

Firm Heterogeneity, Ownership Structure and Labor's Share^{*}

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Abstract: This paper constructs a theoretical model, which from the micro firm perspective, analyses the firm heterogeneity that will lead to significant differences of labor's share among different types of firms. The theoretical model is extended to three types of firms those that are state-owned, private and foreign enterprises. Thus, this paper discusses the impact of ownership restructuring of state-owned enterprises, privatization, and entry of foreign investment on labor's share during China's economic transition and opening process. Utilizing the World Bank Investment Climate Survey, the paper investigates the difference of labor's share by types of ownership, and claims that change of ownership structure will reduce factor distortion and promote economic efficiency, which in turn will impose a positive and transitory impact on the decreasing labor's share. By using System-GMM estimation, it shows that, after controlling for other factors, firm with private and foreign ownership have decreasing levels of labor's share. By examining time series change of state-owned enterprises, it finds that their productivity rises dramatically two years after the ownership restructuring. The paper also introduces the government enterprise relationship variable, which shows that competition among local government in attracting foreign enterprises in order to pursue GDP does exist. Finally, it is shown that the "foreign investment led" feature of China's export enterprises may be the reason of the failure of neoclassic trade theory prediction for China.

Key words: labor's share; heterogeneity; ownership structure; ownership restructuring of state-owned enterprise; privatization; entry of foreign investment

JEL Classification: D3, F16, J33, L16, D61, O14, D24

I. Introduction

In the thirty years' reform and opening up, China's economy has made a drastic growth miracle, in which the annual economic growth rate between 1978 and 2008 is 9.85%. With the economic development, national income distribution in the thirty years has been also experiencing several significant changes. Since the beginning of reform and opening up, the share of the national income accruing to labor has raised steadily, from 52.2% in 1978 to 72.2% in 1990¹. The national income has a leaning trend towards individuals, which Dai and Li (1988) summarize as "wage erodes profits" phenomenon. However, Li (1992) considered that it is a natural come back

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¹ The data is from Table 1 in Liyang, "Adjustment of Functional Income Distribution: Thinking of the Phenomenon of National Income Inclining to Individual." *The Economic Research Journal*, 1992, No.7.

from distorted labor price.

Recently, the pattern of China's national income distribution shows new changes. According to the income approach of GDP, labor's share of GDP decreases from 51.9% in 1995 to 39.7% in 2007², indicating that the fall in labor's share becomes an undisputed fact (Cai 2005; Li 2007). Correspondingly, profits of firms have increased steadily, and capital's share of GDP increased from 34.9% in 1997 to 46.1% in 2007. The pattern of national income distribution changes from "wage erodes profits" at the beginning of reform to "strong capital and weak labor" relations (Yao 2005).

Economists try to explain the underlying factors in the story behind the decreasing labor's share from two perspectives. Firstly, they point to industrial structural changes during the economic development process. Bai and Qian (2009) indicate that the industrial structural changes from agricultural sector to non-agricultural sectors has resulted in the labor's share dropping by 3.36 per cent from 1995 to 2004. Meanwhile, the adjustment of China's industrial structure shows the pattern that drastic industrialization and drawling post-modernization, which in turn impeded the further increasing of labor's share (Luo 2008; Luo and Zhang 2009a). Based on this, Li et al. (2009) show that at the end of the labor transfer from agricultural sector to the industrial sectors, the marginal labor production rose rapidly which will make the labor's share stop decreasing and turn to an increasing trajectory. By using multi-national data, they show a U-shaped curve of labor's share in GDP, which is confirmed by Luo and Zhang (2009b) using China's provincial panel data. Interestingly, both studies state that the lowest point of the U-shaped curve will be at about US\$3000 per capita GDP level (2000 nominal exchange rate). Therefore, they draw an optimistic conclusion that the labor's share will be increasing trajectory in next two years.

Secondly, studies mainly focus on the empirical evidence of factors that have an impact on the decrease of China's labor's share using data of firm and provincial level. Bai and Qian (2008; 2009a) find that ownership restructuring of state-owned enterprise has made the labor's share in industrial sector drop by 4.7 per cent by using firm level data. They explain that the average labor's share in state-owned enterprises were obviously higher than in the non-state-owned enterprises, and the decrease of labor's share was caused by the distortion reducing in factor market. This point is consistent with Luo and Zhang (2009b) who claim negative effects of privatization on the labor's share. Meanwhile, the increase of enterprises' monopoly power and the technology progress are also main reasons for the decrease of labor's share. On the contrary, Li et al. (2009) claim that the labor's share is negatively correlated with the share of state's stake by using firm level data, and explain that the state-owned enterprises represent capital intensive industries with lower labor's share. Therefore, they claim that the increasing share of state-owned enterprises will lead to the decrease of labor's share. Comparing with the empirical evidences by using firm level data in a closed setting, studies based on provincial panel data combine labor's share with the China's embracing of economic globalization. Luo and Zhang's (2009b) empirical results indicate that there were mutual correlations between FDI and labor's share, and explain that competition among local government in attracting foreign capital weakened the bargaining position of labor. Meanwhile, export had non-significant positive impacts on labor's share, and

² Data before 2004 is from *China's GDP Accounting: Historical Data 1952-2004(G)*. Data after 2004 is from China's Statistical Yearbook aggregating by provincial panel data. Recent Study of Bai and Qian (2009a) indicates that changes of statistical definition made an overestimate the extent of decreasing of labor income share. However, even after the adjustment of statistical caliber, labor income share still dropped 5 per cent from 1995 to 2004.

they explain that this may be caused by increase of foreign capital engaged in exporting and raising sophistication of export product. However, the results are not supported by other empirical studies by using provincial data (Jiang and Zhang, 2008; Bai and Qian 2009b). Additionally, Luo and Zhang (2009b) assert that other factors like fiscal expenditure, physical and human capital accumulation will have positive impacts on labor's share.

This paper analyzes factors which determine the movement of labor's share from micro-firm perspectives. Comparing with the available empirical work, the results of this paper differ significantly in several aspects. Firstly, we find that the labor's share in three different types of ownership those that are state-owned, private and foreign firms are different from one another. We explain that this is caused by the firm heterogeneity. Therefore, by constructing a theoretical model, this paper could analyze the impact of ownership restructuring of state-owned enterprises, privatization, and entry of foreign investment on labor's share in a unified framework. We consider that this will decrease factor distortion and promote economic efficiency though labor's share is decreasing. Secondly, by using the World Bank Enterprise Survey data, we can test mechanism of factors that affect on the labor's share directly. By tracing time series changes of state-owned enterprises, we actually find that their production efficiency rises dramatically two years after the ownership restructuring, which brings significant drop of labor's share. By investigating government and firm relations, we find the proof that there are remarkable competition effects among local government in attracting foreign capital in order to pursue their GDP growth. Thirdly, we find labor's share of exporting firms are significantly lower than that of non-exporting firms, indicating that export will have a significant negative impact on labor's share. We explain that the reason for the failure of neoclassic trade theory prediction for China may lie in the "foreign investment led" feature of our export enterprises. The structure of this paper is arranged as follows: section II constructs a theoretical model, which analyzes difference of labor's share among firms with heterogeneity. The model will be extended so that we can discuss the impacts of ownership structure on labor's share; section III illustrates Investment Climate Survey data of World Bank, and gives data support for the theoretical model; section IV constructs the econometric model, illustrates the variables and introduces estimation methods; section V discusses the empirical results, analyzes the determinants of movements of labor's share, and emphasizes on the impact of ownership structure and export on the labor's share; section VI draws conclusion and brings forward policy implication.

II. Theoretical Model

Theoretically, research of labor's share can be traced back to Ricardo (1817) and Marx (1867; 1894). Marx discusses the rules of division of production between wage and profit from perspectives of production relations based on the labor value and surplus value theory. Neoclassicist discusses functional income distribution from the productivity perspective, and they consider the distribution patterns between wage and profit as the result of marginal productivity of labor and capital (Cobb and Douglas, 1928). Bentolina and Saint-Paul (2003) start from the neoclassical framework, and they find the one to one functional relations between labor's share and capital output ratio, which they call SK curve, by constructing linear production function with constant returns to scale. They claim that other factors such as technology progress, imperfect competition market, price of export product, and labor heterogeneity will move off the SK curve to affect on the labor's share. However, the theory assumes that the firms are homogenous,

neglecting the firm heterogeneity in the real world.

Many empirical studies indicate the firm heterogeneity in the same industry (e.g. scale and productivity). It is found that those who engaged in exporting and foreign investment are a few of firms with large scale, advanced technology, high wage rate, and high productivity level (Bernard and Jensen, 1999; Clerides et al., 1998; Bernard et al., 2006)³. Helpman and Itshoki (2010) and Egger and Kreickemeier (2009) construct models to discuss effects of trade liberalization on labor market based on the assumption of firm heterogeneity. This paper, which differs from above, combines firm heterogeneity with labor's share, which discusses the impact of changes of ownership structure such as ownership restructuring of state-owned enterprises, privatization, and entry of foreign investment on labor's share. The paper refers to the theoretical framework of Decreuse and Maarek (2008) which discusses the impacts of FDI on labor's share in the host country. We modify the model and extend to discuss the impacts of changes of ownership structure.

Assume that there are two types of firms in the economy, which produce two substitutive products. The firms differ from each other, in other words, one type of firm will have higher productivity, so that $y_1 > y_2$. The heterogeneous firm may caused by technology, finance ability, and institutional factors. The proportion of the first type of firm in the economy is α , thus $(1-\alpha)$ for the second type. Assume that labors are homogenous, and they are looking for jobs between two types of firms. Therefore, firms are facing all labor supply, which can be standardized as one. There are matching problems between firm and labor, meaning that there are wage competition effects when both types of firm want to hire labors. Finally, we assume that the firm has perfect information and follow rules of profit maximization, meaning that the firms know other firms' productivity, and make payment decision based on the information.

Our model is dynamic compared with the static one of Decreuse and Maarek (2008). We assume that the second type of firms with lower productivity exists firstly in the economy and it pays wage w_2 to the labors according to its productivity y_2 . The first type of firms with higher productivity enters into the economy thereafter, and it will compete with the second type of firms into hiring labors, thus it tends to pay wages higher than w_2 . Meanwhile, this type of firms will pay wages w_1 not based on its productivity but on the average productivity of all firms in the economy. Therefore, the wages paid by the first type of firms are satisfied with the following formula:

$$w_1 = \frac{\alpha y_1 + (1-\alpha) y_2}{y_2} w_2 \quad (2.1)$$

It can be easily proved that the wages paid by two types of firms satisfy the condition $w_1 > w_2$. Meanwhile, the wages paid by the first type of firms are decided by the structure of heterogeneous firms with dynamic feature. Naturally, the labor's share of two types of firms is:

$$LS_1 = \frac{w_1}{y_1} = \frac{[\alpha y_1 + (1-\alpha) y_2] w_2}{y_1 y_2}; LS_2 = \frac{w_2}{y_2} \quad (2.2)$$

Proposition 1: when heterogeneous firms exist in the economy, the higher the productivity of the firms, the lower the labor's share of these firms are. That is to say, when $y_1 > y_2$, it can be

³ The breaking through of the new trade theory thought that the firm heterogeneity made them to engage in the exporting and foreign investment business by a self-selected mechanism (Bernard et al., 2003; Melitz, 2003; Helpman et al., 2004).

proved that $LS_1 < LS_2$. This means firm heterogeneity will lead to difference of labor's share among firms.

The conclusion drew from above are static and micro. We also wish to examine how the aggregate labor's share changes as macro variable with changing structure of heterogeneous firms. Therefore, we first get aggregate labor's share:

$$LS = \frac{\alpha w_1 + (1-\alpha)w_2}{\alpha y_1 + (1-\alpha)y_2} = \frac{w_2}{y_2} \frac{\alpha[\alpha y_1 + (1-\alpha)y_2] + (1-\alpha)y_2}{\alpha y_1 + (1-\alpha)y_2} \quad (2.3)$$

From above formula, aggregate labor's share is determined by firm heterogeneity and distribution of different types of firms. From dynamic perspective, we concern more about how the labor's share changes with the proportion of the first type of firms (α). Concretely, we can differentiate the aggregate labor's share with the proportion α :

$$\frac{dLS}{d\alpha} \stackrel{sign}{=} -dY/d\alpha \times LS + dW/d\alpha \stackrel{sign}{=} -(y_1 - y_2) \times LS \frac{y_2}{w_2} + 2\alpha(y_1 - y_2) \quad (2.4)$$

For simplicity, the above formula neglects items which have no effects on the sign. It can be seen that there are two opposite effects when the proportion of firms with higher productivity α increases. The first is the technological gap effect: an increase in the proportion of firms with higher productivity raises output, as they benefit from better productivity. At given wages, this reduces the labor's share, which is the first part of the right hand of the equation. The second is the wage competition effect: an increase in the proportion of firms with higher productivity intensifies wage competition among firms. At given output, this raises the labor's share, which is the second part of the right hand of the equation. The interaction of the two effects determines the relationship between firm structure and labor's share. When wage competition effect is smaller than the technological effects, the labor's share will decrease as the proportion of firms with higher productivity increases and vice versa. Then, form (2.4) is simplified further, and we can get the moving trend of labor's share with the proportion of the first type of firms:

$$\frac{dLS}{d\alpha} \stackrel{sign}{=} \left[\alpha^2 y_1 - (1-\alpha)^2 y_2 \right] \quad (2.5)$$

We can find that $dLS/d\alpha$ is a non-monotonic function of proportion α . Meanwhile, the second order derivative $d^2LS/d\alpha^2 > 0$, which indicate that the labor's share decreases with α at first, then turn direction as it reaches the bottom, and have an increasing trend afterwards. Therefore, we can get another proposition.

Proposition 2: With the firm heterogeneity, when the proportion of firms with higher productivity (α) increases in the economy, the labor's share will move as a U-shaped curve. This means firm heterogeneity will lead to the movement of aggregate labor's share.

When $dLS/d\alpha$ is equal to zero, the labor's share reaches to the bottom of the U-shaped curve, thus this point α^* is:

$$\alpha^* = \frac{(y_1 y_2)^{1/2} - y_2}{y_1 - y_2} \quad (2.6)$$

From above, we can see that the lowest point of the labor's share reflects the pattern of productive heterogeneity among firms. In addition, because $0 \leq \alpha \leq 1$, we could confirm the boundary point of the U-shaped curve:

$$LS_{\alpha=0} = LS_2 = \frac{w_2}{y_2}; LS_{\alpha=1} = LS_1 = \frac{w_1}{y_1} = \frac{[\alpha y_1 + (1-\alpha) y_2] w_2}{y_1 y_2} \quad (2.7)$$

Compared with the two boundary points, we find that the U-shaped curve has a higher left shoulder than the right one in the interval $\alpha \in [0,1]$.

$$LS_{\alpha=0} - LS_{\alpha=1} = LS_2 - LS_1 > 0 \quad (2.8)$$

Therefore, we draw the U-shaped curve of labor's share with respects to the structure movement of the heterogeneous firm:

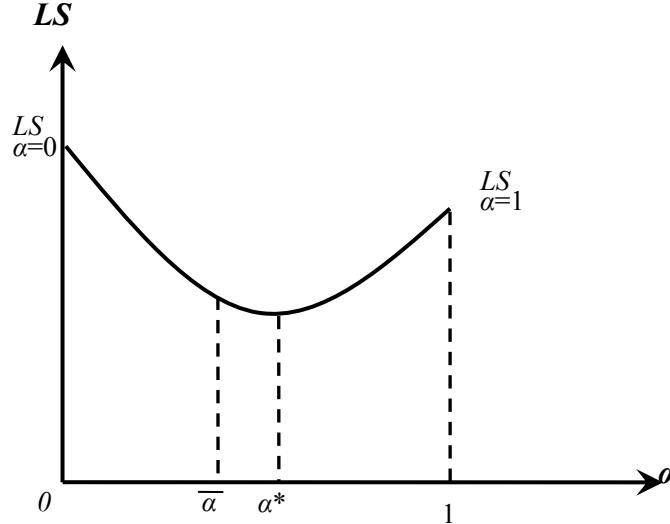


Figure 1: Movement of Labor's share with Structure of Heterogeneous Firm

Harrison (2002) claims that financial openness will affect the proportion of the first type of firms with higher productivity when discussing the impact of globalization to labor's share. Decrease and Maarek (2008) assert that the increase of multinational firms in the host country will let the labor's share move along the U-shaped curve from left to right. However, their study shows that the proportion of foreign firms was not only constrained by the extent of financial openness of the host country, but also related to opportunity cost of alternative investment. Therefore, the proportion of firm with higher productivity can not reach to the lowest point α^* , whereas constrained by $\bar{\alpha}$. Their empirical study indicated most of the developing countries are located in decreasing trajectory of the U-shaped curve. Thus, this may indicate that the technological gap effects will surpass the wage competition effect so that the curve is along the decreasing trajectory.

So far, we assume two types of firms in the economy, the model can be extended to three or more types of firms. As an implication of the theoretical model, combining with the reality of the China's economic transition and opening up, we can discuss about the impact of ownership restructuring of state-owned enterprises, privatization, and entry of foreign investment on labor's share. We categorize different types of firms according to the division of ownership, which are state-owned, private, and foreign firms. The corresponding productivity is y_S, y_P, y_F respectively. The state-owned enterprises have relatively low efficiency because of policy burden and soft budget constraint (Lin and Tan, 1999; Lin and Li, 2004). Foreign enterprises have relatively high efficiency because of advanced technology and financial support. And the efficiency of private enterprises are between other two types of firms, so that $y_S < y_P < y_F$. This means that different types

of firms' ownership satisfy the assumption of heterogeneity. Based on the theoretical model, we can conclude that the relationship of labor's share among three types of firms are $LS_S > LS_P > LS_F$, indicating that the impacts of heterogeneity on the difference of labor's share. Meanwhile, we assume the proportion of three types of firms in the economy is α, β, γ respectively. Then we can analyze the impacts of change of ownership structure. *Ceteris paribus*, ownership restructuring of state-owned enterprises (or privatization) means that the decrease of α (or increase of β) in the economy will put a downward pressure of the labor's share. And the entry of foreign investment (increase of γ) also poses an downward pressure on movement of the labor's share. Therefore, as inference of generalization of the model, the change of ownership structure, summarized as "privatization and the foreign capitalization", is the main reason for the decrease of labor's share in China's economy.

III. Data and Statistical Facts

The data of this paper is from the Investment Climate Survey of Work Bank in 2003. This is the second enterprise survey of China conducted by World Bank, of which the range covers 2400 enterprises in 18 cities⁴ and 14 industries⁵ which belongs to manufacturing and service. The survey provides panel data from 1999 to 2002 about corporate finance, technology innovation, international trade, and government and firm relations. To be noted, World Bank only provides the survey year data for qualitative questions.

Corresponding to the theoretical model, table 1 reports the ownership structure of firms in the survey data. This paper categorizes the ownership type by proportions of state, private and foreign shareholders. Where, the foreign firms are defined when the proportion of foreign shareholders are bigger than or equal to 10%⁶. Among the domestic firms, the types are determined by maximum of the proportion between state-owned and private shareholders. The results show that there are 1581 private firms which are the most, 521 state-owned firms which ranks second, and 298 foreign firms. By observing the structure of shareholders in each type of firms, we find that the state share takes up for 96.7% in the state-owned enterprises, the private share takes up 99.2%, indicating the robustness of the classification. However, the foreign firms are jointly held by the private and foreign shareholders, indicating the joint feature of foreign and private firms.

Table 1: Structure of Shareholders and Types of Ownership

ICS (2003)	Number of Total Firms	State-owned Firms	Private Firms	Foreign Firms
Overall:	2400	521	1581	298
State Shareholders (%)	21.9	96.7	0.8	3.1

⁴ Of the cities surveyed, four are in the northeast (Benxi, Changchun, Dalian and Harbin), four along the coast (Hangzhou, Jiangmen, Shenzhen and Wenzhou), four in the central region (Changsha, Nanchang, Wuhan and Zhengzhou), and six in the western region (Chongqing, Guilin, Kunming, Nanning, Lanzhou and Xi'an).

⁵ The manufacturing industries include: clothing and leather products, electronic and communication equipment making, electronic components, household electrical goods, auto and auto parts, food processing, petrochemical and medicines, biotechnology products and Chinese medicine, machinery and equipments, and electricity equipments, ship, and orbit transporting machines and aircraft. The services industries consist of information technology services, communication services, accounting, auditing and non-bank financial services, advertising and marketing services, and business logistics services.

⁶ The definition of foreign firms is the same as Yang (2009) for the same data. We consider that when the foreign shareholders reach certain level, they will affect the production decision of firms so that they will differ from domestic firms in many aspects. When the proportion is higher, the difference is more obvious. This research indicates that the categorization for 10% level can distinguish foreign firms from productivity, wages and labor share. Meanwhile, this threshold will retain more samples for foreign firms.

Private Shareholders (%)	70.2	3.2	99.2	33.5
Foreign Shareholders (%)	7.9	0.1	0.0	63.4

Note: The numbers are calculated by authors from the Investment Climate Survey of World Bank (China 2003).

The ratio of firm's labor compensation to total value of sales is the proxy of the labor's share⁷, and we try to identify the difference of labor's share in different types of ownership. Interestingly, three types of firms significantly differ from one another, and the order is exactly predicted by the theoretical model, which is $LS_S > LS_P > LS_F$ (see table 2). In table 2, the labor's share of state-owned and private firms is relatively close to each other, while that of foreign firms is the lowest. According to the theoretical model, the differences of labor's share are caused by the firm heterogeneity, which are the differences of productivity among three types of firms. We use the ratio of total value of sales to the number of employment as the labor productivity to be a proxy. And we also find strong evidence that the labor productivity differs significantly among three types of firms. We get the expected order, that is $y_S < y_P < y_F$, in which foreign firms are higher than the others. Therefore, the enterprise survey data support the prediction of the theoretical model with respects to the labor's share difference among different ownership structure. The results show that the relatively low efficiency of the state-owned enterprises and high efficiency of foreign firms due to its technological and financial advantage.

In the theoretical framework, we also discuss about the wage competition effects, and here we use average wages to identify the effects among three types of firms. A lot of empirical evidences show that foreign firms tend to pay higher wages than domestic firms (Aitken et al., 1996; Lipsey, 2002), and the extent of wage premium of foreign firms is higher in developing countries (Lipsey and Sjöholm, 2004; Zhao, 2002; Liu et al., 2004). The data of table 2 also supports the above judgments so that the average wages in foreign firms are higher than state-owned and private firms. Interestingly, we find the average wages in state-owned are the lowest, indicating that the high labor's share in state-owned enterprises is not due to its high wage payment⁸, but rather the result of the low production efficiency. Correspondingly, private firms don't depend on the low wage strategy for raising their benefit, but rather through institutional and technological innovation strategy.

From the above analysis, if the types of ownership are considered as dummy variable to examine the effects on labor's share, the sign of coefficients of private and foreign firms are expected to be negative. Although it is an static inference, the dynamic theoretical meaning is that ownership restructuring of state-owned enterprises and entry of foreign firms will dramatically raise economic efficiency and surpass the wage competition effect, so that the labor's share will have a downward trend in the short term. The survey data of World Bank provides structure of shareholders of firms in the first and last year, so that we can directly examine the effects of restructuring of state-owned enterprises into private firms. The study shows that there are 54 firms

⁷ The more accurate definition is the labor compensation divided by value added of the firms. Because part of the firms' business profit are less than zero, so that the labor income share will be bigger than 1 (Kalleberg and Wallace 1984). In addition, even though we can get the value added by computing the firms' related financial data, it will substantially reduce the validity and number of our sample. Therefore, we use this proxy as a second best measures.

⁸ Large state-owned enterprises tend to pay high wages due to their monopoly power. These state-owned enterprises are concentrated on monopoly industry such as electricity, petroleum, hydropower, and this will give rises to the high wage illusion for the state-owned enterprises. We consider that most of the small and medium state-owned enterprises are low efficiency and low wage payment, which is confirmed by the survey data of World Bank.

which qualify the rigorous definition⁹ of restructuring of state-owned enterprises in the time interval. Last three rows of table 2 reports the situation of restructuring firms before and after. It can be seen that after two years of restructuring of state-owned enterprises, the production efficiency has significantly raised by 46%, so that the labor's share drops from 0.202 in 1999 to 0.177 in 2002.

Table 2: Ownership Difference of Labor's share and Elementary Explanation

ICS (2003)	Unit: ¥1000	1999	2000	2001	2002
Overall	Labor's share (%)	16.3	15.5	15.4	15.7
	Average Wage	8.6	9.4	10.5	10.7
	Labor Productivity	95.9	111.9	120.9	126.2
State-owned	Labor's share (%)	18.6	17.6	18.2	19.1
	Average Wage	7.1	7.8	9.2	9.7
	Labor Productivity	69.9	79.0	86.3	96.1
Private	Labor's share (%)	16.7	16.0	15.9	16.0
	Average Wage	8.2	9.1	10.0	10.2
	Labor Productivity	91.3	107.2	118.3	119.6
Foreign	Labor's share (%)	11.1	10.4	9.8	10.2
	Average Wage	12.4	13.9	14.6	15.1
	Labor Productivity	246.4	297.8	306.4	328.6
Restructuring (54)	Labor's share (%)	20.2	20.0	18.3	17.7
	Average Wage	9.9	12.2	14.9	13.3
	Labor Productivity	73.6	77.6	107.2	110.8

Note: The numbers are calculated by authors from the Investment Climate Survey of World Bank (China 2003), and all are average numbers of the survey firms.

Although we can not directly examine the impacts of the entry of foreign capital to labor's share, studies of Diwan (2000; 2001) and Decreuse and Maarek (2008) claim that the proportion of foreign investment γ can be raised by financial openness, which will oppose a downward pressure on labor's share. Therefore, we can compare the finance situation of foreign and domestic firms horizontally (see table 3 line 2-6). It can be seen that the financial channel of foreign firms are relatively abundant. They can not only finance through foreign exchange from parent countries, but also are welcomed by the domestic financial institution. Despite of relative high loan's interest rate, the financial environment of foreign enterprises is little bit better than the state-owned enterprises, much better than private firms. This means that the foreign firms will still actively invest in China due to the loose financial environment.

On the other hand, the entry of foreign firms is also affected by the policy environment. Luo and Zhang (2009b) claimed that there are competition effects of local government in attracting foreign investment. Local governments offer a lot of favorable policies to foreign firms, and

⁹ The definition of restructuring of state-owned enterprises is as follows: the state-owned enterprises (which the state shareholders dominate in 1999) are changed into private enterprises (which the private shareholders dominate in 2002).

consider low labor cost as necessary means to attract investors. Therefore, the negotiation power of capital is rising, and the negotiation position of labor is weakening. By using government and firm relationship data of World Bank (see table 3 line 7-13), we can confirm the above assumption directly. Interestingly, the survey data shows that the affinity of foreign firms and government are as close as state-owned firms, and much closer than private firms. Some of the indexes are even higher than the state-owned enterprises. This indicates that the competition in attracting capital of local government does exist in the economy. In the theoretical part, we have already claimed that the entry of foreign firms will improve the production efficiency in the economy to oppose positive impacts on the decrease of labor's share. However, we suggest that the local government should not give foreign firms excessive policy leaning. This policy leaning will deliver distorted incentive signal, so that it will accelerate the extent of decrease of labor's share.

Table 3: Difference of Finance of Foreign and Domestic Firms and Government-Firm Relation

ICS (2003)	Survey Item	Overall	State-owned	Private	Foreign
Finance Situation	Share of Foreign Exchange Borrowing (%)	3.14	0.69	1.54	14.9
	Share of Bank Loan (%)	23.0	26.0	20.8	29.6
	Numbers of Banks Related	2.81	3.17	2.54	3.63
	Share of Collateral in Loan Value (%)	59.2	62.4	58.4	57.7
	Annual Loan's Interest Rate (%)	5.39	5.78	5.13	5.87
Relation with Government	Days Dealing with Officials (Each Month)	7.4	8.3	7.0	8.2
	Help from Government (0-6)	3.1	3.5	2.9	3.6
	Share of Efficient Service (%)	35.5	36.4	34.0	42.0
	Predictability of Laws (%)	27.6	29.8	26.5	29.4
	Fairness in the Business Disputes (%)	64.0	67.6	62.6	64.7
	Share of Competent Officials (%)	50.9	51.6	50.4	52.2
	Share of Helping Officials (%)	34.3	35.0	33.2	39.2

Note: The numbers are calculated by authors from the Investment Climate Survey of World Bank (China 2003), and all are average numbers of the survey firms.

IV. Empirical Model, Variables and Estimation Methods

So far till now, we analyze the ownership difference of labor's share in China and provide elementary explanations. If we regress private and foreign ownership on labor's share, the expected sign of both variables are negative. In order to draw robust conclusion, we must control for other factors that may affect on labor's share. This paper set up variables according to the model used by Bentolina and Saint-Paul (2003) in determining labor's share in the neoclassical framework. In order to capture institutional factors during the economic transition in China, we supplement several variables related to recent literature (Bai and Qian, 2008; 2009a; 2009b; Luo and Zhang, 2009b). On concrete, the following linear model by using panel data is:

$$\begin{aligned}
 LS_{i,t} = & \beta_0 + \beta_1 pri + \beta_2 for + \beta_3 KtY_{i,t} + \beta_4 exp + \beta_5 mkup \\
 & + \beta_6 newp + \beta_7 gov + \sum \omega_i city_i + \sum \phi_i ind_i + \sum \psi_t year_t + \varepsilon_{i,t}
 \end{aligned} \tag{4.1}$$

Where, LS stands for labor's share; pri is the proportion of private shareholders; for is the proportion of foreign shareholders; KtY is the capital output ratio, which is book value of fixed assets divided by output; exp is the export sales ratio, which is proportion of firm's export divided by total value of sales; $mkup$ is the mark up of the price, which identifies the extent of monopoly

of firms¹⁰; *newp* is the development of new product, which is share of sales of new products, measuring innovation and technology progress; *gov* identifies the relationship between government and enterprises. By using the survey data, this paper constructs 0-6 ordinal index to measure the extent to which government assist the enterprises¹¹; *city*, *ind* are dummy variables control for the city and industrial effects; *year* is the time dummy; ε is error term, β_0 is constant, β_1 - β_7 are coefficients of regressors, ω , φ , ψ are the coefficients of industry, city, and time dummy, subscriptions *i* and *t* represent firm *i* and year *t* respectively.

The proportions of ownership of private and foreign are the main concerning variables, expecting negative sign. Meanwhile, we will construct dummy variable for private and foreign firms by above classification to check robustness¹². As for capital output ratio, the theoretical framework of Bentolina and Saint-Paul (2003) considered that when the substitutive elasticity between capital and labor is bigger than one, the coefficient of this variable is negative; when the elasticity is smaller than 1, the coefficient is positive. Diwan (2002) found that the former is suited for rich country and the latter is for the poor country. The empirical studies using provincial panel data supported the evidence that the substitutive elasticity is smaller than one in China (Luo and Zhang, 2009b; Shao and Huang, 2009; Bai and Qian, 2009b), however, results from enterprise data supported the evidence that the elasticity is bigger or equal to one (Bai and Qian 2009a; Li et al. 2009). We incline to support the supplementary hypothesis between capital and labor. As for the export sales ratio, the neoclassical theory claimed that international trade and specialization should increase the income share of abundant factors and decrease the income share of scarce factors. It suggested that international trade will raise China's labor's share. However, available researches indicate weak correlation between trade and labor's share. And this paper will give empirical results from firm level data, and try to explain from the ownership structure perspective. The coefficient of price mark up *mkup* is expected to be negative. Bentolina and Saint-Paul (2003) claimed that when imperfect competition exist in the product market, the increase of monopoly will raise monopoly rent thus decrease labor's share. Empirical results of Bai and Qian (2008; 2009a; 2009b) support above assertion. The next index is innovation and technology progress *newp*, and Bentolina and Saint-Paul (2003) claimed that capital biased technology progress would accelerate the capital accumulation, thus decrease the labor's share. According to the section III, we find that the relationship between government and firms are quite different among three types of firms. Therefore, this paper adds a new ordinal variable *gov* to discuss the impacts of government policy to labor's share. Finally, we control for city and industry dummies for robustness.

In the model, the relationship between government and firms are qualitative index, and World Bank only provides data in 2002. Therefore, we will run OLS regression for the cross sectional data of firms in 2002 firstly. Then, we will run pooled OLS regression when the index is extended to all years. However, pooled OLS regression will overestimate the coefficient of regressors in face of endogenous problem. In our econometric model, there is strong simultaneous problem

¹⁰ The computational formula is $mkup = (\text{total value of sales} - \text{total cost of production sold}) / \text{total value of sales}$.

¹¹ This index is constructed by the part H in the questionnaire of World Bank survey. The question is "During the year 2002 did any government agency or official assist you in: 1) Identifying foreign investors; 2) Locating foreign technology to license; 3) Identifying potential foreign clients; 4) Identifying potential foreign suppliers; 5) Obtaining bank financing; 6) Identifying potential domestic clients. If the answer is yes, we code 1, if else we code 0. Then we sum all six questions to get the index whose interval is 0-6.

¹² No matter the share or categorization of ownership, we should omit state-owned preventing the multilinear problem.

between capital output ratio and labor's share. Low labor's share indicates high capital share, and firm with high capital share will have more retained profits which will also raise the capital output ratio. Therefore, this paper adopts "system GMM" estimation method outlined by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998), and this method will solve the endogenous problems for the independent variables. Meanwhile, the "system GMM" is more suitable for "small T, large N"¹³ panel data structure compared with "difference GMM", which was put forward by Arellano and Bond (1991). Thus our dataset is suitable for "system GMM". In addition, some researches suggest that foreign direct investment is also endogenous (Decreuse and Maarek, 2008; Luo and Zhang, 2009b). For our data, the ownership structure along the survey interval doesn't experience dramatic changes. For instance, the number restructuring stat-owned firms is 54, which only takes 2% of total firms. And the proportion of foreign shareholders merely changes between 1999 and 2002 which are 7.86% and 7.93% respectively. Therefore, the concerning variable of private and foreign ownership can be considered as exogenous. We will compare the results of OLS and GMM regressions, and test robustness of each estimation method. Table 4 gives the summary statistics of main variables, in which the number of samples are adjusted by treating missing data and outliers. It should also be noted that the survey doesn't provide the data of proportion of new product sales in 1999, and we substitute with data in 2000.

Table 4: Summary Statistics of Main Variables

Variables	Definition	Samples	Average	S.D.	Max	Min
<i>LS</i>	Labor's share (%)	7513	15.8	15.7	1	98.0
<i>pri</i>	Share of Private Ownership (%)	9554	69.1	43.4	0	100
<i>for</i>	Share of Foreign Ownership (%)	9554	7.8	23.2	0	100
<i>KtY</i>	Capital Output Ratio (¥)	9053	1.22	1.65	3.07	29.7
<i>exp</i>	Export Sales Ratio (%)	9369	8.2	25.1	0	100
<i>mkup</i>	Price Mark Up (%)	9199	23.3	20.4	0	100
<i>newp</i>	Share of New Product Sales (%)	9600	9.9	21.2	0	100
<i>gov</i>	Government-Firm Relations (0-6)	9312	0.62	1.16	0	6

Note: The numbers are from the Investment Climate Survey of World Bank (China 2003), which obtained after organizing into panel data structure.

V. Empirical Tests and Discussion

Our research finds that the labor's share decreases in three years between 1999 and 2002 (see table 2). The aggregate labor's share in China also experienced a decreasing trend in the same time, so that the micro and macro data are matching with each other. Therefore, we will report and discuss the estimating results of model (4.1) by econometric regression (see table 5). We will mainly focus on the coefficients of private and foreign ownership after controlling for other variables. Estimation 1 estimates factors of labor's share by using cross sectional data in 2002 directly. Estimation 2 estimates results by pooling data of each year. In order to solve the

¹³ "Difference GMM" will directly difference the regression model, using lagged explanatory variables as instrument variables. This will subtract the time dimension of panel data, and also difference out the dummy variable from regression equation. "System GMM" combines difference equation with level equation, and adds a group of lagged differencing variable as instrument variables for the level equation. The biggest advantage is that this doesn't reduce the sample volume.

endogenous problem of capital output ratio, estimation 3 and 4 will give system GMM estimating results with one-step and two-step method respectively. In the GMM estimation, we set the first and second order of lagged capital output ratio as instrument variable of the difference equation, and the first and second order of differenced capital output ratio as instrument variable of the level equation. Meanwhile, we get the Arellano-Bond serial correlation test and Sargan and Hansen instrument variable over identification and effectiveness test. To test the robustness of coefficient of main variables, private and foreign ownership and export sale ratio are replaced with dummy variable in estimation 5. And private and foreign ownership are replaced by dummy variable of private and foreign firm (see the discussion in table 1 of section II). And export sales ratio is replaced by dummy variable of export firms, and we set export firms whose export sales ratio is bigger than 10%. Finally, we consider that the wage setting of this year may be depended on the real wage of last year. Therefore, estimation 6 will set first order lagged labor's share as regressors so that the panel data will have dynamic feature.

Table 5 Results of Regression of Determinants of Labor's share

Regressors	Estimation 1 Cross Sectional OLS	Estimation 2 Pooled OLS	Estimation 3 System GMM(1)	Estimation 4 System GMM(2)	Estimation 5 Variable Substitution	Estimation 6 Dynamic Feature
<i>pri</i>	-0.019** (-2.05)	-0.012*** (-2.68)	-0.020*** (-7.62)	-0.020** (-2.35)	-0.018** (-2.22)	-0.016** (-2.12)
<i>for</i>	-0.048*** (-2.76)	-0.037*** (-4.37)	-0.041*** (-9.48)	-0.041*** (-2.58)	-0.043*** (-3.99)	-0.033*** (-2.66)
<i>KtY</i>	0.016*** (13.50)	0.013*** (20.98)	0.0062** (5.58)	0.0055** (2.17)	0.0055** (2.16)	0.0053** (1.91)
<i>exp</i>	-0.031** (-3.25)	-0.039*** (-4.93)	-0.043*** (-10.83)	-0.044** (-4.05)	-0.034** (-4.53)	-0.033** (-3.45)
<i>mkup</i>	-0.072*** (-3.77)	-0.097*** (-10.09)	-0.101*** (-20.85)	-0.101*** (-6.50)	-0.099*** (-6.39)	-0.077*** (-5.80)
<i>newp</i>	-0.045*** (-3.23)	-0.038*** (-4.81)	-0.044*** (-10.87)	-0.045*** (-4.45)	-0.044*** (-4.35)	-0.039*** (-4.20)
<i>gov</i>	-0.010*** (-3.60)	-0.010*** (-7.12)	-0.010*** (-13.58)	-0.010*** (-4.80)	-0.009*** (-4.69)	-0.007*** (-3.82)
<i>city dummy</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>ind dummy</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>year dummy</i>	No	Yes	Yes	Yes	Yes	Yes
Constant	0.269*** (12.43)	0.276*** (24.82)	0.299*** (44.16)	0.302*** (11.89)	0.300*** (11.97)	0.2116*** (6.29)
No. of Sample	1815	7055	7055	7055	7055	5261
F Test	14.73	45.47	---	---	---	---
Adjusted R ²	0.2188	0.2014	---	---	---	---
AB (1) Test	---	---	0.000	0.000	0.000	0.000
AB (2) Test	---	---	0.130	0.548	0.543	0.007
Sargan Test	---	---	0.283	0.283	0.294	---

HansenTest	---	---	---	0.653	0.663	0.288
Dif-in-Sargan	---	---	0.135	---	---	---
Dif-in-Hansen	---	---	---	0.374	0.383	0.489

Note: Number in brackets are T statistics; * stands for 10% significant level; **stands for 5% significant level, ***stands for 1% significant level; AB(1) and AB(2) are first and second order serial correlation tests respectively; Dif-in-Sargan and Dif-in-Hansen are effectiveness test of extra instrument variables, the original assumption is that these instrument variables are effective.

It can be seen that the results of all estimations are very close to each other, and the coefficient all variables are significant above 5%. In the cross sectional and pooled OLS, the coefficient and significance of capital output ratio KtY are relatively high so that the capital output ratio may be over estimated because of endogenous problem. After using system GMM estimation, the coefficient and significance reduces dramatically, indicating that the endogenous of this variable may exist. Meanwhile, after dealing with the endogenous problem, the coefficient and significance of other variables are improving compared from estimation 2 with estimation 3. No matter the one-step and two-step system GMM estimation¹⁴, coefficients of all variables are consistent with each other and both estimations pass through test of serial correlation and over identification and effectiveness test of instrument variable, indicating that the robustness of GMM estimation. Therefore, we use estimation 4 as our final result. Through analysis of coefficient of all variables, we can conclude as follows:

Firstly, the coefficient of our main concerning variable, which are private and foreign ownership, are significantly negative, this is consistent with the theoretical analysis. The coefficient of private ownership is -0.02, indicating that the raising of ownership by one per cent will make labor's share fall by 0.02 per cent. The effect of foreign ownership is bigger that the raising of ownership by one percent will make labor's share fall by 0.04 per cent. From the above analysis, the labor's share of foreign firms is significantly lower than other two types of firms.

Secondly, the coefficient of capital output ratio is significant and positive on the 5% level, indicating that the substitutive elasticity between capital and labor is smaller than one. Therefore, our empirical result is consistent with other studies using provincial panel data of China. We consider that the capital accumulation not only promote the capital per worker, but also raise the marginal capital of labor, thus raising labor's share. The variable $mkup$ measuring the extent of firm monopoly is significantly negative, indicating that the more the monopoly power of firms, the less labor's share they will be. This result is consistent with Bai and Qian (2008; 2009a). The innovation index $newp$ is also negative, indicating that firms which engage in the new product development and sales are capital intensive firms, and innovation and technology progress will promote capital accumulation of firms.

Thirdly, this paper introduces new variable gov so that we may directly examine the effect of government policy to labor's share. We find that the coefficient of this variable -0.01, indicating that the labor's share will fall one per cent when the relationship of firm and government is rising by one. Despite of the policy burden by providing help to state-owned enterprises, the policy leaning of local government to those high scale and efficiency firms will increase capital share of these firms and decrease aggregate labor's share. Meanwhile, the competition among local

¹⁴ In system GMM, two-step estimation is relatively effective compared with one-step estimation (Roodman 2006). The result of this paper shows that the coefficients of both estimations are nearly the same. The coefficient of endogenous variable KtY decreases further and the significance of all variable also become smaller.

government in attracting foreign capitals will accelerate the inequality of government policy among firms.

Fourthly, the coefficient of trade variables *exp* is significantly negative, which contradicts with the prediction of neoclassic trade theory, and contrasts with the weak correlation between trade and labor's share of empirical study by Luo and Zhang (2009b). Meanwhile, the result also doesn't agree with the assertion that the export products of China mainly concentrate on labor intensive industries.

In order to get more robust results, we use dummy variable of export firms instead of export sales ratio as regressor. Meanwhile, the ownership of private and foreign firms is substituted by dummy variable of private and foreign firms. The concrete results are showed in table 5 of estimation 5. We find that the alternative dummy variables are still negative, whose coefficients are close with that in estimation 4. Estimation 5 not only tests the robustness of the regression, but also indicates that the main effects of ownership and export sales ratio are mainly through firm heterogeneity. For the difference of labor's share with different ownership, this paper has already had a detailed discussion. For the export dummy, this means that there is difference of labor's share between export and non-export firms, and the former is smaller than the latter¹⁵. According to the data of World Bank, we find that the labor's share of export firms are much lower than that of non-export firms (see table 6 line 2-4) during the survey year. In 2002, the discrepancy of average labor's share between both types of firms reaches 6 per cent.

We consider that there are two possibilities to explain the negative effects of export to labor's share. Firstly, the structure of export products is transferred from labor intensive to capital intensive. For example, Rodrik (2006) claims that China's export basket is more sophisticated than what would be normally expected for a country at its income level. Secondly, foreign firms play an increasing important role in China's export. From macro data, the share of export mechanizes of foreign firms is 20.4% in 1992, and it increases to 55.3% in 2008¹⁶. Combined with our analysis, if the more foreign firms engage in exporting business, the lower will the labor's share of export firms. Following this, we further divide export firms into different types of ownership. Table 6 also shows that the share of foreign firms in export firms increases from 32% in 1999 to 41% in 2002 in the survey data. This is highly consistent with the macro merchandize data. Meanwhile, the number of state-owned export firms is relatively smaller. In 2002, there are only 29 state-owned export firms, which further explain the reason why labor's share of export firms is smaller. In addition, because of the advanced technology and high productivity of foreign firms, the increasing extent of foreign firms engaging in exporting business will raise the sophistication of China's export products. Therefore, the "foreign investment led" feature of our export enterprises may be the reason of the failure of neoclassic trade theory prediction for China. And the negative effects of export can be explained from a unified framework of firm heterogeneity and ownership.

Tale 6 Difference of Labor's share Export and Non-export Firms

ICS (2003)	Firm Type	1999	2000	2001	2002
Labor's share	Overall	16.3	15.5	15.4	15.7
(%)	Export Firms	11.4	10.6	11.0	10.6

¹⁵ The new development of trade theory seems to be consistent with our study. And this theory claimed that export firms have high productivity than non-export firms, so that the relative effectiveness of export firm will make the labor share relatively lower.

¹⁶ Data is from *China Statistical Yearbook*, 1995 and 2009.

	Non-export Firms	17.0	16.3	16.1	16.5
The	Overall	381	293	301	306
Ownership	State-owned Firms	39	30	33	29
Distribution of	Private Firms	220	152	154	152
Export Firm	Foreign Firms	122	111	114	125
(Number)					

Note: The numbers are calculated by authors from the Investment Climate Survey of World Bank (China 2003).

Finally, considering the dynamic feature of the panel data, we use first order lagged labor's share as regressor, and we also treat first order and second order lagged variable as instrument variable for difference equation of system GMM, which is the estimation 6. The coefficient of lagged labor's share is 0.26, indicating that the positive impact of last period on the current period¹⁷. In addition, the coefficients of other variables don't change much and are also significant. Meanwhile, estimation 6 pass through Hansen test. It should be noted that the joint F tests of dummy variables of regions, industries and time shows significant time and fixed effects.

VI. Conclusion and Policy Implication

This paper constructs a theoretical model, which, from the micro firm perspective, analyses the firm heterogeneity that will lead to significant difference among different types of firms. The theoretical model is extended to three types of firms those that are state-owned, private and foreign enterprises. Thus, this paper discusses the impact of ownership restructuring of state-owned enterprises, privatization, and entry of foreign investment on labor's share during the economic transition and opening process. Utilizing the World Bank Investment Climate Survey, the paper investigates the difference of labor's share by types of ownership, and claims that change of ownership structure will reduce factor distortion and promote economic efficiency which will impose a positive and transitory impact on labor's share decreasing. By using OLS and System-GMM estimation, it shows that, after controlling for other factors, increase of private and foreign ownership will lead to decrease of labor's share. The two estimation and robustness test shows that the raising of private and foreign ownership by one per cent will make labor's share decreases by 0.02 and 0.04 per cent respectively.

Because of low wage and low productivity of state-owned firms, the labor's share of state-owned firms is the highest among three types of firms. Therefore, restructuring of state-owned enterprises to private firms will increase the productivity and decrease labor's share. By tracing time series change of state-owned enterprises, it finds that their production efficiency rises dramatically two years after the ownership restructuring. We claim that the restructuring of state-owned enterprises means economic improvement in the economic sense. Therefore, the impact on decreasing labor's share can be seen as positive.

Study shows that although the wage premium of foreign firm is significant, the productivity of foreign firm is much bigger than other two types of firms, which make relatively low labor's share of foreign firms. We should affirm the positive effect which foreign firms help to raise the technology and productivity of China. However, we should also note that the labor payment is relatively low compared with foreign firms' own productivity. This also means that the low labor cost is the main reason of attracting foreign firms. On the other hand, this research shows that

¹⁷ We omit this result in table 5 for sake of briefness.

competition among local government in attracting foreign enterprises in order to pursue GDP does exist. The leaning government policy towards foreign firms will provide distorted incentive signal for attracting even more foreign firms. Therefore, with the deepening of the capital and financial globalization, foreign firms will still enter into China with a rapid pace, which may accelerate the decreasing extent of labor's share. It may also have a negative effect on the pattern of national income distribution, which needs more attention. The policy advice is that we should fully utilize the productivity promoting effects of foreign firms, and avoid the unfair competition and distortion of factor distribution because of leaning government policy. In 2007, China implemented a unified 25% income tax for foreign and domestic enterprises which is an attempt to remedy the distortion.

In the econometric regression, we find that the labor's share of export firms is significantly smaller than that of non-export firms. The research shows that there are about 30-40% foreign firms engaging in export business, and their high productivity will impose a downward pressure on labor's share of export firms.

The paper also introduces the government firm relationship variable, which shows that competition among local government in attracting foreign enterprises in order to pursue GDP does exist. Finally, the "foreign investment led" feature of our export enterprises may be the reason of the failure of neoclassic trade theory prediction for China. Therefore, we use a unified framework of firm heterogeneity and ownership to explain the failure of HO theory prediction for China.

Acemoglu (2003) claims that in the short run, when economy is running on the transitional path, the technology progress and rising productivity will decrease labor's share. The transitional feature in China can be expressed as restructuring of state-owned enterprises, privatization and entry of foreign firms, so that they will put a downward impact on labor's share. In the long run, when economy is running on the balanced growth path, Acemoglu claims that the labor compensation would be determined by marginal labor product to stabilize the labor's share. Therefore, after the completeness of restructuring of state-owned enterprises and the orderly introduction of foreign investment, we will realize the balanced growth by promoting economic efficiency while stabilizing distributional relations.

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Appendix

I Proof: $w_1 > w_2$, and high profits for the first type of firms.

$$w_1 - w_2 = \frac{\alpha y_1 + (1 - \alpha) y_2}{y_2} w_2 - w_2 = \frac{\alpha w_2 (y_1 - y_2)}{y_2} > 0$$

$\therefore w_1 > w_2$ # End

$$\begin{aligned} \Delta profit &= (y_1 - w_1) - (y_2 - w_2) \\ &= (y_1 - y_2) - (w_1 - w_2) \\ &= (y_1 - y_2) - \frac{\alpha w_2 (y_1 - y_2)}{y_2} \\ &= \frac{(y_1 - y_2)(y_2 - \alpha w_2)}{y_2} > 0 \end{aligned}$$

\therefore The first type of firms pay high wage and obtain high profits.

II Proof: $LS_1 < LS_2$:

$$\begin{aligned} LS_1 - LS_2 &= \frac{w_1}{y_1} - \frac{w_2}{y_2} \\ &= \frac{[\alpha y_1 + (1 - \alpha) y_2] w_2}{y_1 y_2} - \frac{w_2}{y_2} \\ &= \frac{w_2 [\alpha y_1 + (1 - \alpha) y_2 - y_1]}{y_1 y_2} \\ &= \frac{-\alpha w_2 (y_1 - y_2)}{y_1 y_2} < 0 \end{aligned}$$

$\therefore LS_1 < LS_2$ # End

III Total Labor's share LS :

$$W = \alpha w_1 + (1 - \alpha) w_2$$

$$Y = \alpha y_1 + (1 - \alpha) y_2$$

$$LS = \frac{W}{Y} = \frac{\alpha w_1 + (1 - \alpha) w_2}{\alpha y_1 + (1 - \alpha) y_2}$$

$$\begin{aligned}
& \frac{\alpha[\alpha y_1 + (1-\alpha)y_2]w_2}{y_2} + (1-\alpha)w_2 \\
&= \frac{\alpha y_1 + (1-\alpha)y_2}{\alpha y_1 + (1-\alpha)y_2} \\
&= \frac{w_2}{y_2} \frac{\alpha[\alpha y_1 + (1-\alpha)y_2] + (1-\alpha)y_2}{\alpha y_1 + (1-\alpha)y_2}
\end{aligned}$$

IV Differentiate labor's share with the proportion of first type of firm $dLS/d\alpha$:

$$\begin{aligned}
\frac{dLS}{d\alpha} &= \frac{1}{Y} (-dY/d\alpha \times LS + dW/d\alpha) \\
&= \frac{1}{Y} \times \frac{w_2}{y_2} \left[-(y_1 - y_2) \times LS \frac{y_2}{w_2} + 2\alpha(y_1 - y_2) \right] \\
&= \frac{1}{Y^2} \times \frac{w_2}{y_2} (y_1 - y_2) \left\{ -\alpha[\alpha y_1 + (1-\alpha)y_2] - (1-\alpha)y_2 + 2\alpha[\alpha y_1 + (1-\alpha)y_2] \right\} \\
&= \frac{1}{Y^2} \times \frac{w_2}{y_2} (y_1 - y_2) \left[\alpha^2 y_1 - (1-\alpha)^2 y_2 \right]
\end{aligned}$$

V The lowest point of U-shaped curve α^*

$$\frac{dLS}{d\alpha} = 0$$

$$\therefore \frac{1}{Y^2} \frac{w_2}{y_2} (y_1 - y_2) > 0$$

$$\therefore \alpha^2 y_1 - (1-\alpha)^2 y_2 = 0$$

$$\frac{(1-\alpha)^2}{\alpha^2} = \frac{y_1}{y_2}$$

$$\frac{1}{\alpha} = \sqrt{\frac{y_1}{y_2}} + 1$$

$$\alpha^* = \frac{\sqrt{y_2}}{\sqrt{y_1} + \sqrt{y_2}} = \frac{(y_1 y_2)^{1/2} - y_2}{y_1 - y_2}$$