Processing Trade and Enterprise Productivity:

Firm-level Evidence from China

Jie Zhang & Wenping Zheng
(School of Economics, Renmin University of China)

Authors information: Zhang, School of Economics, Renmin University of China, Email: zhangjie0402@ruc.edu.cn; Zheng(corresponding author), School of Economics, Renmin University of China, Email: wenpingzheng@ruc.edu.cn. Address: Room 303, Mingde International Building, No. 59 Zhongguancun Street, Haidian District, Beijing, P.R. China, 100872

Abstract: Recent literature found that the productivity of export enterprises is lower than the non-export enterprises in China, which challenges the recently developed new new trade theory. By using the unique combined data of Chinese industrial enterprises and customs enterprises, we found that the productivity of foreign-funded processing trade enterprises was significantly lower than non-export enterprises. Our evidence shows that processing trade can be the key factor in understanding the "mystery" of Chinese export enterprises productivity. Moreover, it was found that the low productivity of foreign-funded enterprises of processing trade was related to the "error" of "measuring productivity", which was derived from the low nominal value of the enterprise value added to the price level, while the low nominal value of the enterprise value added was closely related to its low level of taxes and employee wages. Therefore, the low productivity of foreign-funded enterprises of processing trade may not reflect the actual low productivity, while it could be generated from the tax benefit policy towards foreign-funded enterprises and their possible price transferring behaviors.

Key words: processing trade; total factor productivity; value added; foreign invested enterprises.

JEL classification: F1, L1, O1.

1. Introduction

Within the last 10 years, the influence of export on enterprises' productivity has become one of the core research topics in the field of new new trade theory. Melitz (2003), Bernard et al. (2003), Melitz & Ottoviano (2008) and other scholars all pointed out that due to a variety of fixed costs and sunk costs of exports, export enterprises ought to have a higher productivity than non-export enterprises. The high productivity of the export enterprises was supported by empirical studies conducted in many countries, and initiated many literatures to explore the reasons behind it (Bernard & Jenson, 1999; Clerides et al., 1998; De Loecker, 2007). However, the empirical studies based on the world's largest exporter, China, provide different results. For example, Lu et al. (2010) found that the productivity of foreign invested export enterprises is much lower than that of non-export enterprises. In addition, Lu's (2010) found that labor productivity of export enterprises is lower than non-export enterprises in the labor-intensive industries. The same applied to

capital-intensive industries whose labor productivity in export enterprises remained higher than the non-export enterprises. If the anomaly phenomenon of the low productivity of export enterprises exists in China, what is the cause?

By analyzing the combined data of Chinese industrial enterprises and customs enterprises from 2000 to 2006, we reveal that those questionable findings in previous studies can be largely explained by the low productivity of processing trade enterprises in China. It is widely known that processing trade has a pivotal position in Chinese foreign trade. Their exports account for nearly 50 percent of Chinese total value of trade and contribute all the trade surplus. Due to the data limitations, the previous study did not distinguish the processing trade enterprises from general trade enterprises; however, this paper obtained the important information about whether a company is a processing trade enterprise combining level customs data in a transactional level and industrial enterprise data used in previous studies. Our research highlights that the processing and general trade enterprises must be differentiated in order to fully understand the productivity of China's export enterprise. By means of the combined dataset, we find: (1) the total factor productivity (TFP) of processing trade enterprises is significantly lower than the general trade and non-export enterprises, and lower than non-export enterprises between 17% and 22%. Besides the phenomenon found in related literature before can be largely explained by the low productivity of the processing trade enterprises. In fact, the productivity of general trade enterprises is still relatively higher than the non-export enterprises, according with the heterogeneity enterprise international trade theory. (2) The TFP of the foreign invested processing trade enterprises is significantly lower than that of non-export enterprises, while that of processing trade enterprises in other ownership is not. Such findings can be the main reason for why the TFP of processing trade enterprises in China is lower than that of non-export enterprises. (3) By analyzing the causes of low productivity of the foreign-funded processing trade enterprises, we found that the logical conclusion is that the low TFP of processing trade enterprises was caused by low value added of those enterprises. And, the low value added of processing trade enterprises resulted from lower wages and taxes that constituted the value added but not by the actual low productivity of processing trade enterprises. Therefore, there is not enough empirical evidence to illustrate whether foreign-funded processing trade enterprises is conflicting with the new new trade theory.

In previous studies, the calculation and comparison of productivity between Chinese export and non-export enterprises is rare. Perhaps only one piece is very close to our study, made by Dai, Maitra and Yu (2011). They found that, the productivity of processing trade enterprises is significantly lower as much as 4%-30% than that of non export enterprises. And, with the findings, they challenged the theory developed by Melitz (2003). Our study is different with Dai, Maitra and Yu (2012) in the following three aspects. Firstly, we adopted a new and more reliable method to calculate productivity. Secondly, we found the scenario that the productivity of processing trade enterprises is lower than non export enterprises only exists in foreign funded enterprises, while not in Chinese domestic enterprises. Finally, our research takes a further step to explain why the productivity different may not conflict with the new new trade theory.

The study concentrates on the significant differences concerning the export performance and behavioral differences between the processing trade and trade enterprises. The research takes their basic distinction into consideration, without which researchers may have biased understanding. By studying the export behavior of developing countries where processing trade is prevalent such as China, Vietnam, Mexico and etc., we must give thought to the complex effects brought by the

processing trade enterprises, especially the foreign-funded enterprises. The remainder of the paper is organized as follows: Section 2 describes the data that will be used in the analysis. Section 3 provides typical cases about China's processing trade enterprises and connects it with the low productivity of Chinese export enterprises mentioned in the previous studies. Section 4 provides several possible explanations for the low productivity of the processing trade enterprises and does a simple test using data. The last section is a conclusion of this article.

2. Data

In this paper, we use two sets of official statistics. The first set of data is derived from the National Bureau of Statistics survey about industrial enterprises above designated scale from 2000 to 2006. The survey covers all of China's state-owned enterprises and non-state-owned enterprises above designated scale (i.e. enterprises whose total value of output is more than ¥5,000,000). The total export of these enterprises accounted for about 98% of China's total manufacturing export. The Data includes more than 80 variables from enterprise balance sheet, income statement and cash flow statement and provides detailed information on the corporate identity, ownership, exports, employment, and total fixed assets and so on. This set of data provides all the information that we need to calculate the enterprise productivity. In the data processing, we delete observed values that do not accord with any of the following observations: (1) One of Industrial sale, revenue, employment, total fixed asset, export, intermediate input is negative or the default. (2) The number of employment is less than 8. (3) Enterprise exports are over the total industrial sales. The second set of data is the monthly trade data at the transaction-level from China's General Administration of Customs. The data contains monthly import and export trade information about customs clearance enterprise from 2000 to 2006, including the business duty paragraph, import and 8-digit codes of export products, import and export volume, value, destination (source), and transport manner. More importantly, for each transaction, the customs have recorded its way of trade specifically, processing trade, general trade or other trade types. Therefore, we can estimate whether the enterprise is processing enterprise according to this data. We add up data of enterprises per month to obtain the annual data. In addition, according to the way of export recorded in the data, we divide the export enterprises into three categories: (1) general trade enterprises which are only engaged in exports of general trade; (2) processing trade enterprises, engaged only in the export of processing trade; (3) mixed enterprises engaged in, i.e. enterprises both general trade and processing trade exports.

The focus of this paper is to study the relationship between exports of processing trade and enterprises' productivity, thus we need to combine the two sets of data to calculate the productivity and the product level transaction data including information of enterprises of processing trade. The combination of the two sets of data involves a series of strenuous technical details, because the enterprise code in enterprise data and duty paragraph in transaction data uses two coding systems. Therefore, even the same company is identified by different codes, we will combine the two sets of data according to the Chinese name of the enterprises[1]. The combined data includes all export enterprises, and all the non-export enterprises which can be combined, 779,722 observations in total. 197070 observations are from the export enterprises, accounting for 25.27% of the observed

[1] In related literature, there are different merging methods. We also tried their methods and found ours is much more efficient.

values of the export enterprises in the 2000-2006 survey data. Among the 197070 observations of export enterprises, the observations of general trade type enterprises are 98857, accounting for 50.16%; the observations of the type of processing trade enterprises are 29543, accounting for 14.99%; the observations of mixed types of enterprises are 57230, accounting for 29.04%.

The data after combination only contain less than 30% export of the original survey data. One possible problem is the sample selection bias of the enterprises. However, it is not an important issue for two main reasons. Firstly, we compare the main features of the descriptive statistics of export enterprises that can be combined and those that cannot be combined in table 1. From table 1, we can see the average number of employment, the number of sales and productivity levels of two sets of export enterprises are very similar. More importantly, as is shown in the appendix, the combined data can fully replicate the result of low productivity of the export enterprises in the previous studies. Attached table 1a shows the productivity of export enterprises is lower than the non-export enterprises among, foreign-funded enterprises, consistent with Lu et al. (2010); Attached table 1b shows that the labor productivity (per capita industrial value added) of export enterprises is lower than non-export enterprises in labor-intensive industries, which is consistent with Lu (2010) again. Therefore, we believe that the combined data still have a strong representation.

3. Methodology

3.1 The basic regression model and the data processing

In order to ensure the better breadth of the study sample and the reliability of the results, the sample of Chinese industrial enterprise database from 1999-2007 was selected to calculate the enterprises' TFP. We consider the basic model as follows:

$$\ln valueadded_{ijkt} = \alpha_0 + \alpha_1 \ln L_{ijkt} + \alpha_2 \ln K_{ijkt} + \alpha_3 age_{ijkt} + \alpha_4 timetrend_{ijkt} + \alpha_5 wto_{ijkt} + \sum_{n=1}^{6} ownership_{ijkt} + \sum province_{ijkt} + \sum industry_{ijkt} + \sum year_{ijkt} + \varepsilon_{ijkt} \quad (1)$$

In equation (1), $valueadded_{ijkt}$ indicates the enterprises value added. The enterprises' value added is calculated in this way: the industrial value added = gross output value (present value) - industrial intermediate input + VAT payable. In this paper, we use enterprises' value added rather than the total output as the output variable in C-D production function. There are two reasons: Firstly, eliminating intermediate inputs from enterprise value added can make the value mainly reflect the enterprise ultimate productive capacity and fits its conception better. Secondly, it is highly correlated between output value and intermediate inputs in China. In this study sample, their correlation coefficient is up to 0.856. Moreover, we found that if the intermediate input variable is considered into regression, the output elasticity of intermediate input variable is more than 0.8, which will greatly reduce the size of the elasticity values of capital and labor inputs. Therefore, taking the enterprise value added as output variable in production function may be more suitable for the production function in China. Further, taking 1998 as the base, we use provincial annual industrial product prices deflator as the total industrial output, and the purchasing deflator for raw materials, fuels and power as intermediate input.[2] K_{ijkt} represents the

[2] As De Loecker (2007) and Van Beveren (2012) points out, if we do not deflate the price of the input and output variables of the production function, there may exit deviation of the estimation results. Flat reduction method can be for both the industry and regions. Considering Chinese circumstance, local protectionism and regional segmentation motivation may cause price difference; therefore, it may be more reasonable to deflate indexes

logarithm of enterprise net fixed assets[3] (Using the 1998 base period provincial annual investment deflator in fixed assets). L_{ijkt} represents the logarithm of the enterprise's annual average number of employees. age_{ijkt} represents enterprise's age. $timetrend_{ijkt}$ represents time trend. wto_{ijkt} represents virtual variable of China's accession to the WTO, and this variable are exogenous variables. Its value is set at 0 before 2002 and 1 after 2002. $ownership_{ijkt}$ is categorized as six types of state; foreign investors (excluding those from Hong Kong, Macao, and Taiwan); investors from Hong Kong, Macao, and Taiwan; legal entities; individuals; and collective investors in accordance with its capital proportion($\geqslant$50) in its registered investment capital of enterprises. As Guariglia et al. (2011) pointed out, this way of distinguishing ownership type in accordance with the enterprise paid-in capital proportion is more accurate and reliable than the way in accordance with registration status of enterprises. $province_{ijkt}$, $industry_{ijkt}$ and $year_{ijkt}$ is provinces that enterprises located in, industries (3-digit level), and year fixed effects respectively, ε_{ijkt} is random error.

Next, according to the definition of enterprises' TFP, we can get:

$$TFP_{ijkt} = \ln valueadded_{ijkt} - \hat{\alpha}_1 \ln L_{ijkt} - \hat{\alpha}_2 \ln K_{ijkt} \qquad (2)$$

3.2 What method is more reasonable to estimate the enterprise's TFP in China?

As Van Beveren (2012) pointed out in his review paper, the current ways to estimate the enterprises' TFP can be summarized as follows: the fixed effects methods (FE), the instrumental variable method (IV) and GMM, Olley-Pakes semi-parametric method (OP) and Levinsohn-Petrin semi-parametric methods (LP). However, from the effect of these popular methods we use to estimate Chinese enterprises' TFP, we find some problems:

(1) In terms of the ability to deal with problems, because OP can solve the problem of simultaneity bias between corporate assets and TFP in C-D production function and the problem of unbalanced panel data and sample selection bias caused by corporate survival and exit. Therefore, the OP method is a relatively effective method. However, in the process of using the method to estimate enterprise's TFP, there are following problems that may significantly impact on estimating results The method requires enterprises' investment data (I_{it}). But, there is no concrete investment data in the Chinese industrial database, so we need to use the equation $I_{it} = K_{it+1} - (1-\delta)K_{it}$ to estimate indirectly. However, there is a lot of negative corporate investment (I_{it}) by using this method to estimate the effect of corporate investment (I_{it}). And the basic logic of the OP method requires $I_{it} > 0$, thus a large number of negative corporate investment I_{it}[4] leads to considerable loss of the samples, resulting in the deviation of the estimated results.

(2) The starting point of LP method is due to the mandatory requirement $I_{it} > 0$ which will lead to the deviation of the estimation methods, therefore intermediate input variables m_{it} is used instead. However, LP method cannot handle the selection problem brought by the probability of business survival, so this method still has certain limitations.

(3) Wooldridge (2009) proved that one step GMM-SYSTEM can perfectly solve the problem of simultaneity between corporate assets and TFP in C-D production function and the problem of unbalanced panel data and sample selection bias. Therefore, it is a consistent and effective

---

regionally.

[3] We think, the use of enterprise net fixed assets can preferably reflect the amount of the fixed assets of enterprise in the stock.

[4] More specifically, for the 639897 general demographic data, if using 5% rate of depreciation, the number of sample in which investment >0 is 402015; if using 10.196% rate of depreciation, the number of sample in which investment >0 is 402015.

estimation method. However, when we use the xtabond2 method built by Roodman (2009) to estimate enterprises' TFP, we found that whether one step GMM-SYSTEM, the two-step GMM-SYSTEM or the first difference GMM-SYSTEM method, the test can't meet the inspection requirements of GMM-SYSTEM. It proves that GMM-SYSTEM is not stable to a certain extent.

3.3 Comparison and analysis of different measurement methods

Table 1 reports the regression results obtained by different methods in estimating TFP. We can see by comparison: (1) Comparing regression results of POLS and OP method, whether it is the depreciation rate of 5% or 10.019% as the OP method to estimate the amount of business investment, regression coefficients of *lnk* is larger than that in POLS method and coefficients of *lnl* is lower than POLS method. Obviously, this result shows OP is effective; (2) the regression coefficient of *lnl* is lower than other methods in estimation results of the LP method. (3) The regression coefficient of *lnl* is relatively close, while the gap of the coefficient of *lnk* is relatively large in all estimation methods.

Table 1 Results of different measures method of TFP

	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	FE	OP	OP	LP	ONE STEP GMM
	Full sample	Full sample	$I>0$ ($\delta=5\%$)	$I>0$ ($\delta=10.019\%$)	Full sample	Full sample
L.lnvalueadded						0.354***
						(81.09)
lnk	0.279***	0.141***	0.411***	0.417***	0.140***	0.123***
	(269.33)	(69.03)	(111.53)	(81.27)	(61.35)	(15.13)
lnl	0.587***	0.528***	0.543***	0.543***	0.176***	0.672***
	(391.51)	(145.77)	(173.79)	(159.68)	(107.98)	(53.74)
age	-0.000***	-0.000*	-0.000	-0.000		-.001***
	(-17.91)	(-1.66)	(-0.33)	(-1.60)		(-11.19)
t	0.119***	0.119***	0.115***	0.114***	0.052***	0.088***
	(161.30)	(172.61)	(112.86)	(110.56)	(93.22)	(90.02)
wto	-0.052***	-0.118***	-0.063***	-0.062***	-0.004	-0.042***
	(-12.84)	(-40.60)	(-12.41)	(-17.31)	(-1.33)	(-12.45)
collective	0.709***		0.697***	0.695***	0.205***	0.454***
	(152.76)		(69.63)	(62.68)	(41.94)	(57.64)
legalperson	0.739***		0.658***	0.656***	0.217***	0.462***
	(159.40)		(67.38)	(65.83)	(45.07)	(69.36)
private	0.724***		0.649***	0.650***	0.212***	0.499***
	(161.90)		(72.69)	(71.55)	(47.87)	(66.11)
hmt	0.721***		0.655***	0.650***	0.206***	0.444***
	(127.42)		(53.84)	(57.47)	(34.48)	(56.48)
foreign	0.973***		0.871***	0.866***	0.298***	0.569***
	(165.95)		(63.41)	(79.90)	(47.09)	(64.14)
province	YES		YES	YES	YES	YES

industry	YES		YES	YES	YES	YES
year	YES		YES	YES	YES	YES
constant	1.663***	4.354***				0.127*
	(48.05)	(199.03)				(1.91)
N	851177	860449	394354	474980	849355	611074

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

Table 2 is statistics table of enterprises' TFP data characteristics of different measurement methods. We can see by comparison, the average of enterprises' TFP, which is estimated by POLS, FE and GMM, is relatively close. The average of enterprises' TFP estimated by OP is relatively smaller, while the average of enterprises' TFP estimated by LP is relatively larger. Table 3 shows the Spearman correlation coefficient matrix of enterprises' TFP estimated by different measurement methods. It can be seen, the correlation coefficient of enterprises' TFP estimated by OP and LP methods were slightly lower, about 0.72, while other correlation coefficients were above 0.8. It can be speculated that the enterprises' TFP estimated by different methods are highly consistent essentially.

Table 2

Statistics of enterprises' TFP estimated by different measurement methods

Variable	Obs	Mean	Std. Dev.	Min	Max
tfp_ols	860449	3.400	1.135	-9.665	11.301
tfp_fe	860449	4.860	1.168	-8.397	13.010
tfp_op1	860449	2.500	1.152	-10.539	10.993
tfp_op2	860449	2.452	1.154	-10.583	10.973
tfp_lp	860449	6.615	1.296	-7.189	15.268
tfp_gmm	860449	4.295	1.160	-8.750	12.266

Table 3

The Spearman correlation coefficient matrix of enterprises' TFP estimated by different measurement methods

	tfp_ols	tfp_fe	tfp_op1	tfp_op2	tfp_lp	tfp_gmm
tfp_ols	1.000					
tfp_fe	0.958	1.000				
tfp_op1	0.979	0.885	1.000			
tfp_op2	0.977	0.881	0.9999	1.000		
tfp_lp	0.822	0.935	0.729	0.724	1.000	
tfp_gmm	0.975	0.989	0.912	0.908	0.874	1.000

4. Results and analysis

4.1 Are there any significant differences in TFP between different types of export enterprises and non-export enterprises?

In order to the difference of productivity between the processing trade enterprises and other

types of enterprises, we use the following equation to estimate:

$$TFP_{ijkt} = \beta_0 + \sum_{n=1}^{4} \beta_n tradestyle_{ijkt} + \gamma X + province + industry + \mu \quad (3)$$

The dependent variable TFP_{ijkt} is the enterprises' TFP calculated by different methods. i stands for enterprises; j stands for industry; k stands for the enterprise is in; t stands for years. $tradestyle$ is a set of dummy variables related to the information of the way of enterprise exports: $tradestyle1$ represents that the companies use only the export of general trade, indicateing that the companies use only the export of processing trade, $tradestyle2$ represents the enterprise which uses both general trade and processing trade export, $tradestyle3$ represents non-export enterprises. X -set includes a series of control variables, in which we include firm size (represented by the enterprise total employment), and the square of the scale of business, firm age, corporate capital-intensity, degree of competition in the industry (the Herfindahl index), as well as the demand growth rate of enterprise and industry, the 4-digit industry and the provinces which the enterprises are in, as well as time dummy variable.

Table 4 (without the corporate characteristic variables) and Table 5-1 (with the corporate characteristic variables) are listed to show the regression results of equation (1). From the regression results of models in Table 4 and 5, we get the following two important findings:

Firstly, by means of different methods to measure enterprises' TFP as the dependent variable, the results obtained do not have significant differences. Whether or not to include the control variables in the measurement equation (2), the regression results for different types of export enterprises in different methods of measuring TFP demonstrates that using different methods to measure the enterprises' TFP will not cause significant impact on the test results. Thus, in the Chinese context, to demonstrate that the TFP of processing trade enterprise is less than other types of enterprises, there is enough empirical evidence.

Secondly, it can be shown from the overall regression results, regardless of the choice of the estimation indicators to measure enterprises' TFP, the general trade type of enterprise's productivity is higher than non-exporting companies, which obviously meet the forecast that export enterprises are more productive which is part of the heterogeneous enterprise theory of new trade theory. However, the performance of the processing trade enterprises is different. The regression results of all the methods above measuring the enterprises' TFP show that the TFP of type of processing trade enterprises is lower than non-export enterprises by 17% (TFP_OP2, taking a sample with 10.019% depreciation rate) to 22% (TFP_GMM). In addition, the productivity of mixed trade type enterprises is also significantly higher than non-exporting enterprises by about 6% to 47%. While in the OP method, mixed-trade type enterprise's productivity is higher than the non-export enterprises by about 4% to 7%. In Table 5-1, we have taken the firm age, firm size and square, corporate capital-intensity, enterprises' 4-bit degree of industrial competition, the sales growth rate of the province area they are in, enterprise ownership type and corporate 4-digit industry, province and fixed effects of year into consideration. Therefore, the differences in TFP of processing trade enterprises may not be resulted from the processing trade enterprises' size, age or ownership. Nor does the industry environment, the regional structure and timing differences, cause it.

Table 4 Test results of enterprises' TFP differences of different trade (without control variables)

	(1)	(2)	(3)	(4)	(5)	(6)
	tfp_ols	tfp_fe	tfp_opa	tfp_opb	tfp_lpnn	tfp_gmm
tradestyle1	0.141***	0.284***	0.056***	0.051***	0.465***	0.225***

	(31.67)	(60.56)	(12.37)	(11.32)	(85.22)	(48.75)
tradestyle2	-0.095***	-0.055***	-0.169***	-0.174***	0.296***	-0.029***
	(-12.71)	-(7.10)	(-22.67)	(-23.24)	(33.66)	(-3.74)
tradestyle3	0.171***	0.388***	0.044***	0.038***	0.672***	0.295***
	(34.15)	(72.13)	(8.90)	(7.49)	(107.13)	(55.70)
constant	2.029***	3.599***	1.094***	1.043***	5.601***	2.943***
	(59.57)	(95.86)	(32.74)	(31.23)	(122.88)	(82.45)
N	860449	860449	860449	860449	860449	860449

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

Table 5-1 Test results of enterprises' TFP differences of different trade (with control variables of enterprises' own characteristics)

	(1)	(2)	(3)	(4)	(5)	(6)
	tfp_ols	tfp_fe	tfp_opa	tfp_opb	tfp_lpnn	tfp_gmm
tradestyle1	0.094***	0.119***	0.070***	0.069***	0.119***	0.122***
	(20.89)	(25.85)	(15.43)	(15.19)	(25.90)	(26.43)
tradestyle2	-0.193***	-0.213***	-0.173***	-0.172***	-0.214***	-0.216***
	(-25.17)	(-26.87)	(-22.61)	(-22.48)	(-26.89)	(-27.02)
tradestyle3	0.055***	0.072***	0.039***	0.038***	0.072***	0.074***
	(10.40)	(13.07)	(7.39)	(7.25)	(13.09)	(13.37)
size	-0.537***	-0.406***	-0.561***	-0.564***	-0.054***	-0.542***
	(-87.20)	(-64.35)	(-91.04)	(-91.45)	(-8.52)	(-85.38)
$Size^2$	0.051***	0.057***	0.045***	0.045***	0.057***	0.058***
	(90.38)	(98.36)	(80.21)	(79.72)	(98.44)	(99.20)
age	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-17.95)	(-17.92)	(-17.74)	(-17.73)	(-17.92)	(-17.90)
capital	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(4.08)	(3.50)	(6.21)	(6.32)	(3.50)	(3.46)
herfind	0.408***	0.463***	0.354***	0.352***	0.464***	0.471***
	(11.29)	(12.67)	(9.69)	(9.62)	(12.68)	(12.82)
saleincrease	0.000**	0.000*	0.000***	0.000***	0.000*	0.000*
(industry level)	(2.54)	(1.89)	(3.28)	(3.32)	(1.88)	(1.81)
collective	0.758***	0.717***	0.798***	0.800***	0.717***	0.712***
	(162.49)	(152.49)	(168.70)	(168.89)	(152.36)	(150.95)
legalperson	0.772***	0.775***	0.770***	0.770***	0.775***	0.775***
	(165.76)	(164.72)	(163.34)	(163.17)	(164.69)	(164.32)
private	0.767***	0.736***	0.797***	0.798***	0.736***	0.732***
	(170.51)	(162.35)	(174.89)	(175.00)	(162.24)	(161.04)
hmt	0.774***	0.799***	0.751***	0.749***	0.799***	0.802***
	(133.60)	(135.49)	(128.29)	(127.99)	(135.49)	(135.47)
foreign	1.007***	1.085***	0.931***	0.927***	1.086***	1.096***
	(168.58)	(177.39)	(155.59)	(154.93)	(177.46)	(178.18)
constant	3.021***	3.646***	2.420***	2.394***	3.653***	3.728***
	(79.52)	(94.27)	(63.56)	(62.84)	(94.42)	(96.02)

N	851177	851177	851177	851177	851177	851177

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

4.2 Comparison with related literature

Now, we compare our findings with the previously mentioned related literature. Lu et al. (2010) found that the TFP of export enterprise is lower than non-export enterprise, in terms of foreign-owned enterprises, By using different methods to estimate TFP, the regression results in the Table 5-1 and its appendices show, whether Hong Kong, Macao and Taiwan enterprises of the foreign capital enterprise or not, TFP of export enterprises is significantly lower than non-export. Then, can the result be explained by processing trade enterprise? Table 6-1 and its appendices are the regression results according to the different types of ownership and steadily show that only for Hong Kong, Macao and Taiwan enterprises and other foreign-owned enterprises, TFP of processing trade enterprise is as well as TFP of mixed enterprise; Among the state-owned enterprises and collective enterprise, no matter it is processing trade enterprise, mixed enterprise or general trade enterprise, its TFP is significantly higher than those of non-export enterprise; Among the independent legal person enterprise and private enterprise, TFP of processing trade enterprise does not show significant difference from non-export enterprise, and TFP of mixed enterprise and general trade enterprise is significantly higher than non-export enterprise. Above all, we can conclude that the phenomenon，among processing trade enterprise of Hong Kong, Macao and Taiwan enterprise and other foreign capital enterprise, their lower TFP than non-export enterprises, is the core factor which leads the whole processing trade enterprises' TFP below non-export enterprise.

Table6-1 TFP characteristics comparison between different ownership enterprises (TFP estimated by OLS as dependent variable)

	(1)	(2)	(3)	(4)	(5)	(6)
	OWN=1	OWN=2	OWN=3	OWN=4	OWN=5	OWN=6
	tfp_ols	tfp_ols	tfp_ols	tfp_ols	tfp_ols	tfp_ols
tradestyle1	0.370***	0.103***	0.056***	0.067***	0.008	0.017
	(20.43)	(6.51)	(5.85)	(9.91)	(0.66)	(1.30)
tradestyle2	0.580***	0.120**	-0.005	-0.050	-0.209***	-0.212***
	(9.45)	(2.48)	(-0.19)	(-1.15)	(-19.76)	(-12.94)
tradestyle3	0.525***	0.141***	0.116***	0.121***	-0.060***	-0.007
	(19.07)	(6.44)	(8.69)	(9.76)	(-5.96)	(-0.69)
size	-0.082***	-0.776***	-0.470***	-0.769***	-0.613***	-0.564***
	(-6.60)	(-41.24)	(-32.98)	(-62.28)	(-26.27)	(-24.54)
$Size^2$	0.020***	0.062***	0.042***	0.072***	0.058***	0.056***
	(18.78)	(33.92)	(32.55)	(58.93)	(27.61)	(26.89)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.0001	0.000
	(-8.44)	(-9.14)	(-9.47)	(-9.28)	(-0.37)	(0.63)
capital	0.000***	-0.000	0.000***	0.000***	0.000***	0.000***
	(3.55)	(-0.96)	(4.25)	(4.02)	(5.05)	(6.67)
herfind	0.142*	0.138*	0.263***	0.372***	0.584***	1.280***

	(1.65)	(1.67)	(3.38)	(6.05)	(4.40)	(10.68)
saleincrease	0.000***	-0.000	0.000***	0.000	0.000	-0.000
(industry level)	(9.87)	(-0.62)	(4.17)	(0.81)	(0.63)	(-0.31)
cons	2.011***	5.065***	3.696***	3.814***	3.468***	2.281***
	(26.43)	(47.27)	(22.24)	(23.79)	(19.02)	(4.80)
N	144015	143779	166249	260157	73435	63542

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

Lu（2010）found that, in labor-intensive industries, productivity of export enterprise is lower than non-export enterprise. However, our empirical research cannot provide evidence for that. By means of different estimation methods, the regression results in Table 6-1 and its appendices according to different levels of capital-intensity show that among the labor-intensive enterprises, productivity of export enterprise is not all lower than the non-export. In contrast, in the labor-intensive enterprise, some export enterprise is higher than non-export enterprise. In addition, no matter middle industry or capital-intensive enterprise samples, export enterprises' TFP is significantly higher than the non-export. Further, the results on table 7 and its appendices steadily show that, whether in labor-intensive enterprise or capital-intensive enterprise, processing trade enterprise productivity is significantly lower than the non-export, and the productivity of both general trade enterprise and mixed enterprise is significantly higher than non-export enterprise.

Table 7 TFP characteristics comparison between different intensive types of enterprises (TFP estimated by OLS as dependent variable)

	(1) labor-intensive tfp_ols	(2) Middle industry tfp_ols	(3) capital-intensive tfp_ols	(4) labor-intensive tfp_ols	(5) Middle industry tfp_ols	(6) capital-intensive tfp_ols
ex	0.006	0.023***	0.075***			
	(1.29)	(5.12)	(15.11)			
tradestyle1				0.079***	0.077***	0.123***
				(9.60)	(10.46)	(16.43)
tradestyle2				-0.216***	-0.176***	-0.100***
				(-17.47)	(-13.56)	(-7.24)
tradestyle3				0.047***	0.033***	0.083***
				(4.73)	(3.71)	(9.71)
Size	-0.480***	-0.549***	-0.368***	-0.509***	-0.559***	-0.374***
	(-33.89)	(-47.86)	(-38.72)	(-37.04)	(-50.11)	(-39.82)
$Size^2$	0.035***	0.051***	0.042***	0.037***	0.052***	0.043***
	(25.48)	(48.27)	(50.02)	(28.22)	(50.59)	(51.86)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.000***	-0.001***
	(-8.13)	(-8.86)	(-11.49)	(-8.17)	(-8.90)	(-11.54)
capital	-0.009***	0.001***	0.000***	-0.009***	0.001***	0.000***
	(-32.16)	(5.78)	(4.41)	(-33.63)	(5.51)	(4.38)
herfind	0.550***	0.208***	0.378***	0.532***	0.201***	0.371***
	(8.96)	(3.39)	(5.80)	(8.85)	(3.32)	(5.70)

sale increase	0.000	0.000***	0.000	0.000	0.0000***	0.000
(industry level)	(0.56)	(2.90)	(0.23)	(0.57)	(2.79)	(0.14)
collective	0.778***	0.754***	0.760***	0.779***	0.758***	0.767***
	(95.60)	(94.92)	(84.98)	(97.42)	(96.36)	(86.59)
legalperson	0.827***	0.759***	0.741***	0.822***	0.761***	0.748***
	(96.75)	(96.30)	(90.88)	(98.01)	(97.50)	(92.30)
private	0.798***	0.763***	0.771***	0.797***	0.763***	0.779***
	(98.67)	(100.70)	(94.08)	(100.43)	(101.85)	(95.74)
hmt	0.732***	0.712***	0.826***	0.758***	0.735***	0.848***
	(70.12)	(72.33)	(84.51)	(72.70)	(74.33)	(86.91)
foreign	0.897***	0.900***	1.073***	0.904***	0.910***	1.089***
	(75.65)	(84.50)	(113.93)	(76.62)	(85.42)	(115.93)
constant	3.063***	3.337***	2.652***	3.155***	2.647***	2.664***
	(39.26)	(29.43)	(31.29)	(41.12)	(14.04)	(44.31)
N	271093	271372	273461	283896	280435	281433

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

4.3 Why is the TFP level of processing trade enterprise low?

In terms of this paper's theme, it is obviously important to find that TFP of processing trade enterprise is low, but even more importantly, we must as much as possible find the reason why in Chinese context TFP of processing trade enterprise is low? Does the low level of processing trade enterprise's TFP means the low production efficiency?

Towards this problem, we do a series of researches: the regression results of model 1 in Table 8 show that the value added of processing trade enterprise is significantly less than non-export enterprise when we use the logarithm of value added of enterprise as the dependent variable. The results can explain why TFP of processing trade enterprise is lower than the non-export. It is because we use value added as the core indicator of enterprise output in TFP estimation equation that what the value added of processing trade enterprise is low, which will lead to low level of TFP. Based on the factor income method, GDP can be divided into laborer compensation, net production tax, fixed assets depreciation and business surplus. Fully taking example by this idea, method of accounting value added in enterprise level can be from several following aspects. We, therefore, subdivide the reasons for the low value added of processing trade enterprise. According to the regression results of model 2, 3, 4 in table 8, we can know that processing trade enterprise's per capita salary[5] is significantly lower than the non-export, and the tax rate of processing trade enterprise (tax in total[6] /sales) is significantly less than non-export enterprise. On the contrary, profit rate (corporation profits/sales) between the two types of enterprise have no significant difference. The results of model 5 in table 8 show that by using the corporate R&D investment-intensity (R&D input/sales) as the dependent variable, there are no significant differences about R&D investment-intensity between the processing trade enterprise and

[5] Per capita salary is the total salary and welfare expenses/the number of staff, enterprise total salary and welfare include accrued payrolls, accrued welfares, unemployment insurance premium, endowment and medical insurance and housing fund and allowance.

[6] Including (income tax payable+ value-added tax+ sales tax and extra Charges+ tax expenditure in management cost)-subsidies income.

non-export. Because R&D activities play an important role in enterprise production efficiency, it illustrates to a certain extent, there are no significant differences about productivity between the processing trade enterprise and non-export.

The regression results about clearly show the following logic: The low level of processing trade enterprise's TFP is caused by the low value added and the low value added derives from the low employee wages and taxes, not necessarily due to real production efficiency. Therefore, there are no evidences that can support the fact that processing trade enterprise goes against the new trade theory, in which export enterprise productivity is higher than the non-export!

Table 8 Regression results of enterprise important characteristics

	(1)	(2)	(3)	(4)	(5)
	lnvalueadded	r_salary	ros	tax_sale	r_d
tradestyle1	0.147***	1.983***	0.223**	0.010	-0.009
	(30.06)	(11.62)	(2.36)	(0.42)	(-1.09)
tradestyle2	-0.230***	-1.343***	-0.000	-0.015**	0.008
	(-26.93)	(-3.77)	(-0.01)	(-2.38)	(0.78)
tradestyle3	0.095***	0.976***	0.128*	-0.008	0.006
	(16.07)	(7.43)	(1.78)	(-0.35)	(0.78)
size	0.864***	-0.122**	0.098***	0.002	-0.013
	(728.49)	(-2.32)	(3.89)	(0.59)	(-0.93)
age	-0.000***	-0.000	-0.000	0.000	-0.000
	(-17.38)	(-0.04)	(-1.23)	(1.58)	(-0.98)
rcapital	0.000***	0.005	-0.000	-0.000	0.000
	(3.27)	(1.40)	(-1.46)	(-0.33)	(0.96)
herfind	0.645***	11.05***	0.169	0.022	-0.050
	(16.62)	(12.01)	(0.31)	(0.15)	(-0.78)
saleincrease	0.000***	0.000***	0.000	0.000	-0.000
(industry level)	(12.63)	(5.58)	(1.50)	(0.76)	(-0.42)
collective	0.619***	-0.869***	1.540***	0.058	-0.081
	(128.59)	(-5.22)	(3.91)	(0.50)	(-1.10)
legalperson	0.734***	0.456	1.471***	0.065	-0.097
	(152.01)	(1.45)	(3.74)	(0.59)	(-1.07)
private	0.654***	-1.009***	1.585***	0.068	-0.093
	(140.98)	(-4.85)	(3.94)	(0.61)	(-1.08)
hmt	0.773***	2.331***	1.480***	0.054	-0.089
	(125.74)	(6.38)	(3.89)	(0.49)	(-1.09)
foreign	1.118***	8.332***	1.587***	0.067	-0.087
	(174.00)	(12.95)	(3.70)	(0.53)	(-1.10)
constant	2.793***	9.372***	-1.324***	0.115***	0.068
	(47.34)	(13.67)	(-4.49)	(2.93)	(0.96)
N	854201	876310	876310	876310	634783

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

In table 9 we take into account of enterprise important features for different types of ownership,

and the above results robustly show: as for the state-owned and collective enterprise, the value added and per capita wage of processing trade enterprise are significantly higher than non-export enterprise, while the investment density, R&D, the profit rate and tax rate between the two have no significant difference. For independent legal person enterprise, the value added of processing trade enterprise is not significantly lower than non-export enterprise, while investment-density in R&D and tax rate is significantly low. On the contrary, per capita wage and profit rate is significantly higher than the non-export. For private enterprise, the value added of processing trade enterprise is not significantly lower than non-export enterprise, whereas investment-density in R&D of processing trade enterprise and mixed enterprise is lower than the non-export, both per capital wage and profit rate of processing trade enterprise is significantly lower than the non-export, but tax rate is contrary. For Hong Kong, Macao and Taiwan enterprises, no matter general, processing or mixed enterprise, the value added and tax rate are both significantly lower than the non-expert, investment-density in R&D, per capital wage and profit rate of processing enterprise is also lower. For non-Hong Kong, Macao and Taiwan foreign-found enterprises, only processing enterprise's value added is significantly lower than the non-export, and investment-density in R&D of both processing and mixed enterprise is also lower than non-export. Although, the low level of investment-density in R&D for processing enterprise may not be caused by productivity's lowness, the possible reason for the low level is that R&D activities are controlled by the parent company. Per capital wage and profit rate of processing enterprise is not significantly lower than the non-export. However, all of general trade, processing trade and mixed trade type enterprises' tax rate are significantly lower than non-export enterprises.

All the results considered, the reason for the low TFP of processing trade enterprise in China is that the value added of both Hong Kong, Macao and Taiwan enterprises and other foreign-owned enterprises is low, which lies in low tax rate and wage. Therefore, Hong Kong, Macao and Taiwan enterprises and other foreign-owned enterprises are the main reason for this phenomenon.

The reasonable explanations that cause the various phenomena are as following: Firstly, there is the "error" on measuring productivity caused by special preferential tax policy on foreign capital enterprise and processing trade from government. GDP competitions among government officials in China greatly encourage local government to make all kinds of preferential policies in order to attract FDI and investment from foreign-funded enterprise. For example, the most typical tax preferential policy is the "two head out" method for foreign processing trade enterprise. It guarantees that a "double" tax breaks be collected with customs imports of raw materials and value-added tax with export-finished product. This is equal to "double" reducing the marginal cost of production of export products for the foreign-funded processing enterprises.

If profit rate in foreign processing trade enterprise is similar to other types of enterprise, under this circumstance, export prices of foreign processing trade enterprise are inevitably low. Considering the fact that Chinese customs data also provides the quantity and the value of the information of enterprise import product, we can directly compare average export prices of processing trade enterprise with the non-processing (Table 10). The results in table 10 show that average export price of processing trade enterprise are significantly lower than general trade enterprise. When measuring enterprise productivity (whether labor productivity or TFP), we use nominal value as output variables. If the price of output products in processing trade enterprise is lower than other types of enterprise, value added, the proxy variable of processing trade enterprise

output, measured by nominal value, is relatively lower than other types of enterprise, Which shows that measuring productivity of processing trade enterprises is lower than that of other types of enterprises. Therefore, the "error" on measuring productivity may be the reason that causes foreign trade enterprises lower productivity.

Secondly, the "error" on measuring productivity caused by transfer pricing behavior of processing trade enterprises is because of the "Three minus two avoid" preferential tax policy for foreign enterprise in China, who possibly shift profits to abroad in the way of transferring pricing to avoid tax. They can sell final products at a low price to affiliated enterprises in low tax-burden country or buy raw material at a high price from the one.

Among the above two, it is an important channel for foreign enterprise, especially processing enterprise, to transfer pricing by buying raw material at a high price. Because China's customs data offer the quantity and the price of enterprise import products, we can directly compare average import prices between processing trade enterprise and the non-processing (table 10). We can see from table 10, in terms of average import price, processing trade is higher than general trade enterprise by 5%, but foreign processing trade is higher than general enterprises by 22%.

We have showed that the average export price of processing trade enterprises are lower than of non-processing trade enterprises, and now we will see whether the average import prices of processing trade enterprises are higher? Unfortunately, it shows that the average import prices of processing trade enterprises are also lower (Table 10). Does it mean the theory of transferring pricing is not suitable for China? No, the results in table 10 also shows that, comparing to the average import prices, the average export prices of processing trade firms is more lower than non-processing trade enterprises. We then focus on the ratio of average export price to average import price, which represents the gap between average export price and average import price. The coefficient of processing trade enterprises is -2.356, which significantly lower than non-processing trade enterprises. The lower gap of processing trade will lead to lower value added. While in measuring productivity of enterprises (whether labor productivity or TFP), value added as output variables should be subtracted the nominal value of intermediate inputs which are calculated in nominal price level, transfer pricing will reduce the nominal value of enterprise value added. Therefore, the action of transferring pricing can lead to the "error" on measuring productivity caused by the low level of value added for foreign processing enterprise. Obviously, it is not easy for general trade to transfer pricing, because the "two head out" for raw materials and finished product also provide convenience to processing enterprise. The foreign processing enterprises do not sale their products, so it is difficult for regulators to find whether enterprise transfer pricing or not by comparing domestic price with foreign price, thus transferring pricing for the processing trade enterprise has become easier.

Thirdly, China's processing trade enterprise orders mainly come from multinational companies or the large international buyers in developed countries or emerging countries (regions). Foreign investors often transfer low value-added manufacturing assembly link, which is labor-intensive and has low technology attached to China in the processing trade, while marketing channels, brand and product patents and other core innovation technology are firmly seized in their hands. Therefore, these multinational companies and large international buyers have stronger bargain power than either processing trade enterprise or general trade enterprise in developing countries. The group has the ability to drive down markup on cost and export price, which causes

lower measuring productivity.

[Table 9 about here]

[Table 10 about here]

5. Conclusion

As one of the most important developing countries and major exporters, processing trade is critical in promoting China's exports. The amount of the export of processing trade accounts for more than 55 percent of China's total exports from 1999 to 2011. According to our calculation, the TFP of processing trade enterprises is not only significantly lower than non-export enterprises, but also much lower than that of the general trade and mixed trade enterprises. It seems that such comparison can challenge the logic of the new new trade theory. The calculation in this paper is based on the adopting of merged database of Chinese industrial enterprises and China Customs from 2000 to 2006 and equipped with multiple mainstream accounting methods of enterprises' TFP.

The deeper study found that the low TFP of processing trade enterprises was caused by low value added of processing trade enterprises, while the low value added of processing trade enterprises was not caused by true low productivity of processing trade enterprises, but caused by enterprises value added constituted by lower wages and taxes. Therefore, we cannot find enough empirical evidence to prove whether it is really contrary to the heterogeneity hypothesis, the productivity of export enterprises is higher than the non-export enterprises in the processing trade enterprises, of new international trade theory. The most important finding of this paper is that foreign-invested enterprises, including enterprises invested by Hong Kong, Macao and Taiwan, and non-Hong Kong, Macao and Taiwan, are the main factors that led to the phenomenon. As for the foreign-invested enterprises, the results of different methods to estimate the enterprises' TFP show that the TFP of the processing trade enterprises is significantly lower than non-exporting enterprises, and more significantly lower than the general trade enterprises and mixed trade enterprises. In State-owned and collective enterprises, the results show that no matter what type the enterprise is, processing trade enterprises, general trade enterprises or mixed trading enterprises, their TFP is significantly higher than the non-export enterprises. And the results are consistent with the heterogeneity hypothesis that the productivity of export enterprises is higher than non-export enterprises in new international trade theory. While in enterprise of private ownership, including independent legal entity and private ownership enterprises, the results of different methods to estimate the enterprises' TFP show that the TFP of processing trade enterprises is not lower than the non-export enterprises stably, but it is significant lower than the general trade enterprises and mixed enterprises. Finally, we found that the core reason why the TFP of foreign-invested processing trade enterprises is its low value added, while the low value added of foreign-invested processing trade enterprises closely related to price transferring in the type of processing trade of foreign-invested enterprises and the "super-national" preferential tax policies engaged in foreign-invested processing trade enterprises and lower wage expenditure.

References

Bernard, A. B., & Jensen, J. B. (1999). Exceptional Exporter Performance: Cause, Effect, or Both? *Journal of International Economics*, *47*(1), 1-25.

Bernard, A. B., Eaton, J., Jensen, J. B., & Kortum, S. S. (2003). Plants and Productivity in International Trade. *American Economic Review*, *93*(4), 1268-1290.

Clerides, S., Lach, S. & Tybout, J. (1998). Is Learning by Exporting Important? Micro-dynamic Evidence from Columbia, Mexico and Morocco. *Quarterly Journal of Economics*, *113*(3), 903-947.

Dai, Mi, Maitra, Madhura and Yu, Miaojie, (2011). Unexceptional Exporter Performance in China? The Role of Processing Trade (November 23, 2011). Available at SSRN: http://ssrn.com/abstract=1963652 or http://dx.doi.org/10.2139/ssrn.1963652

De Loecker, J. (2007). Do exports generate higher productivity? Evidence from Slovenia. *Journal of International Economics*, *73*(1), 69-98.

Lu, D. (2011). Exceptional Exporter Performance? Evidence from Chinese Manufacturing Firms. mimeo, University of Chicago.

Lu, J., Lu, Y., & Tao, Z. (2010). Exporting Behavior of Foreign Affiliates: Theory and Evidence. *Journal of International Economics*, *81*(2), 197-205.

Melitz, M. J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, *71*(6), 1695-1725.

Melitz, M. J., & Ottaviano, G. I. P. (2008). Market Size, Trade, and Productivity. Review of Economic Studies, Wiley Blackwell, vol. 75(1), pages 295-316, 01.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, *9*(1), 86-136.

Van Beveren, I. (2012). Total Factor Productivity Estimation: A Practical Review. *Journal of Economic Surveys*, *26*(1), 98–128.

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, *104*(3), 112-114.

Tables

Table 9 Differences for basic characteristics of enterprises different ownerships

	(1)	(2)	(3)	(4)	(5)
	lnvalueadded	r_salary	ros	tax_sale	rd
	state-owned enterprise				
tradestyle1	0.465***	3.524***	1.964**	0.109	-0.087
	(24.38)	(6.25)	(2.46)	(0.49)	(-1.11)
tradestyle2	0.632***	3.373***	0.955	-0.048	0.022
	(9.61)	(5.86)	(1.32)	(-0.29)	(0.56)
tradestyle3	0.642***	3.758***	1.455**	0.055	-0.020
	(21.74)	(9.05)	(2.02)	(0.25)	(-0.86)
size	1.037***	0.173	0.296***	-0.019	-0.049
	(389.10)	(1.31)	(2.81)	(-1.10)	(-0.95)
age	-0.000***	0.000	-0.000	0.000	-0.001

	(-8.86)	(0.06)	(-0.89)	(1.43)	(-1.00)
capital	0.000***	0.006	-0.000	-0.000	0.000
	(2.92)	(0.94)	(-1.09)	(-0.44)	(0.83)
herfind	0.252***	6.678***	2.215	0.712	-0.174
	(2.81)	(6.49)	(1.07)	(1.45)	(-0.86)
saleincrease	0.000***	0.000***	0.000	0.000	0.000
(industry level)	(18.85)	(5.42)	(0.60)	(0.93)	(1.00)
cons	1.908***	5.975***	-0.696	0.231*	0.251
	(35.64)	(5.79)	(-0.76)	(1.96)	(0.92)
N	144918	153705	153705	153705	89063
	collective enterprise				
tradestyle1	0.197***	1.479***	0.018**	-0.008**	0.000**
	(11.13)	(10.29)	(2.20)	(-2.44)	(2.52)
tradestyle2	0.162***	1.500***	0.053	0.008	-0.000
	(3.19)	(3.68)	(1.36)	(0.30)	(-1.17)
tradestyle3	0.243***	2.847***	0.026	-0.009	0.000
	(10.12)	(12.40)	(1.29)	(-0.64)	(0.26)
size	0.691***	-0.415***	0.010	0.007***	0.000***
	-180.37	(-13.66)	(1.47)	(3.23)	(5.01)
age	-0.000***	-0.001***	-0.000***	0.000	-0.000***
	(-8.36)	(-3.88)	(-4.09)	(0.41)	(-2.98)
capital	0.001***	0.010***	-0.000**	-0.000	0.000***
	(5.08)	(6.48)	(-1.99)	(-0.47)	(3.03)
herfind	0.127	4.060***	-0.021	0.031**	0.005***
	(1.46)	(4.49)	(-0.20)	(2.44)	(2.87)
saleincrease	0.000	-0.000***	0.000	-0.000*	0.000
(industry level)	(0.55)	(-3.41)	-1	(-1.76)	(0.06)
cons	3.043***	7.806***	0.265***	0.120***	-0.000
	(23.18)	(18.19)	(5.51)	(9.29)	(-0.58)
N	144334	147098	147098	147098	89514
	Independent legal person enterprise				
tradestyle1	0.105***	2.488***	0.067***	-0.011***	-0.001
	(10.19)	(3.72)	(3.18)	(-8.99)	(-0.70)
tradestyle2	0.027	2.169***	0.053**	-0.021***	-0.002***
	(0.90)	(3.49)	(1.98)	(-9.60)	(-6.23)
tradestyle3	0.178***	2.946***	0.086***	-0.021***	-0.001*
	(12.09)	(11.38)	(2.86)	(-16.65)	(-1.82)
size	0.856***	0.204**	0.022	-0.000	0.001***
	(334.12)	(2.04)	(1.63)	(-0.08)	(3.96)
age	-0.001***	0.002***	-0.001***	0.000	0.000
	(-9.28)	(3.33)	(-3.95)	(0.56)	(1.29)
capital	0.000***	0.004	-0.000	0.000	0.000
	(3.17)	(1.15)	(-1.18)	(0.37)	(0.75)

herfind	0.559***	8.649***	0.232	-0.022	0.014***
	(6.80)	(3.19)	(0.94)	(-0.94)	-3.16
saleincrease	0.000***	0.000*	0.000	0.000	-0.000
(industry level)	(4.52)	(1.80)	(0.49)	(0.68)	(-0.78)
cons	3.607***	12.150***	-0.006	0.153***	-0.011**
	(23.99)	(4.14)	(-0.07)	(12.84)	(-2.35)
N	166837	170995	170995	170995	132293
	private enterprise				
tradestyle1	0.111***	0.684***	0.004	-0.011***	0.001***
	(15.62)	(6.87)	(0.72)	(-5.91)	(7.31)
tradestyle2	0.024	0.762	0.006	-0.017***	-0.001***
	(0.53)	(1.62)	(0.67)	(-9.76)	(-3.05)
tradestyle3	0.243***	1.483***	0.005	-0.021***	0.000
	(18.61)	(9.39)	(0.72)	(-7.45)	(0.69)
size	0.800***	-0.210	-0.002	0.002	0.001***
	(392.13)	(-1.64)	(-0.44)	(0.70)	(18.04)
age	-0.000***	-0.001**	-0.000***	0.000	0.000
	(-7.92)	(-2.16)	(-2.58)	(1.52)	(1.10)
capital	0.002***	0.027***	-0.000	0.000	0.000***
	(24.82)	(3.73)	(-1.19)	(0.79)	(4.92)
herfind	0.462***	0.587	0.027	-0.025***	0.008***
	(7.22)	(0.22)	(1.35)	(-2.62)	(6.58)
saleincrease	0.000	0.000	0.000	-0.000	-0.000
(industry level)	(0.83)	(1.11)	(1.24)	(-1.52)	(-0.44)
cons	3.075***	12.420***	0.064	0.104***	-0.004***
	(21.65)	(12.14)	(1.33)	(11.77)	(-4.69)
N	260718	263880	263880	263880	215903
	Hong Kong, Macao and Taiwan enterprises				
tradestyle1	-0.028**	0.953***	-0.001	-0.006***	-0.001
	(-2.16)	(5.28)	(-0.25)	(-8.76)	(-0.83)
tradestyle2	-0.229***	-0.399***	-0.008***	-0.014***	-0.001**
	(-20.21)	(-2.63)	(-3.98)	(-20.57)	(-2.36)
tradestyle3	-0.056***	0.701***	-0.003	-0.016***	-0.000
	(-5.30)	(5.06)	(-1.12)	(-25.80)	(-0.51)
size	0.859***	-0.268***	0.008***	-0.000	-0.000
	(229.30)	(-4.39)	(3.56)	(-1.38)	(-0.59)
age	-0.000	0.002*	-0.000	0.000	-0.000
	(-0.48)	(1.87)	(-0.78)	(0.13)	(-0.33)
capital	0.001***	0.009***	-0.000***	0.000**	0.000
	-6.23	-7.62	(-3.48)	(2.31)	(1.55)
herfind	0.703***	14.370***	-0.199**	-0.018***	0.009
	(4.61)	(5.88)	(-2.35)	(-2.67)	(0.74)
saleincrease	0.000	-0.000	0.000	-0.000**	-0.000
(industry level)	(1.01)	(-1.21)	(0.06)	(-2.17)	(-0.25)

cons	4.648	14.19***	-0.048	0.123***	0.001
	0	(3.14)	(-0.22)	(2.76)	(0.34)
N	73589	75070	75070	75070	57142
	non-Hong Kong, Macao and Taiwan enterprises				
tradestyle1	0.014	1.203***	0.021***	-0.006***	0.001
	(0.97)	(3.53)	(2.98)	(-4.84)	(1.33)
tradestyle2	-0.244***	-1.112	0.008	-0.019***	-0.001***
	(-13.31)	(-1.03)	(1.22)	(-16.87)	(-5.59)
tradestyle3	0.012	0.794***	0.021***	-0.018***	-0.000**
	(1.02)	(3.44)	(3.89)	(-16.13)	(-2.08)
size	0.895***	-0.957***	0.007***	-0.000	0.000**
	(221.09)	(-6.17)	(2.67)	(-0.18)	(2.33)
age	0.000	0.001	0.000	0.000***	-0.000
	(0.19)	(1.15)	(0.38)	(2.64)	(-0.62)
capital	0.000***	0.001***	-0.000	0.000**	0.000
	(5.88)	(5.56)	(-1.18)	(2.19)	(0.99)
herfind	1.678***	41.800***	-0.040	-0.019**	0.020***
	(12.43)	(10.76)	(-0.87)	(-2.57)	(2.89)
saleincrease	-0.000	-0.000	0.000	0.000	0.000
(industry level)	(-0.14)	(-0.09)	(1.12)	(0.52)	(0.66)
cons	5.000	13.230***	0.389***	0.140***	0.089
	.	(5.27)	(3.10)	(2.92)	(0.99)
N	63805	65562	65562	65562	50868

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively.

Table 10

Differences for import price of enterprises different ownerships and trade terms

	Average export price	Average import price	Ratio of export price to import price	Average export price	Average import price	Ratio of export price to import price
	All firms			Foreign firms		
Processing trade firms	-73.07***	-37.64***	-2.356***	-82.56***	-47.03***	-1.170**
	(-8.05)	(-11.55)	(-7.93)	(-4.03)	(-8.59)	(-2.50)
Other trade firms	-15.57**	-35.09***	-0.475*	-12.50	-37.59***	0.695
	(-2.36)	(-14.69)	(-1.91)	(-0.78)	(-8.62)	(1.62)
Observation	186288	113476	113413	44424	37272	37202
R-Square	0.2193	0.1303	0.1204	0.1960	0.1622	0.1361

Note: the based group is general trade firms. Age, scale, ownership-specific fixed effects, the 4-digit industry-specific fixed effects, province-specific fixed effects and year-specific fixed effects are included in the estimation. Robust t-values corrected for clustering at the firm level in parentheses. *, **, *** indicates significance at the 10, 5, 1 percent level respectively.

Appendix：

Table 5-2 Results of different measures method of TFP in different ownerships

	OWN=1	OWN=2	OWN=3	OWN=4	OWN=5	OWN=6
	tfp_fe					
ex	0.344***	0.080***	0.058***	0.039***	-0.113***	-0.033***
	(32.95)	(10.76)	(9.42)	(9.25)	(-13.43)	(-3.36)
size	0.125***	-0.592***	-0.332***	-0.592***	-0.457***	-0.376***
	(9.91)	(-29.83)	(-22.29)	(-45.11)	(-18.56)	(-15.69)
$size^2$	0.019***	0.062***	0.048***	0.074***	0.061***	0.056***
	(17.69)	(32.03)	(35.40)	(57.03)	(27.23)	(25.95)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.000	0.000
	(-8.38)	(-8.81)	(-9.51)	(-8.92)	(-0.49)	(0.30)
capital	0.000***	0.001***	0.000***	0.001***	0.001***	0.000***
	(3.22)	(12.12)	(3.49)	(22.96)	(11.35)	(6.09)
herfind	0.147*	0.108	0.345***	0.400***	0.582***	1.442***
	(1.69)	(1.29)	(4.36)	(6.32)	(4.14)	(11.46)
saleincrease	0.000***	-0.000	0.000***	0.000	0.000	-0.000
(industry level)	(9.57)	(-0.36)	(4.25)	(0.71)	(0.62)	(-0.28)
cons	2.168***	4.056***	4.345***	5.659	5.395	3.056***
	(34.98)	(29.47)	(26.83)	(0.01)	(0.00)	(6.37)
N	140563	138886	160402	247927	71282	62028
	tfp_opa					
ex	0.297***	0.068***	0.050***	0.052***	-0.094***	-0.042***
	(28.80)	(9.10)	(8.13)	(12.41	(-11.05)	(-4.32)
szie	-0.154***	-0.836***	-0.465***	-0.783***	-0.641***	-0.627***
	(-12.04)	(-42.56)	(-31.92)	(-60.72)	(-26.92)	(-26.61)
$Size^2$	0.015***	0.060***	0.033***	0.065***	0.054***	0.054***
	(14.17)	(31.78)	(24.79)	(51.61)	(25.13)	(25.47)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.000	0.000
	(-7.99)	(-9.38)	(-9.31)	(-9.61)	(-0.42)	(0.61)
capital	0.000***	-0.001***	0.000***	-0.001***	-0.000***	0.000***
	(4.68)	(-10.88)	(7.23)	(-15.73)	(-5.00)	(6.85)
herfind	0.118	0.165*	0.203**	0.369***	0.528***	1.158***
	(1.35)	(1.91)	(2.53)	(5.69)	(3.96)	(9.74)
saleincrease	0.000***	-0.000	0.000***	0.000	0.000	-0.000
(industry level)	(9.17)	(-0.85)	(3.93)	(0.70)	(0.40)	(-0.52)
cons	1.406***	3.213***	2.978***	4.738	4.082	1.575***
	(22.45)	(22.53)	(17.23)	.	.	(3.26)
N	140563	138886	160402	247927	71282	62028
	tfp_opb					
ex	0.296***	0.068***	0.050***	0.053***	-0.094***	-0.042***
	(28.69)	(9.06)	(8.09)	(12.46)	(-10.99)	(-4.33)

size	-0.159***	-0.841***	-0.467***	-0.787***	-0.644***	-0.632***
	(-12.45)	(-42.73)	(-32.06)	(-60.90)	(-27.05)	(-26.79)
$size^2$	0.015***	0.060***	0.032***	0.065***	0.054***	0.054***
	(14.08)	(31.72)	(24.52)	(51.39)	(25.05)	(25.43)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.000	0.000
	(-7.98)	(-9.39)	(-9.30)	(-9.61)	(-0.42)	(0.62)
capital	0.000***	-0.001***	0.000***	-0.001***	-0.000***	0.000***
	(4.74)	(-11.00)	(7.46)	(-16.03)	(-5.62)	(6.75)
herfind	0.118	0.166*	0.200**	0.368***	0.527***	1.152***
	(1.35)	(1.92)	(2.49)	(5.68)	(3.95)	(9.69)
saleincrease	0.000***	-0.000	0.000***	0.000	0.000	-0.000
(industry level)	(9.16)	(-0.86)	(3.92)	(0.70)	(0.40)	(-0.53)
cons	1.389***	3.195***	2.948***	4.715	4.056	1.544***
	(22.17)	(22.37)	(17.03)	0	.	(3.19)
N	140563	138886	160402	247927	71282	62028
	tfp_lpnn					
ex	0.344***	0.080***	0.058***	0.038***	-0.114***	-0.033***
	(32.96)	(10.76)	(9.43)	(9.23)	(-13.44)	(-3.35)
size	0.478***	-0.239***	0.020	-0.239***	-0.104***	-0.023
	(37.95)	(-12.03)	(1.33)	(-18.23)	(-4.23)	(-0.97)
$size^2$	0.019***	0.062***	0.048***	0.074***	0.061***	0.056***
	(17.71)	(32.02)	(35.45)	(57.03)	(27.24)	(25.95)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.000	0.000
	(-8.38)	(-8.80)	(-9.51)	(-8.91)	(-0.49)	(0.30)
capital	0.000***	0.001***	0.000***	0.001***	0.001***	0.000***
	(3.22)	(12.16)	(3.49)	(22.99)	(11.36)	(6.08)
herfind	0.148*	0.108	0.346***	0.400***	0.582***	1.443***
	(1.69)	(1.29)	(4.37)	(6.32)	(4.14)	(11.46)
saleincrease	0.000***	-0.000	0.000***	0.000	0.000	-0.000
(industry level)	(9.57)	(-0.35)	(4.25)	(0.71)	(0.62)	(-0.28)
cons	2.173***	4.061***	4.353***	5.664	5.41	3.065***
	(35.04)	(29.50)	(26.89)	.	.	(6.39)
N	140563	138886	160402	247927	71282	62028
	tfp_gmm					
ex	0.347***	0.080***	0.059***	0.038***	-0.115***	-0.033***
	(33.14)	(10.84)	(9.47)	(9.01)	(-13.53)	(-3.28)
size	-0.002	-0.721***	-0.469***	-0.725***	-0.590***	-0.505***
	(-0.19)	(-36.11)	(-31.31)	(-54.83)	(-23.85)	(-20.96)
$size^2$	0.019***	0.062***	0.049***	0.075***	0.061***	0.056***
	(17.88)	(31.88)	(35.96)	(57.03)	(27.27)	(25.88)
age	-0.000***	-0.000***	-0.001***	-0.000***	-0.000	0.000
	(-8.39)	(-8.76)	(-9.50)	(-8.85)	(-0.50)	(0.28)
capital	0.000***	0.001***	0.000***	0.001***	0.001***	0.000***
	(3.18)	(12.56)	(3.44)	(23.28)	(11.47)	(6.03)

herfind	0.149*	0.105	0.355***	0.402***	0.585***	1.461***
	(1.70)	(1.25)	(4.47)	(6.34)	(4.14)	(11.52)
saleincrease	0.000***	-0.000	0.000***	0.000	0.000	-0.000
(industry level)	(9.59)	(-0.33)	(4.26)	(0.71)	(0.64)	(-0.27)
cons	2.219***	4.112***	4.436***	5.72	5.485	3.155***
	(35.74)	(29.84)	(27.45)	.	0	(6.57)
N	140563	138886	160402	247927	71282	62028

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels, respectively. Estimations include industry, province, and time (year) specific effects.

Table 6-2 Differences in TFP (measured by different methods) for Enterprises of different ownership

		OWN=1	OWN=2	OWN=3	OWN=4	OWN=5	OWN=6
tfp_fe	tradestyle1	0.405***	0.143***	0.079***	0.087***	-0.007	0.014
		(-21.92)	(8.83)	(8.09)	(12.73)	(-0.56)	(1.04)
	tradestyle2	0.609***	0.141***	0.014	-0.025	-0.216***	-0.222***
		(9.68)	(2.87)	(0.49)	(-0.58)	(-20.11)	(-13.05)
	tradestyle3	0.569***	0.182***	0.141***	0.148***	-0.051***	0.008
		(20.09)	(8.19)	(10.28)	(11.75)	(-5.05)	(0.68)
tfp_opa	tradestyle1	0.337***	0.065***	0.034***	0.047***	0.023*	0.02
		(18.61)	(3.99)	(3.51)	(6.98)	(1.81)	(1.51)
	tradestyle2	0.552***	0.100**	-0.023	-0.073*	-0.202***	-0.202***
		(9.04)	(2.04)	(-0.85)	(-1.69)	(-18.85)	(-12.43)
	tradestyle3	0.483***	0.101***	0.092***	0.096***	-0.068***	-0.022**
		(17.66)	(4.54)	(6.85)	(7.66)	(-6.68)	(-2.04)
tfp_opb	tradestyle1	0.336***	0.063***	0.033***	0.047***	0.024*	0.020
		(18.52)	(3.88)	(3.41)	(6.85)	(1.85)	(1.52)
	tradestyle2	0.551***	0.099**	-0.024	-0.074*	-0.202***	-0.202***
		(9.02)	(2.02)	(-0.88)	(-1.71)	(-18.80)	(-12.40)
	tradestyle3	0.481***	0.099***	0.091***	0.095***	-0.069***	-0.022**
		(17.59)	(4.46)	(6.77)	(7.56)	(-6.71)	(-2.10)
tfp_lpnn	tradestyle1	0.405***	0.144***	0.079***	0.087***	-0.007	0.014
		(21.94)	(8.86)	(8.11)	-12.76	(-0.58)	(1.04)
	tradestyle2	0.610***	0.141***	0.014	-0.025	-0.216***	-0.222***
		(9.68)	(2.87)	(0.50)	(-0.57)	(-20.11)	(-13.05)
	tradestyle3	0.569***	0.183***	0.141***	0.148***	-0.051***	0.008
		(20.10)	(8.20)	(10.29)	(11.77)	(-5.03)	(0.70)
tfp_gmm	tradestyle1	0.409***	0.148***	0.082***	0.089***	-0.009	0.014
		(22.09)	(9.10)	(8.36)	(13.08)	(-0.72)	(1.01)
	tradestyle2	0.613***	0.143***	0.016	-0.022	-0.216***	-0.223***
		(9.69)	(2.91)	(0.57)	(-0.50)	(-20.10)	(-13.03)
	tradestyle3	0.574***	0.188***	0.144***	0.151***	-0.050***	0.010
		(20.19)	(8.39)	(10.46)	(11.99)	(-4.92)	(0.85)

Note: Robust t statistics in parenthesis. The symbols *, ** and *** refer to the 10%, 5% and 1% significance levels,

respectively. The control variables contain size, size2, age, capital, herfind, saleincrease (industry level), and the fixed effects of province, industry, and year.