonmanual occupations, which further lower the earnings gap by attenuating the degree of occupation segregation between genders (Bauer, 1992; Wu & Wu, 2008).

Moreover, accelerating economic development paves the way for the penetration of the western conception and attitude toward "gender egalitarianism," which has significantly changed the traditional thinking on gender in China. Therefore, in this sense, economic development may reduce gender inequality.

Macro and Micro Measurements of Gender-earning inequality

A considerable amount of previous research documents the earning inequality between men and women in the labor market. Human capital theory is one of the most widely used theories on rational economic behavior by individuals in labor market where the qualifications such as on-the-job training, labor market experience, and formal training are the main indicators of earnings. This theory places higher value on

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[1] In the handbook of Income Distribution, Chapter 13, Kuznets (1955) shows that "long-run data for the UK, Germany and the US, all showed declining inequality with increasing per capita over time. It was to incorporate this finding that Kuznets continued the process discussed in the quote, arguing that eventually population shifts on its own would tend to decrease inequality, and that various policy measures and interventions would begin to reduce inter- and intra-sectoral inequality-hence the observed decline, the only tendency for which he had evidence (Kanbur, 2000)." This implicitly describes positive correlation between income inequality and increasing per capita.

the personal characteristics of individuals. According to a number of studies, increasing wage inequality has been associated with rising prices of both measured and unmeasured labor market skills, thereby increasing the demand for specific skills (Katz & Murphy, 1992; Juhn, Murphy, & Pierce, 1993). When it comes to the gender inequality on earning, women are believed to be more unwilling to invest more on increasing their own human capital, such as education, skills or work experience; the earning gap is therefore based on compensating the cost of such human capital investment (Becker, 1964; Becker, 1993; Mincer, 1974). Nevertheless, in accordance with market transition theory, as the degree of marketization increases, the importance of human capital becomes more and more prominent, however, in China, the lack of true labor market where the rate of return of human capital doesn't increase with the economic growth may distort this impact (e.g., Peng, 1992; Walder, 1990; Whyte & Parish, 1984; Xie & Hannum, 1996; Zhao & Zhou, 2002).

Given this historical reason, China continues to be highly influenced by the socialist economy. When viewing the market as a generic institutional force that reshapes the social stratification order (Nee, 1989, 1991; Szelenyi, 1978; Szelenyi & Kostello, 1996), taking the work unit as a specific institution through which the market exerts its influence on urban social inequality is necessary especially when lacking of the longitudinal data. (Guthrie, 1997; Oberschall, 1996; Zhou & Pei, 1997). This idea illustrates that marketization primarily influences workers through their work units, which vary in terms of proximity to market forces (Wu, 2002). However, this operationalization is hard to achieve. Instead of measuring the longitudinal effect of work unit, measuring the individual-level labor market attributes, such as sector of employment and type of work organization, could be a good substitution because it assumes that workers in non-state segments of the labor market are more affected by marketization than those working in the segments owned or controlled by the state (Bian & Logan, 1996; Zhao & Zhou, 2002; Zhou, 2000).

Regional inequality in China

China has great imbalance on regional economic development (see Figure 1). During the Maoist-era (1958–1973), egalitarianism penetrated the entire period, and

redistribution measures were heavily relied upon in an attempt to equalize regional economic development and to emphasize extensive, rather than intensive, modes of economic growth. However, since the launch of the economic reforms in 1978, China's dominant development policies have changed from self-reliance to open-door and policies of comparative advantages. Following the ladder-step theory, the government encouraged certain regions to develop first with the belief that coastal development would serve as a catalyst in the modernization of the entire country. In favor of the coastal areas, these regions are much more industrially developed than the interior regions.[2] (Yang, 1991b; Fan, 1997; Wei, 1997). As a result, the homogeneity of individuals is more salient than individuals from different regions.

[Figure 1 is about here]

Therefore, gender inequality, despite its social context, is unrealistic. Capitalizing on the pace of regionally uneven economic reforms, a multilevel model is employed in this paper by considering the variation of individual characteristics, especially return to gender earning determination, as changed by the economic development and degree of marketization. Separately, GDP per capita and employment share of private sector are used as indicators to capture the concept of economic development and the degree of marketization as the regional characteristics of the post-economic reform era.

Hypotheses

The preceding description offers a theoretic perspective on how economic development and marketization would affect gender inequality in post-reform China. It is shown that as a legacy of the socialist economy, work units continue to play a crucial role in the economic and social lives of urban residents in China (Bian, 1994; Bian & Logan, 1996; Tang & Parish, 2000; Walder, 1992a, 1992b; Xie & Hannum, 1996). However, unlike Maoist era, the post-1978 reforms have sought to convert

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[2]Both China's Sixth (1981–1985) and Seventh Five-Year Plans (1986–1990) emphasize the different economic development levels in the coast and interior (Yang, 1990).

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state firms to more profit-oriented entities and less dependent on administrative fiats (Wu 2002). This effort has been further intensified since the mid-1990s as Chinese government determined to push state firms into the market for competition and survival. They have been increasingly allowed to adopt market practice to recruit, reward, and dismiss workers to boost their economic efficiency at expense of their social responsibilities (Wu 2010). In the course of the market reform, state firms now behave more like private enterprises, whereas government agencies and institutions continue their redistributive role to provide public goods and promote social justice (Zang 2010). Therefore, government/institutions, public, private and self-employment sectors constitute a continuum that approximates the decline in the influence of the redistributive state and the increase of market forces on labor market inequality. (Bian & Logan, 1996; Zhao & Zhou, 2002; Zhou, 2000). If market transition theory serves right, there is the reason to believe that gender earning inequality should be the most prominent among private sector, followed by state firms, then government/institutions. Therefore, the following hypothesis is proposed:

Hypothesis 1: In general, gender inequality is increasing as work unit becomes more and more marketized which means that earning difference between genders should be smallest among government/public institutions, and largest among private and its hybrid sector.

My ultimate goal is to examine the impact of Economic reform on gender earning inequality. Because the severely imbalanced regional development in China has been well documented in a large body of literature, sufficient reason to believe that the different level of regional development can represent the different stages of development in China over time exists due to data limitation. How the effect of gender on earning difference varies by different regions is tested under this approximation. With regard to gender gap on earnings, different forces could affect the trends in different ways. The transition from state socialism to market capitalism transforms the ideology from "egalitarianism" to "market efficiency". Under socialist egalitarian policies in Maoist era, the status of women were promoted, "Women hold up half the sky" was reiterated throughout the period, the equality between men and

women is highlighted. Since 1978, the economic structure was gradually transformed from the centralized planned economy to a market-oriented system. The booming private sector created diverse opportunities and temporarily changed the nature of work in China. Economic efficiency is emphasized in hiring and rewarding workers within sector. These changes place women, traditionally considered as weak and incapable, in a very disadvantaged situation in the labor markets. (Nee, 1996; Nee & Matthews, 1996). Thus, under this logic, I propose that:

Hypothesis 2: Marketization (measured by the employment share of private sector) increases the gender-earning inequality.

However, the process of marketization is frequently intertwined with economic development. Economic reform spurs economic development in China, adding to the enlarging proportion of service industry, which boosts the demand for educated labor force and intrigued education expansion in China. It has been known that the educational level and labor participation rate has been largely increased especially for women. Moreover, the penetration of the Western conception and attitude brought by rapid economic development has made the way for change in the traditional thinking on gender in China. In this sense, women do gain some advantages from economic development. Hence, the following hypotheses are raised:

Hypothesis 3: Economic development (measured by the increase of GDP per capita) decreases the gender-earning inequality.

Data, Variables, and Methods

Data

The dataset used for this paper is composed of the 2005 0.1% population mini-census of China and additional city-level data collected by National Bureau of Statistics, which comprise comprehensive information that can be used to construct the characteristics of cities. In this paper, Prefecture level characteristics are needed to match individual level data, thus, I merged the two dataset and deleted those regions have missing data on either individual level or Prefecture level, as a result, 28

provinces and 282 Prefectures are included. This analysis targets a population of people aged 18−55 that have work at the time the census was conducted. Because the regional data includes the information of both rural and urban areas, I control *hukou* status throughout the analysis, rather than analyze urban and rural sample separately given the assumption that the residences of majority of people are still tied to their *hukou* registration places. Considering the regional uneven pace of development in China, two indicators ── Gross Output of Industry and Employment share of private sector are included to capture the concept of economic development and marketization.

Variables

As mentioned earlier, my main research interest lies in the gender-earning inequality thus, the key dependent variable throughout the analysis is logarithms of monthly income and the main effect focus is on gender, which is a dummy variable, with 1 denoting female; otherwise, male. Other demographic characteristics of individuals include education (1– primary or below; 2 – junior high; 3 – senior high; 4– college or above), work experience [calculated by the actual age of each person minus 7 (the average age when one starts to go to school) and years of schooling[3] (which is approximated by the education attainment with the assumption that the work experience of individuals begins after completing education)] and working hours per week, with 1 meaning work less than 26 hours per work, 2 meaning work between 27-50 hours per week, and 3 meaning work than more 50 hours per week. I group the working hours as this because work part time and work full time may have different mechanisms, and moreover, among those who work full time, work overtime or not may have different implications. *Hukou,* or household registration status, is also considered given the fact that people with different *hukou* type have different privileges in China: 1 is rural *hukou*, whereas 0 is urban *hukou. Danwei,* or work unit, is taken as the four-category dummy variable (1– government or public institutions ; 2– state-owned or collective owned enterprises; 3– private or self-employed sector; 4–

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[3] Illiterate – 0 year of schooling; primary school – 6 year of schooling; junior high – 9 years of schooling; senior high – 12 years of schooling; college – 15 years of schooling; undergraduate – 16 years of schooling; postgraduate – 18 years of schooling.

other).

Gross Product Value of industry (GPVI) is obtained from the additional data collected by the National Statistical Bureau, whereas the employment share of the private sector used in the analysis is generated from the 0.1% 2005 China Census, using the variable work unit by counting the number of people in private sector (private enterprises and self-employed enterprises) divided by all the people employed. Moreover, I also conduct the factors analysis based on the prefecture level city characteristics to check the significance the two dimension factors – economic development and marketization.

In this paper, my analysis contains two steps. At the First step, I use modified human capital model to examine overall gender earnings inequality, with gender earnings inequality across different sectors which approximate the degree of marketization. At the Second step, multi-level models are employed to investigate how gender inequality varies by the regional context in terms of economic development and marketization.

Model:

Mincer's Human Capital Model:

In the first step, Mincer's (1974) human capital model is modified according to the research interest of this study into the form below：

$$\ln(income) = \beta_0 + \beta_1 female + \beta_2 education + \beta_3 \exp + \beta_4 \exp^2 + \beta_5 rural + \beta_6 han + \beta_7 whour + \beta_8 danwei + \varepsilon$$

$$(1)$$

where $\ln(income)$ is the natural logarithm of individual income; As defined before, $education$ is a 4-category variable; $whour$ is working hours per week; and $\exp$ is work experience, which is a continuous variable calculated by

$\exp = age - 7 - schoolyr$ under the two assumptions. First, all people begin to go to school at the age of 7. Second, their work experience after completing education is continuous. Here, β_1 is the main effect (i.e., the gender difference of interest); and

ε is a mean zero residual with $E(\varepsilon \mid schooly, \exp) = 0$.

Multi-level Model

Applying the human capital model is the first step of the analysis. This assumes the regional homogeneity in China. This assumption, however, is theoretically unreasonable and wasteful. Therefore, the multilevel model is needed to relax this assumption in order to consider the heterogeneity of different regions.

In the second step, the two-level structure model is employed. The Level 1 model is nearly the same as human capital model, whereas, for the Level 2 model, I allow the Level 1 residual and coefficient of female varies by the change of Gross Product Value of Industry and employment share of private sector of different prefecture.

Level 1 (Individual):

$$\ln(income)_{ij} = \beta_{0j} + \beta_{1j}female_{ij} + \beta_{2j}education_{ij} + \beta_{3j}\exp_{ij} + \beta_{4j}\exp_{ij}^{2} + \beta_{5j}rural_{ij}$$
$$+ \beta_{6j}han_{ij} + \beta_{7j}whour_{ij} + \beta_{8j}danwei_{ij} + \varepsilon_{ij}$$

$$(2)$$

Level 2 (Prefectures):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}GPVI_{1j} + \gamma_{02}R\_private_{j} + u_{0j} \qquad (3)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}GPVI_{1j} + \gamma_{12}R\_private_{j} + u_{1j} \qquad (4)$$

$$\beta_{2j} = \gamma_{20} \qquad (5)$$

$$\beta_{3j} = \gamma_{30} \qquad (6)$$

$$\beta_{4j} = \gamma_{40} \qquad (7)$$

$$\beta_{5j} = \gamma_{50} \qquad (8)$$

$$\beta_{6j} = \gamma_{60} \qquad (9)$$

$$\beta_{7j} = \gamma_{70} \qquad (10)$$

$$\beta_{8j} = \gamma_{80} \qquad (11)$$

where j indexes the jth Prefectures. Note that u_{0j} and u_{1j} are Prefecture-level residual terms, assumed to follow a multivariate normal distribution, whereas the residuals of Level 1 are also assumed to be normally distributed, $\varepsilon_{ij} \overset{iid}{\square} N(0, \sigma^2)$. In this specification, the β parameter represents the ''return'' to an independent variable in 2005. Note that GPVI and employment share of private sector enters the model only as predictors of the β vector.

In the Level 2 model, the coefficient β_{2j} represents the logarithm of income of female compared with that of male in 2005. It can be decomposed as the sum of the average affecting across Prefectures and heterogeneity of Prefectures. For the latter, the changes of logarithm income in the returns to gender include two parts: (1) a systematic component due to GPVI and employment share of private sector, and (2) the a Prefecture-level residual term (u_{1j}). In Equation (4), γ_{10} refers to the average change across Prefectures in the return to gender if there is no economic development or marketization, $\beta_{1j}\gamma_{11}$ refers to the amount of change associated with economic development, $\beta_{1j}\gamma_{12}$ refers to the amount of change associated with marketization, and u_{1j} refers to the variation in change at Prefectures not captured by the multilevel model.

If $\gamma_{01}, \gamma_{02}, \gamma_{11}$ and γ_{12} are zero, the model would then be a "random coefficient" model. In this sense, GPVI and employment share of private sector do not affect determination of earnings, the effect of which are only falling randomly across each prefecture. If $\gamma_{01}, \gamma_{02}, \gamma_{11}, \gamma_{12}$ and u_{1j} are all zero, then model becomes a "variance component" model. In this case, the intercept only varies randomly across different Prefectures, which means that only the overall level of earnings would vary by different Prefectures.

When estimating the model, the covariance matrix is unstructured, given that this structure is the most "liberal" of all, allowing every term to be different.

It can be is used where each variance and unique covariance is freely estimated (Sophia & Anders, 2008).

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \square\ N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{00} & \tau_{01} \\ \tau_{10} & \tau_{11} \end{pmatrix} \right) \tag{12}$$

The residuals of the Level 1 model are independent of the residuals of Level 2, which means that the unobserved characteristics of each individual do not vary by city:

$$\text{cov}(\varepsilon_{ij}, u_{kj}) = 0,\ k = 0,1 \tag{13}$$

Results

Descriptive Statistics

Table 1 presents the descriptive statistics for the variables used in the analysis. This sample contains 71156 individuals and 282 Prefectures on the national level. As is observed, the average monthly income of males is 1126.9 RMB, which is 35.2% [= (1126.92-833.45)/ 833.45] higher than the average for females. In general, men work more hours than women per week, this may explain a portion of income difference between genders, probably due to the reason that women in general work less hours. We can also tell that the proportion of males who have junior high or above is all higher than females. In this sample, the age structure of women in general is approximately one year younger than men, which is consistent with the fact that women in general retire earlier than men and are more likely to leave labor market at an older age. Within in each sample, the percentage of people who hold rural *hukou* is higher for women than in men. The minority contains only 4.5 % in this sample; the proportion is a little lower than the data provided by the National Statistics Bureau (8.5%). This may because of the underestimation of the Western region of China in this sample. With regard to the distribution of employment share of different types of work units in 2005, 12.5% of people are employed in government or public institution, 21.42% are in state or collective-owned enterprises, and 40.15% of people are employed in by the private sector or are self-employed. This is largely due to the fact

that the private sector has expanded at a higher speed since the economic reform and begun to play a significant important role on national economy in China.

[Table 1 is about here]

Human Capital Model

Table 3 shows the ordinary least square (OLS) regression estimates for three models of earning determination.[4] Model 1 is the baseline human capital model, with education, work experience and its square term, and the main effect ——sex as the predictors. All the predictors have significant effects on earnings. As is generally true, females earn 28.2% ($=1-e^{-0.332}$) less than male after controlling for the other factors. In model 2, *hukou* status, ethnicity and working hours are included, the effect of all the variables are still significant, women earn 27.4% ($=1-e^{-0.320}$) less than men net of other characteristics. After further adding work unit into the model (Model 3), the effect of gender becomes even smaller. Evidently, Model 3 has the best fit compared with the previous two models, and the independent variables covered would account for 31.3 % of the variation on logarithm income, which is substantially higher than in Models 1 and 2. Females apparently earn 26.4% ($=1-e^{-0.307}$) less than males, holding the other factors constant. The effect of *hukou* decreases from -0.206 (Model 2) to -0.098 (Model 3) after controlling the work unit, which means that people with rural *hukou* in Model 2 earn 18.6% less than those who have urban *hukou*, whereas, after further controlling the work unit, people with rural *hukou* only earn 9.3% ($=e^{0.098}-1$) less (Model 3). The effect of ethnicity in Model 3 is decreased to about half compared with the coefficient in Model 2. The result implicitly shows that work unit in China does play an important role on earning determinations. The mechanism may be put into effect by assigning people into different *danwei*. This may be caused by the sorting process of workers, namely, people with certain

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[4] The results I showed are the ones excluded those have high influence on regression coefficient, where influence is defined as the combination of residual and leverage(i.e. cook's distance), the higher the value of the influence, the higher the impact on each coefficient of deleting each observation. The procedure of detecting high influence outliers can be seen in Appendix B.

characteristics are more likely to be assigned to one sector rather than the other, thereby further engendering or even intensifying the earning inequality by different genders or other demographic characteristics. Moreover, in comparison with primary or below education, people with junior high or senior high can earn 23.0% and 52.5% more respectively, and college or above education shows even more substantive advantage, we can see that the earning for people holding a college degree or higher is 2.41 times of people with primary or below education.

[Table 2 is about here]

From government or public institution, state or collective owned enterprise, to private enterprise, the sector becomes more and more marketized. In order to capture the earning inequality pattern between gender by the change of the degree of marketization, a separated OLS regression across different sectors is further employed. The results shows that putting the farmers aside, gender earning inequality is greatest in private sector, followed bystate or collective owned enterprises, then in government or public institution(Table 4). Females earn 8.1%($=1-e^{-0.084}$), 18.5% ($=1-e^{-0.204}$) and 33.4% ($=1-e^{-0.406}$) lower than males in government or public institution, state or collective owned enterprises, and private sector sequentially given the similar characteristics, which is lending some preliminary evidence to support our Hypothesis 1. From government to private sector, this monotonically enlarging gap can be clearly seen from the Figure 2.

[Table 3 is about here]

[Figure 2 is about here]

The analysis above is based on the assumption of regional homogeneity. However, from Figure 1, regional inequality on economic development can be clearly seen. Obviously, along the coastal side, the GPVI in general is more concentrated and higher than the interior area in China, which is consistent with the fact that China exerts more endeavors on the development of the coastal, rather than the inland areas. And moreover, it offers sufficient evidence to approximate the regional variation of development on time varied trend for 2-level hierarchical model.

In the following, treating different prefectures as different regimes, and allowing full interactions between them and the coefficient of individual characteristics is employed.

Multilevel Model

The intra-class correlation (ICC) of the null model shows that the 18.21% of variance in income can be accounted for by Prefectures. From the statistical, this result aspect offers us sufficient justification to apply the multilevel model in estimating gender inequality. The variance component model, random intercept and coefficient model, and the goodness of fit of a series of nested multilevel models are further developed (Table 5). The first model is the baseline model of regional homogeneity (Model A). In this model, all γ and u are restricted as 0 for all Prefectures. This is equivalent to Model 3. The second model, B, includes a variance component for the intercept. The results indicate that there are large regional variations in earnings levels of different Prefectures. For the third model, C, the covariance between β and γ for intercept of individual level and coefficient of gender are included. Model C1 allows the intercept of Level 1 model varies by Prefectures and levels of characteristics of Prefectures, and also allow coefficient of female differ by Prefectures but not vary by the characteristics of Prefectures. While Model C2 allows both the intercept and coefficient of female of Level 1 model vary by Prefectures and levels of characteristics of Prefectures. It can be seen that compared with Model C1, the variance component for female goes down from 0.126 in the direct effects model to 0.124 in the cross-level model, apparently, cross-level interaction in Model C2 explains some of the variation of the slopes for gender. And, the goodness of fit of model is significantly improved every time we release some constraints, namely, assuming the earning determination vary by Prefectures and levels of characteristics of Prefectures for return to gender to fit the data better.

[Table 4 is about here]

The estimates of the multilevel model can be seen in Table 6. Through the analysis above, Model C2 is preferred. The constant in fixed part tells us the average

income across all Prefectures and individuals is 255.4 ($= e^{5.543}$) RMB. In this model,

allowing the intercept to vary across Prefectures, the intercept has two structural

components ($\gamma_{01}GDP_{1j}$ and $\gamma_{02}R\_private_j$) and one random component u_{0j}. The

estimated γ_{01} for economic development is significantly positive. This means that

more economically developed regions would generate more economic wealth for

redistribution to work in the local labor force. In the analysis, GPVI varies from 3.143

to 15660.1 per 1,00 million RMB; thus, the estimated γ_{01} would contribute 0.000042

(=0.135*0.0003143) to 0.21 (=0.135*1.566) RMB to the baseline intercept term 5.543.

Another Prefectures level characteristic, employment share of the private sector,

varies from 0.037 to 0.621. Therefore, the estimated γ_{02} could contribute 0.013 to

0.083 to the intercept. This result is consistent with the substantial effect of expansion

of private sector since market transition. However, once we take a further look at the

micro–macro interaction term, for every 1 billion increase in GPVI billion, women's

earnings could only increase 0.01% ($= e^{0.000135} - 1$), and for every 100 billion increase

in GPVI, the earning of women would increase by 1.44% ($= e^{0.0135} - 1$) compared with

men. In terms of employment share of private sector, every 1 % increase on

employment share of private sector would decrease women's earning by 0.4%

($= 1 - e^{-0.0364}$), if the employment share increase 10% , then women's earnings would

clearly decrease women's earning by 3.5% ($= 1 - e^{-0.0364}$), and if employment share

increase 1% which is consistent with both hypothesis 2 and 3. In Figure 3,this trend

can be explicitly seen. Considering the increase of GPVI does not substantially affect

the earning difference between gender despite significant, the effect of increasing

employment share of private sector is dominant on explaining the ever-increasing

gender earnings ratio mentioned at the beginning.

[Table 5 is about here]

[Figure 3 is about here]

Economic Development and Marketization Index

However, conceptualizing the economic development and marketization using one indicator may not capture the full picture, despite its easy interpretation. In the following part, I further conduct the factor analysis using the additional data collected National Statistical Bureau. Given the data, prefectural level employment share of tertiary industry, employment of Private Sector, Gross Product Value of Industry, education expenditure, local fiscal budget revenue as a share of total GDP, GDP share of domestic enterprises and average income of employed people are used for factor analysis. The main goal of this method is to determine the minimum number of common factors that would reflect the correlation among observed variable at maximum. The choice of the factor is on the basis of larger than 1 eigenvalues; clearly, two factors are identified in this analysis (see Table 6 & Figure 4). Here I choose the varimax rotation to differentiate the subsets of factors, this rotation maximize the variance on the new axes so that each factor could be as diverse as the other factors. Since this solution can give clearer separation of the factors and more invariant results in most cases, it is widely preferred when conducting factor analysis. Using the factors loading listed in Table 6, I construct the scale of both factors, so that they would vary from 0 to 1, that is, from low to high level. Using these two factors as the prefecture level variables, I further conduct the multilevel analysis to verify whether the effects of the economic development and marketization are significant as good as the one indicator measurement. From Table 8, it can be seen that both factor show the consistent effects as the one indicator measure, and the results remain significant. Namely, economic development would decrease the gender earnings gap, whereas marketization affects the gender earnings gap in the opposite direction.

As is mentioned in Zhang et. al(2008), the trend of gender inequality is persistently increasing since economic reform, the female-to-male earnings ratio declined from 0.863 in 1988 to 0.762 in 2004 using Urban Household Survey Data in China. Thus, we may claim that Marketization is the driving force that leads to the enlarging gender earnings gap. This finding is also consistent with Hauser and Xie (2005) that gender inequality has been exacerbated since economic reform.

Summary and Conclusion

To summarize, in this paper, I examined the driving forces——economic development and marketization that caused the ever-increasing gender earning inequality since the 1980s —— China's economic reform. I first approximated gender earnings inequality across different sectors to the different degree of marketization on individual level OLS regression, and further looked at the effect of economic development and marketization on gender earning inequality by assuming the regional variation on development can capture different stage of economic reform using 2-level hierarchical model.

The analyses show that although no direct evidence could be found to prove that marketization primarily affects people through their work units, work unit is probably the most important mediator mediate the effect of some demographic characteristics of individuals to their earnings. As a legacy of socialism system, the earnings gap between genders is the smallest in government/institutions, but it increases in the sector that is more marketized and emphasizes more on economic efficiency.

By projecting the cross-sectional finding to the longitudinal trend of gender inequality, I found that both economic development and marketization have a significant positive effect on increasing the earning as a whole. When it comes to the effect of return to gender, these two indicators go in completely opposite directions. Consistent with hypothesis 2 and 3, marketization increases the gender-earning gap, while economic development reduces gender gap on earnings. However, the effect of economic development on gender earning inequality is fairly small, whereas the effect of marketization is dominant in driving the changing gender earnings inequality after economic reform in China.

Discussion

The finding implicitly suggests that the economic development over time could improve the situation of the widening gender gap on earning. The speed of improving, however, cannot catch up with the deterioration speed of the effect brought by

marketization; thus, it is safe to say that the temporal trend in gender earning inequality is mainly driven by marketization.

The economic reform is a multifaceted process, there are some other dimensions of regional variations worth further investigation. One of the potential measurements is migration. Because migration (immigration, outmigration) is usually associated with the changing characteristics of the origin or destination, it can be implicitly used to index the development level of the region. Other factors, such as the globalization, which could be measured by using employment share of foreign invested companies or proportion of FDI, and etc. can also be considered. However, an underlying problem exists in that whether these concepts that used for conceptualization of the marketization are empirically separable remains unclear. Some attempts by a group of economists to develop marketization indices for different regions in China reveal that all available indices of marketization are highly correlated with GPVI (National Economic Research Institute, 2001).

More importantly, although differentiating the concept of economic development from marketization can be seen as feasible, similar to the measurement of marketization, these two concepts are always intertwined. Market transition paves the way for accelerating the development of China's economy, whereas economic development hastens the speed of marketization. It is implausible to draw the boundaries and separate them completely. Nevertheless, the more precise operationalization of the concepts should be employed. Finally, most studies working on gender inequality exert more effort on earning inequality. Gender inequality is the universal phenomena, the scale of which is far larger than merely the earning. To fully understand the gender inequality, further extension of the analysis is necessary.

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Appendix A:

Tables

Table 1 Descriptive Statistic of Selected Characteristics, 0.1% Population Survey of China in 2005

National Sample	Mean		
	Total	Male	Female
Individuals			
Monthly Income / yuan	999.62	1126.92	833.45
	(1018.16)	(1087.41)	(893.05)
Education %			
≤ Primary	15.69	12.67	19.62
Junior High	44.01	45.32	42.30
Senior High	23.32	24.55	21.73
≥ College	16.98	17.46	16.35
Age	35.77	36.49	34.89
	(9.49)	(9.54	(9.36)
Working Hours per Week %			
≤ 26	2.86	1.92	4.09
27-50	59.43	58.33	60.88
≥ 51	37.70	39.75	35.04
Rural *Hukou* %	50.46	49.06	52.30
Han %	95.82	95.95	95.65
Work Sector %			
Government/Public Institutions	12.50	12.33	12.71
State/Collective owned enterprises	19.31	21.42	16.55
Private/self-employed	40.15	40.54	39.64
Other	28.05	25.71	31.10
N	71,156	40,292	30,864
Prefecture City			
Gross Output of Industry /100 million			3154.326
			(4216.66)
Employment Share of Private Sector			0.40
N			282

Note: The numbers in parentheses are standard deviation.

Data Source: 2005 0.1% Population Survey of China

Table 2 OLS Regression Predicting Logarithm of Earnings, 0.1% Population Survey of China in 2005

Independent Variables	Model1	Model 2	Model 3
Female	-0.332***	-0.320***	-0.307***
	(0.006)	(0.006)	(0.005)
Education ($\leq$ Primary is omitted)			
Junior High	0.315***	0.250***	0.207***
	(0.009)	(0.009)	(0.009)
Senior High	0.650***	0.484***	0.422***
	(0.010)	(0.011)	(0.011)
$\geq$ College	1.159***	0.931***	0.880***
	(0.011)	(0.013)	(0.014)
Work Experience	0.009***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)
Work Experience^2	-0.0003***	-0.0003***	-0.0002***
	(0.000)	(0.000)	(0.000)
Rural *Hukou*		-0.206***	-0.098***
		(0.007)	(0.007)
Han		0.144***	0.132***
		(0.014)	(0.013)
Working Hours per Week ($\leq$ 26 is omitted)			
27-50		0.706***	0.588***
		(0.017)	(0.016)
$\geq$ 51		0.732***	0.570***
		(0.017)	(0.017)
Work Sector			
(Government/Public Institutions is omitted)			
State/Collective owned enterprises			0.078***
			(0.010)
Private/self-employed			0.077**
			(0.011)
Other			-0.343***
			(0.011)
Constant	6.216***	5.627***	5.795***
	(0.013)	（0.025）	（0.027）
MSE	0.744	0.728	0.709
R2	0.243	0.275	0.313
Wald Chi2 Test		762.19	1331.75
p-Value		0.000	0.000
N	71,156	71,156	71,156

Note: ***p<0.001, ** p<0.01, * p<0.05.   The number in parentheses are standard errors.

Table 3 OLS Regression Predicting Logarithm of Earnings by Work Sector, 0.1% Population Survey of China in 2005

	Government/Public Institutions		State/Collective owned enterprises		Private/self-employed	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Female	-0.084***	0.011	-0.204***	0.010	-0.406***	0.009
Education ($\leq$ Primary is omitted)						
Junior High	0.198***	0.045	0.155***	0.025	0.136***	0.015
Senior High	0.423***	0.045	0.330***	0.026	0.325***	0.018
$\geq$ College	0.768***	0.046	0.753***	0.028	0.908***	0.025
Work Experience	0.014***	0.002	0.008***	0.002	0.012***	0.002
Work Experience^2	-0.0008	0.000	-0.0001*	0.000	-0.0004***	0.000
Rural *Hukou*	-0.178***	0.023	0.088***	0.015	0.038***	0.011
Han	0.058*	0.025	0.096*	0.027	0.098***	0.024
Working Hours per Week ($\leq$ 26 is omitted)						
27-50	0.234*	0.086	0.507***	0.061	0.417***	0.040
$\geq$ 51	0.077	0.087	0.354***	0.062	0.367***	0.039
Constant	6.001***	0.099	5.927***	0.072	6.050***	0.050
MSE		0.504		0.545		0.780
R2		0.190		0.185		0.141
N		8,891		13.738		28,568

Note: ***p<0.001, ** p<0.01, * p<0.05.

Table 4 Goodness of Fit of Multi-level Model, 0.1% Population Survey of China in 2005

Multi-level Model		No. of parameters	Log likelihood	Deviance	χ^2	Δ df
Regional Homogeneity						
A Human capital model(Model 3)		14	-76454.54	152909.09		
Regional Heterogeneity						
B Random Intercept		16	-69827.73	139655.45	26511.85***	2
C Random intercept + coefficient	i	20	-69565.71	139131.42	524.03***	4
	ii	22	-69556.60	139113.20	18.22***	2

Note:

Model C1 – both intercept and coefficient of female vary by Prefectures, but only intercept of level 1 model vary by the change of levels of characteristics of Prefectures.

Model C2 – see equation (2) to (10) for reference.

Table 5 Coefficients of the Multi-level Mmodel with Coefficient of Gender Vary by Prefecture Level Characteristics, 0.1% Population Survey of China in 2005 (N=71,156)

	Model B		Model C1		Model C2	
	Coef.	S.E	Coef.	S.E	Coef.	S.E
Fixed Part						
Individual Level						
Female	-0.312***	0.005	-0.349***	0.009	-0.277***	0.022
Education ($\leq$ Primary is omitted)						
Junior High	0.183***	0.008	0.179***	0.008	0.179***	0.008
Senior High	0.360***	0.010	0.337***	0.010	0.356***	0.010
$\geq$ College	0.787***	0.012	0.784***	0.012	0.783***	0.012
Work Experience	0.015***	0.001	0.016***	0.001	0.016***	0.001
Work Experience^2	-0.0004***	0.000	-0.0004***	0.000	-0.0004***	0.000
Rural *Hukou*	-0.165***	0.007	-0.148***	0.007	-0.166***	0.007
Han	0.020	0.013	0.020	0.013	0.020	0.013
Working Hours per Week ($\leq$ 26 is omitted)						
27-50	0.456***	0.015	0.448***	0.015	0.449***	0.015
$\geq$ 51	0.465***	0.015	0.457***	0.015	0.457***	0.015
Work Sector						
(Government/Public Institutions is omitted)						
State/Collective owned enterprises	-0.035***	0.009	-0.033***	0.009	-0.033***	0.009
Private/self-employed	-0.082***	0.009	-0.083***	0.009	-0.083***	0.009
Other	-0.372***	0.010	-0.373***	0.010	-0.372***	0.010
Prefecture Level						
GPVI /1,0000 billion RMB			0.627***	0.061	0.567***	0.009
Employment Share of Private Sector			1.234***	0.106	1.394***	0.010
Interaction Term						
Prefecture City Level*Female						
GPVI*Female					0.135**	0.004
Employment Share of Private Sector *Female					-0.364***	0.080
Constant	5.890***	0.029	5.575***	0.035	5.543***	0.036
Random Part						
s.d. (female)			0.102	0.008	0.100	0.008
s.d.(constant)	0.240	0.011	0.156	0.008	0.160	0.007
R(female, constant)			-0.294	0.088	-0.173	0.081
s.d. (Residual)	0.641	0.002	0.639	0.002	0.639	0.002

Note: *** p<0.001, ** p<0.01, * p<0.05.

Table 6 Factor Analysis using Varimax Rotation with Iterated Communalities

	Variables	F1	F2
X_1	Employment Share of Tertiary Industry	0.195	-0.526
X_2	Employment Share of Private Sector	0.074	0.724
X_3	Gross Output of Industry	0.917	0.294
X_4	Gross Output of Tertiary Industry	0.959	0.085
X_5	Education Expenditure	0.999	-0.0335
X_6	Local Fiscal Budget Revenue as a share of GDP	0.915	0.0382
X_7	Average Income of Employed People	0.772	0.4113
X_8	GDP share of Domestic Enterprises	-0.548	-0.6312
	Eigenvalues	4.532	1.465
	Percentage Explained %	69.78	22.56

Table 7 List of Top and Bottom 10 Prefecture Cities Using Constructed Factors

		Economic Development				
		Top 10			Bottom 10	
	Prefecture Code	Name	Index	Prefecture Code	Name	Index
1	3101	Shanghai	100.00	2307	Yichun	0.00
2	1101	Beijing	82.66	2311	Heihe	4.92
3	4403	Shenzhen	60.15	5109	Suining	5.11
4	4401	Guangzhou	56.94	5119	Bazhong	5.38
5	1201	Tianjin	48.39	2305	Shuangyashan	5.39
6	3205	Suzhou	47.13	4207	Ezhou	5.54
7	3301	Hangzhou	44.50	4213	Suizhou	5.66
8	3302	Ningbo	41.26	2206	Jiangyuan	5.92
9	3201	Nanjing	40.80	6206	Wuwei	6.01
10	4419	Dongguan	38.60	2204	Liaoyuan	6.50
		Marketization				
		Top 10			Bottom 10	
	Prefecture Code	Name	Index	Prefecture Code	Name	Index
1	4403	Shenzhen	100.00	4114	Shangqiu	0.00
2	3205	Suzhou	98.34	6210	Qingyang	0.82
3	3302	Ningbo	92.41	6110	Shangluo	3.89
4	3304	Jiaxing	91.80	6404	Guyuan	4.15
5	3505	Quanzhou	91.78	6206	Wuwei	7.98
6	4413	Huizhou	88.41	6211	Dingxi	8.15
7	4420	Zhongshan	87.16	4116	Zhoukou	8.83
8	3502	Xiamen	85.78	6212	Longnan	9.27
9	4404	Zhuhai	82.79	4308	Zhangjiajie	9.34
10	4419	Dongguan	81.97	3416	Woyang	9.47

Table 8 Coefficients of the Multi-level Mmodel with Coefficient of Gender Vary by Prefecture Level Characteristics using Constructed Factors, 0.1% Population Survey of China in 2005 (N=71,156)

	Model I		Model II	
	Coef.	S.E	Coef.	S.E
Fixed Part				
Individual Level				
Female	-0.349***	0.009	-0.328***	0.018
Education ($\leq$ Primary is omitted)				
Junior High	0.179***	0.008	0.179***	0.008
Senior High	0.356***	0.010	0.356***	0.010
$\geq$ College	0.783***	0.012	0.783***	0.012
Work Experience	0.016***	0.001	0.016***	0.001
Work Experience^2	-0.0004***	0.000	-0.0004***	0.000
Rural *Hukou*	-0.148***	0.007	-0.166***	0.007
Han	0.020	0.013	0.020	0.013
Working Hours per Week ($\leq$ 26 is omitted)				
27-50	0.448***	0.015	0.449***	0.015
$\geq$ 51	0.456***	0.015	0.457***	0.015
Work Sector				
(Government/Public Institutions is omitted)				
State/Collective owned enterprises	-0.035***	0.009	-0.035***	0.009
Private/self-employed	-0.083***	0.009	-0.083***	0.009
Other	-0.373***	0.010	-0.373***	0.010
Prefecture Level				
Economic Development Index	0.729***	0.097	0.620***	0.105
Marketization Index	0.783***	0.058	0.860***	0.064
Interaction Term				
Prefecture City Level*Female				
Economic Development Index*Female			0.221*	0.087
Marketization Index *Female			-0.159**	0.057
Constant	5.521***	0.030	5.511***	0.031
Random Part				
s.d. (female)	0.102	0.008	0.100	0.008
s.d.(constant)	0.136	0.007	0.160	0.007
R(female, constant)	-0.394	0.080	-0.173	0.083
s.d. (Residual)	0.639	0.002	0.639	0.002

Note: *** p<0.001, ** p<0.01, * p<0.05.

Figures

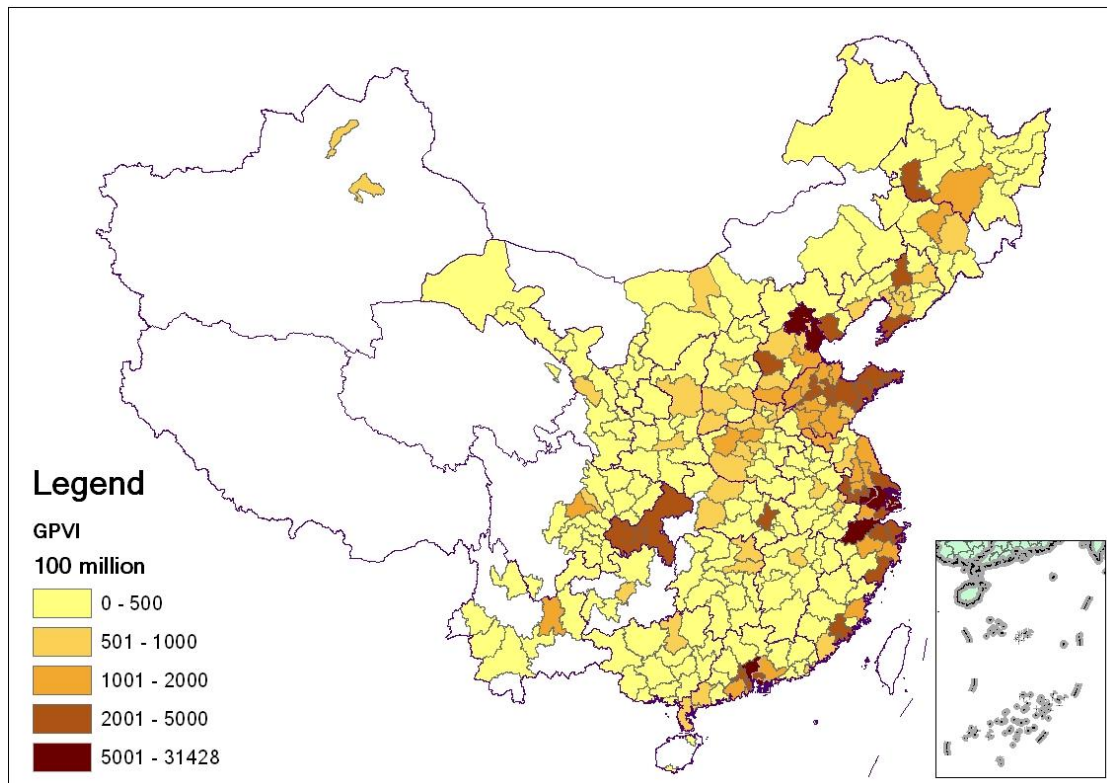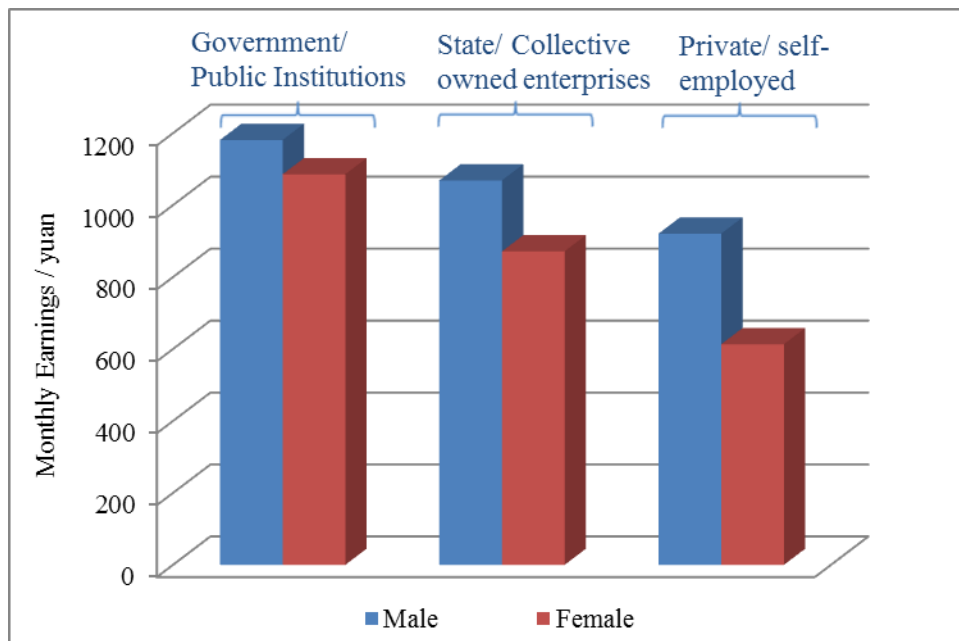Figure 1 GPVI Distribution of Prefecture Level City, 0.1% Population Survey of China in 2005

Figure 2 Gender Earnings Gap Controlling Other Factors, 0.1% Population Survey of China in 2005

Note：This figure drew by the regression results of Table 3, which illustrates the average earnings of men and women holding other characteristics at their mean.

Figure 3 Trend of Predict Logarithm of income by GDP per Capita and Employment
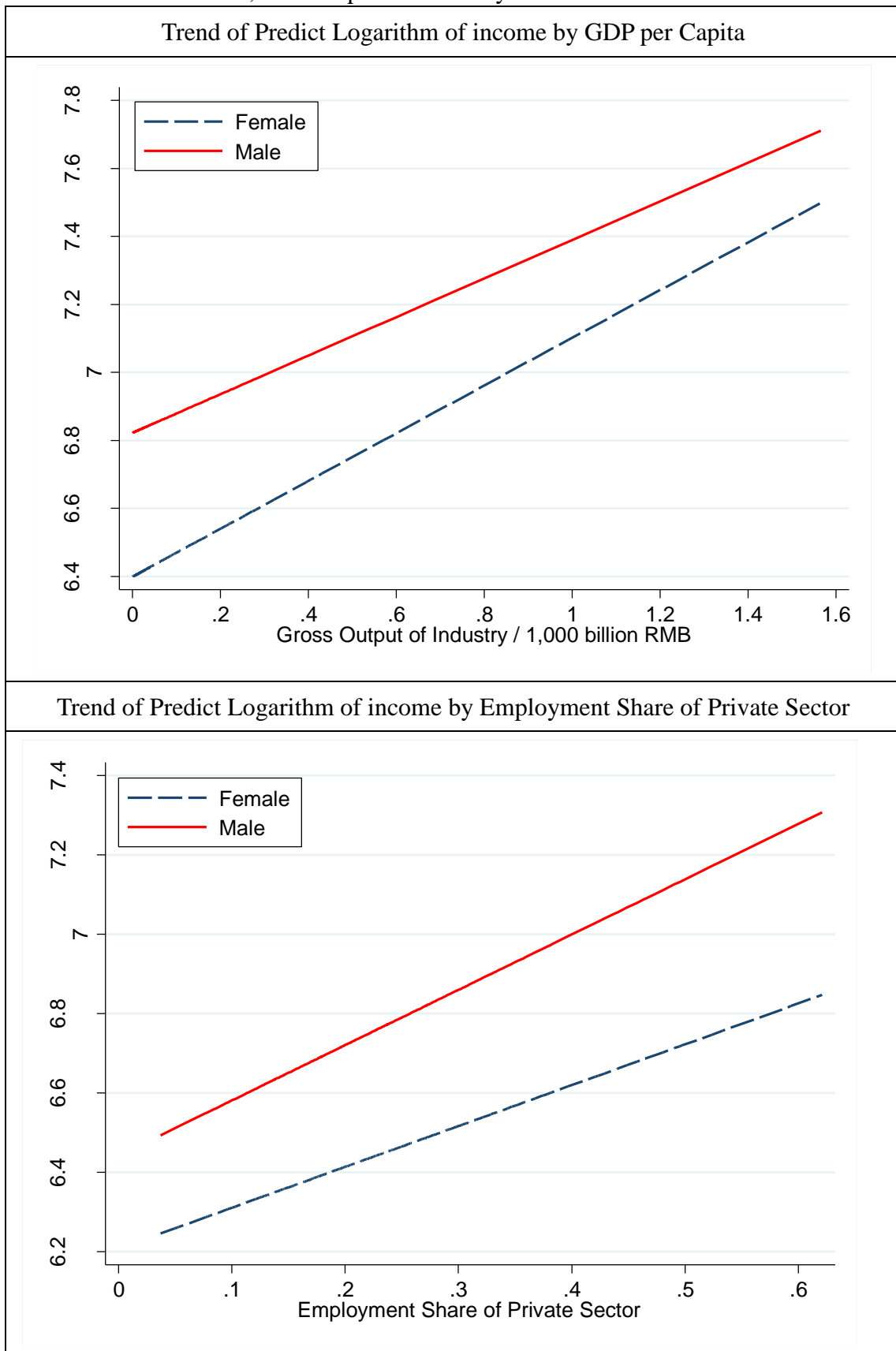Share of Private Sector, 0.1% Population Survey of China in 2005

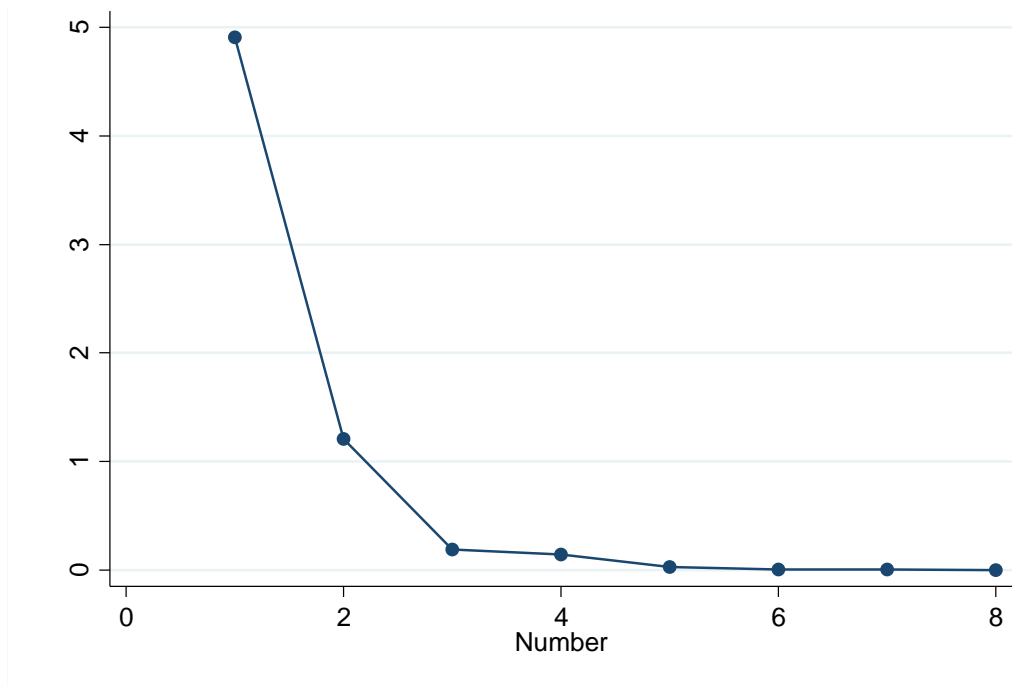Figure 4 Scree Plot of Eigenvalues in Factor Analysis

Figure 5 Scatter Plot of Index of Economic Development and Marketization by Prefecture