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# An Empirical Study about the Marketization Degree of Labor Market from the Perspective of Wage Determination Mechanism

HE Qiushuo

Shenzhen Institute of Information Technology, Shenzhen 518029, China  
heqs@szit.com.cn

**Abstract:** Ten years ago, economists had raised the issue of whether economic freedom can be measured, and there are a large number of domestic and foreign institutions and individuals had researched the measure of marketization degree, but it is few to measure the market degree of the labor market from the perspective of wage determination mechanism. This article attempts to investigate by using the stochastic frontier method of wage determination mechanisms from the micro-perspective, and measure the marketization degree of labor market, but also examine China's labor market and wage reform process, understand and grasp the labor market. At the same time, the research result will feedback the effect of labor market reform and promote the reform of labor market.

**Keywords:** Labor market, Wage determination mechanism, Marketization degree

## 1 Background and Objective

Ten years ago, economists had raised the issue of whether economic freedom can be measured, and there are a large number of domestic and foreign institutions and individuals who had researched the measure of marketization degree, but it is few to measure the market degree of the labor market from the perspective of wage determination mechanism ([2] degree of market about wage). Most researches focus on the part of measure of labor market, which is the part of the measure of overall market. This article attempts to use stochastic frontier method to measure the trend about the degree of marketization of wage determination of Chinese labor market from the perspective of individual human capital promoting the potential income (i.e. market value), thereby measuring the marketization degree of the labor market.

## 2 The Research Methods

This article attempts to use stochastic frontier method from the perspective of wage determination mechanism to measure marketization degree of labor market, it will

refer to Contreras' method of robustness test and add to more related omitted variables such as work experience squared, marital status, sex, occupation nature except level of education, work experience.

### 3 The Empirical Analysis

#### 3.1 Stochastic Frontier Approach

The basic idea of the stochastic frontier method is as follows. Considering a group of individuals, each individual has the same level of human capital. It is obvious that each individual won't own the same income level, because even assuming the same level of human capital, different individual is in different environments such as the department environment, family environment, working industry etc. and this will effect the income level of individual. And so different individual will get different income level, and degree of marketization of the wage determination mechanism will be different. Therefore, if the individuals can get their potential income, then it indicates that the labor market in their wage determination mechanism is completely market-oriented.

Stochastic frontier model is as follows<sup>1</sup>:

$$\ln E_{it} = \alpha + \beta X_{it} + v_{it} - \mu_{it}$$

$\underbrace{\hspace{10em}}$   
 Potential wage (wage border)

$\underbrace{\hspace{10em}}$   
 Random wages border

$\underbrace{\hspace{10em}}$   
 Observations wage (real wage)

That  $\varepsilon_{it} = v_{it} - \mu_{it}$ ,  $\mu_{it} \sim N(m_{it}, \sigma_{it}^2)$ ,  $v_{it} \sim N(0, \sigma_v^2)$

Where i represents the number of samples,  $i=1, \dots, n$ ; t is the time series,  $t=1, \dots, T$ . Since this article attempts to get the marketization degree of wage determination mechanism on the labor market each year, so this article will adopt sectional data, and  $T=1$ . Thus, the equation becomes:

$$\ln E_i = \alpha_0 + \alpha_i X_i + v_i - \mu_i \quad i=1, 2, \dots, N \quad (1)$$

Here  $E_i$  is the observable income of individual i,  $X_i$  is a vector of explanatory variables,  $v_i$  is the white noise, representative of the random error term, subject to the normal distribution of the expected value of 0, and variance  $\sigma_v^2$ , and is independent to  $\mu_i$ .  $\mu_i$  is non-negative random variables and can measure the degree of non-marketization, subject to the normal distribution of the expected value  $m_i$ , variance  $\sigma_{\mu}^2$  and discontinuous at 0. Here  $\mu_i$  reflects the degree of

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<sup>1</sup> The prototype of the model equation derived from the income equation belonging to Jacob, but here we use stochastic frontier approach to estimate.

non-marketization of individual  $i$  obtaining the potential wage, random items  $\mu_i$  is limited to non-negative, because some individuals may get random wages border which is  $\alpha + \beta X_i + v_i$ . The parameters in the Equation 1 are estimated to use the least squares method and the method of maximum likelihood estimation method.

$$\lambda = \frac{\sigma_{\mu}^2}{\sigma_{\mu}^2 + \sigma_v^2} \quad (0 \leq \lambda \leq 1 \text{ can make } \sigma^2 = \sigma_v^2 + \sigma_{\mu}^2) \quad (2)$$

Which  $\lambda$  represents the proportion of non-marketization in the random disturbance term,  $\sigma_{\mu}^2$  is the variance of the difference of marketization degree,  $\sigma^2$  is the summation between  $\sigma_{\mu}^2$  and the variance of the random noise ( $\sigma^2 = \sigma_v^2 + \sigma_{\mu}^2$ ).

We won't use OLS estimation unless  $\gamma = \alpha_0 = \alpha_1 = \dots = \alpha_i = 0$ . When  $\lambda$  is close to 1, it indicates that the deviation of the stochastic frontier income function comes mainly from random variables  $\mu_i$ , and also indicates that the gap between the real income and the boundary income (ie, potential revenue) primarily dues to the non-market of wage determination mechanism. When  $\lambda$  is close to 0, it indicates that the gap between the real income and the maximum possible income mainly dues to the statistical error.

### 3.2 Data Description and Variable Description

In this paper, we use the Chinese Nutrition and Health Survey (CHNS) data. CHNS is operated by international research team, and funded by the American University of North Carolina Carolina Population Research Center (since 1989). The survey included 3800 towns and villages; 14,000 people in total. This paper uses 1989, 1991, 1993, 1997, 2000 and 2004. Since this paper attempts to find the trend of the different marketization degree of wage determination mechanism, so each year is as a cross-section data to analyze in this paper. It will remove the rural areas sample and only leave the working-age population in urban areas sample (survey for the resident

**Table 1.** Definition of the variables

Variable name	
lnWage	logarithm of hourly wage
Education	years of education (years)
Age	Age
exp	Age - years of education - 6
Exp <sup>2</sup>	work experience squared
Gender	1: Men 0: Female
Marriage	1: Unmarried 0: Married
The nature of a work unit	1: SOE 0: Non-state-owned enterprises
Regional dummies	1: Elsewhere 0: Guizhou

population, except to the floating population) because this paper will focus mainly on of the urban labor market, and remove the observed samples, which miss basic personal information and employment, income information. The remaining samples number is 2013 in 1989, 2530 in 1993, 1725 in 1991,1451 in 1997,741 in 2004,1659 in 2000.

### 3.3 Empirical Results and Discussion

This paper uses stochastic frontier method to estimate the existence of non-market in the model. The results are shown in Table 2. Here we use stata statistical software.

#### Analysis

First we examine the result in Table 3 (a). The empirical result of using the maximum likelihood method shows that the degree of wage determination mechanism of the market is not simply random error distribution. Empirical results suggest that it can reject the null hypothesis at the 5% significance level. The difference of marketization degree is existed in the individual of the sample.

T-statistics of  $\lambda$  shows that  $\lambda$  is statistically non-zero from the Table 3 (a). Table 3 (a) indicates that the parameter at the 5% significance level is significant.  $\lambda$  is close to 1. It indicates that there are factors from the non-market in the random disturbance term, other factors come from other exogenous variables such as the statistical error. In addition, based on the results in 2004, we can estimate degree of marketization of each individual and calculate the average marketization degree of all individuals in the sample is 63%, which indicates that the degree of non-marketization is about 37 percent comparing to the individual of the highest marketization level of wage determination on the random border (the highest marketization level of wage determination is 1)<sup>2</sup>.

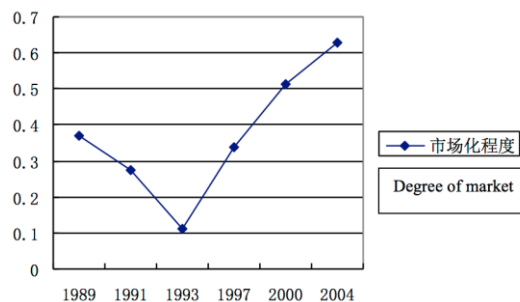


Fig. 1. Degree of wage determination market trend.

<sup>2</sup> Mentioned before, the results of marketization degree of wage determination in [2] were 5.44%, 28.98%, 32.63% and 78.80% in 1979, 1985, 1990 and 1995, although this measure is about different year, but from the overlap of the Year 1990 and the 1995, the result is less than Chen's results, which may be due to the different methods and the different measurement range, so the contrast is not very strong.

**Table 2.** Sample statistics description.

	State sector						Non-state sector					
Years	1989	1991	1993	1997	2000	2004	1989	1991	1993	1997	2000	2004
Hourly wage(Yuan /hour)	0.667 (1.498)	0.594 (0.436)	0.952 (1.713)	3.524 (24.37)	4.017 (5.507)	5.953 (5.109)	0.705 (0.875)	1.047 (1.221)	2.235 (4.620)	3.429 (4.416)	4.784 (8.889)	6.649 (5.435)
Weekly working hours(H)	49.00 (7.596)	48.206 (7.230)	47.45 (8.594)	41.6549 (9.333)	48.873 (15.138)	42.203 (10.366)	46.340 (20.238)	45.930 (16.095)	44.977 (19.540)	49.457 (17.257)	40.942 (10.587)	51.757 (16.777)
Age (years)	34.085 (10.875)	34.767 (10.595)	35.576 (10.584)	36.322 (10.109)	39.096 (11.711)	40.571 (9.818)	33.134 (12.056)	34.583 (11.282)	35.972 (10.221)	33.506 (11.911)	38.021 (10.315)	37.756 (10.864)
Work experience (years)	18.211 (11.501)	18.800 (11.222)	19.501 (11.084)	18.951 (10.831)	2106 (12.569)	22.372 (10.510)	16.615 (12.839)	17.097 (12.164)	18.727 (10.621)	17.843 (12.779)	20.47 (10.891)	21.893 (11.761)
College and above%	0.073 (0.260)	0.081 (0.273)	0.087 (0.282)	0.175 (0.380)	0.074 (0.263)	0.264 (0.441)	0.002 (0.054)	0.027 (0.165)	0.00 (0.00)	0.048 (0.215)	0.089 (0.485)	0.166 (0.249)
High school%	0.315 (0.464)	0.317 (0.465)	0.314 (0.464)	0.455 (0.498)	0.201 (0.401)	0.486 (0.500)	0.173 (0.378)	0.083 (0.278)	0.150 (0.367)	0.301 (0.461)	0.273 (0.446)	0.303 (0.460)
Junior%	0.417 (0.493)	0.415 (0.492)	0.437 (0.496)	0.296 (0.457)	0.526 (0.499)	0.210 (0.407)	0.483 (0.500)	0.569 (0.498)	0.431 (0.491)	0.457 (0.501)	0.288 (0.453)	0.358 (0.498)
Primary and below%	0.195 (0.204)	0.187 (0.196)	0.162 (0.184)	0.249 (0.221)	0.199 (0.310)	0.058 (0.066)	0.342 (0.427)	0.321 (0.503)	0.419 (0.505)	0.194 (0.218)	0.349 (0.442)	0.173 (0.183)
Sex% (Man = 1)	0.590 (0.491)	0.597 (0.490)	0.590 (0.491)	0.579 (0.493)	0.606 (0.488)	0.607 (0.488)	03753 (0.431)	0.383 (0.496)	0.438 (0.441)	0.518 (0.502)	0.609 (0.488)	0.579 (0.493)
Marital status%(Married = 1)	0.202 (0.402)	0.210 (0.407)	0.202 (0.402)	0.155 (0.362)	0.361 (0.480)	0.095 (0.293)	0.258 (0.438)	0.263 (0.443)	0.170 (0.378)	0.253 (0.437)	0.186 (0.389)	0.151 (0.358)

Note: Figures in brackets the standard error of the corresponding variable; Source: Chinese Nutrition and Health Survey (CHNS)

From Fig. 1, we are sure that marketization degree of wage determination mechanism first decreased and then increased gradually in the entire time series, in 1993 it is obvious turning point. Marketization degree of wage determination has been low before this point. The average degree of the whole marketization degree is approximately 20%, the average marketization degree gradually increases to above 50% after 1997, which partly shows that Chinese labor market reform is successful. But in absolute terms, compared to developed countries it is substantially lower, because in United States it is 86% in the same period [7].

From the perspective of human capital investment, Table 3 (a) shows that the impact of education on wages border is very significant, and its coefficient indicates that wage boundary will rise as the year of education is added one (it was 0.7% in 1989, and has been increased to 3% in 2004). And this suggests that the impact year of education on wage border is increased year by year, and the impact of experience on wage border is very significant, but little change.

Overall, the marketization degree of wage determination mechanisms is low, and its evolution path has been relatively consistent with China's development. For example in Fig. 1, the marketization is lower in the early 1990s, which may be mainly two reasons. On the one hand, although the government had began to reform wage before 1993, such as proposing the wage relevant to economic efficiency of enterprises in 1984 and also practiced various forms of wage system. But the reforms didn't change the wage determination of enterprise. The difference of wage determination is huge between the two types of market. In result, the income gap between the two markets is not only reduced, but expanded.

On the other hand, the affection of wage system reform is not obvious. There are two reasons: One is that the concept of return on human capital in the early 1990s might not be very clear. At that time, China adopted a unified wage policy and the gap is not obvious between the wages of various positions, so the status of competitive price system about the marginal productivity compensation paid to workers is not yet stable, especially in the Chinese state-owned sector, competitive wage payment mechanism is far from established. Second is the price information has been vacant in the state-owned economy, because the information is inefficient and the fact was that workers were short of the information about the work accumulation with workers' human capital. More seriously, the country's income level is very consistent, especially in state-owned enterprises. Although the wage was higher in non- state-owned enterprises but the staff mobility was not high due to social security and labor ideology. Because labors were lazy to learn about wage information of other companies, so the wage of workers cannot reach its borders largely.

Also from Fig. 1, marketization degree of wage determination mechanism began to shoot up after 1993, which indicates that the labor market situation had improved significantly. In 1993, the government officially announced the goal as the socialist market economic system reform, and selects the 100 state-owned enterprises to implement the corporate system. State-owned enterprises speed up to change from the planning system to market economy system. At the same time, the government began efforts to build a comprehensive social security system. Labor law formally was enacted in 1995. The government began to build macro-guidance system of enterprise wage income and establish wage guidelines system. Thus series of market-oriented



reform made the individual human capital returns to rise naturally. The marketization degree of wage determination mechanism had been continuously improved.

### **Stability Test**

This paper discusses whether the result is significantly changed after adding more relevant omitted variables using Contreras method. This paper used the same method to estimate [Equation 1]. In addition to the above estimates used by the relevant variables (level of education, work experience and work experience squared), we now add new variables which include the level of education (education), work experience (exp) and work experience squared ( $exp^2$ ), marital status (mar), gender, occupation nature, where corporate ownership dummy variable (SOE) - to estimate the equation [Equation 1].

Estimation results are in Table 3 (b). it is worth noting that the change of marketization degree is small in all time, and basically all the newly added variables were significant. Thus confirms our results stability.

We see that adding gender variable is significant, suggesting that the impact of gender on wages boundary is significant, and wages border of men is average higher around 7% than women. But we examine that men coefficient is 0.0693 in 1989 and rises to 0.0743 in 1993, but began to decline after 1993. This suggests that the impact of gender on wages border is waning after 1993. Marital status variables are most significant, and results also indicate that unmarried can raise wages border around 6% relative to married persons, the most important fact is the coefficient of sector is significant at the 1% level of significance. Before 2000 coefficient is negative which showed that wage boundary in state-owned enterprises was lower than in non-state-owned enterprise. It is consistent with our expectation.

Due to lack of competitive in SOE labor market early, wages and employment determination were more planned (which has been demonstrated in previous chapters), so the wages of workers were lower. Rather than non-state-owned enterprises had been in a competitive labor market, so its wages were relatively higher. However this situation has changed from 2004 (2004's coefficient symbol is changed and a very significant), which also indirectly shows that a series policies about wage and employment of state-owned enterprises play a role and reforms began to show results, particularly human capital returns gradually increased significantly which suggests that the marketization degree of wage determination mechanism gradually increased and also shows that the marketization degree of the labor market is also improving.

## **4 Conclusions**

This paper estimates the marketization degree of the wage determination mechanism. We found that the marketization degree of wage determination mechanism is very low before the 1990s. 1993 was a turning point. The marketization degree of the wage determination mechanism had been low before this point. The average degree of the whole marketization degree is approximately 20%, the average marketization degree

gradually increases to above 50% after 1997, which partly shows that Chinese labor market reform is successful. But in absolute terms, compared to developed countries it is substantially lower, because in United States it is 86% in the same period [7].

Overall, the result is consistent with the path of China's labor market reform.

These empirical studies show that there are some factors that affect non-market-oriented. There is not a bargaining system between labor and State-owned enterprise, and the government still plays a key role in wages of workers' determination. Enterprises have not the autonomy of wage determination. The marketization degree of wage determination in the market is low. While workers' bargaining power has increased in the non-state-owned enterprises, but it is thin in an oversupply of labor market, which also shows that China's labor market need to deepen reform, improve the marketization of wage determination mechanism.

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**Table 3.** Estimated wage equation.

	1989		1991		1993		1997		2000		2004	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Constant term	-0.6109***	-0.5558***	-.5349***	-.3925***	-.272	-.1688**	.1894	.2454**	.2152***	.2083**	.0832	.1683**
Years of education	0.0076***	.0077***	.0111***	.0103***	.0001	.003	.039***	.0037	.0489***	.048***	.0668***	.0701***
Experience	0.0133***	.0129***	.0106***	.0104***	.0124***	.0126***	.009***	.0096***	.0077**	.008***	.009***	.005**
Experience squared	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001**	-0.0001**	-0.00006
Gender	—	.0578***	—	.0499***	—	.0647***	—	.0616***	—	.0577***	—	.0687***
Marital status	—	-.0063**	—	-.00004	—	.0055	—	-.0214	—	.0053***	—	-.05002**
State-owned enterprises	—	-.5558***	—	-.1715***	—	-.1639***	—	-.1015***	—	-.0116	—	0.0647***
$\sigma^2$ *	.0892***	.0869***	.0372***	.0355***	.0625***	.0601***	.0671***	.0652***	.0812***	.079***	.066***	0.074***
$\lambda$ *	0.85**	0.84**	0.85**	0.88**	0.83**	0.83**	0.74**	0.73**	0.78**	0.86**	0.68**	0.67**
The average value of the log-likelihood	-533.0257	-500.71	455.25	501.86	-575	-43.29	-50.97	-39.96	-237.37	-224.94	-110.44	-70.66
Number of samples	2530	2530	2013	2013	1725	1725	741	741	1451	1451	1659	1659
Years	1989	1989	1991	1991	1993	1993	1997	1997	2000	2000	2004	2004
The average degree of market	0.37158	0.37158	0.27245	0.27245	0.111	0.111	0.339	0.339	0.5123	0.5123	0.63	0.63

Note: \*, \*\*, and \*\*\* represent 10%, 5% and 1% significance level,  $\lambda$  is the variance estimation parameters