Processing trade, Sunk Costs, Firm Heterogeneity and Export Behavior[①]

——Theory and evidence from China

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Abstracts

There are debates that whether can the export behavior be explained by the firm heterogeneity and sunk costs, because more than half of the export of China are processing trade whose firms has been exporting when they were founded. This paper provides a theory framework and gives substantial evidence considering processing trade. We define the firms which only serve domestic market and only serve export market as single-market-firms, and the firms which serve both domestic and export market as integrated market firms. Then we use the firm-level data from Manufacture of Communication Equipment, Computers and other Electronic Equipment of China in 2004-2006 to construct a probit model. We find that the greater the TFP, the higher the probability of the firm to become an integrated market firm. At the same time, the sunk costs are significant to affect the export behavior of firms. This research makes the policy implication of heterogeneous-firm trade model more obviously. Government should provide policy assistance for both of the firms wanted to export and the export firms wished to enter domestic market to reduce costs to become integrated market firms.

Key Words: heterogeneous-firm trade model; full export enterprises; TFP; firm-level data; probit model

1. Introduction

The three major demands in the structure of China's economic growth has changed significantly as the net exports decreased from 2008.The contribution of net exports to GDP growth rate declined from 22.8% in 2005 to -4.3% in 2011. At the same time, the contribution of domestic consumption and capital formation to the GDP growth rate rose to 55.5% and 48.8% in 2011 from 38.7% and 38.5% in 2005 respectively. [②] As along with the financial crisis, the shrink of foreign demand and increase of international completion make great pressures on the export enterprises in China whose share of export in the world decline since 2007. The share of export in GDP of China has been lower than the world average level in 2009. The changes in the external market make the future development of export enterprises in China to stand at a crossroad. They need to consider how to reduce the rate of decline of the international market on the one hand. And they also need to consider how to use the potential of the domestic market the opportunity to obtain the time to transform and upgrade. In such context, what kind of business can survive in the crisis, as well as what are the ways for them to survive are not only important theoretical issues, but also may be able to provide a basis of making development strategies for export enterprises.

Heterogeneous enterprise trade model proposed by Melitz(2003) was often used to

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explain the export behavior of enterprises. The model theoretically answered what kind of local enterprises will enter the export market and what will happen after they enter the export market. The model has proved that the higher productivity of enterprises will enter the export market, which makes resources reconfigure therefore overall industrial productivity improved. Thus, the worldwide phenomenon that there are performance advantages of export enterprises compared with the non-export enterprises in productivity and so on can be explained. For example, Bernard and Jensen (1995, 1999, 2004)‘ s studies about the US, Bernard & Wagner(1997)’s study about Germany, Clerides et al (1999)’s study about Colombia, Mexico and Morocco and Greenaway and Kneller (2004)’s study about British found that with compared non-export enterprises, export enterprises show larger scale, higher productivity, pay higher wages, and hire more skilled workers.

However, the revelation of the model to guide the development of export enterprises in China has not yet been fully excavated. Academically, there are debates when it is used to explain the export behavior of firms in China. Some researchers found it can be tested that the higher the productivity is, the export possibilities larger as referred to the firms in China(Jingtao Yi(2009); Wei Zhao, Jinliang Zhao and Yuanyuan Han, (2011)). But some researchers think the relationship between productivities and export behaviors cannot be explained simply by the heterogeneous, especially for the enterprises consumed Processing trade (Chunding Li(2010); Lu Lu and Tao(2010)). Chunding Li and Xiangshuo Yin (2009) proposed the “Productivity Paradox” to describe their found that the productivities of firms with export are lower than the non-export firms. They think the reason of productivity paradox may the processing trade. Lu Lu and Tao (2010) provide a theoretical proof for the foreign direct investment enterprises that if they arrange the manufacturing in China and designing in the US, then the productivity of the firm will be higher when sale the product in the US than sale in China.

This paper combine the opinions of Melitz(2003) and Lu Lu and Tao (2010) to make a theory framework to consider processing trade in the heterogeneous-firms trade model and use the firm-level data in manufacture of communication equipment, computers and other electronic equipment of China from 2004 to 2006 to test the theory with probit model. The statistics show the domestic and international markets are segmented. Although the productivity can used to explain which market the firms choose, the sunk cost is important factor for them to make the decision to enter the other market. The research makes the policy implication of heterogeneous-firm trade model for China more clear.

2. Theory

The focus of the heterogeneous-firm trade model is the local firms’ export behavior in the internationalization. Its basic theoretical logic is the higher productivity of local enterprises, the greater the likelihood of its exports. In the model, the position of the firms in the global production chain is ignored. But it is really important when the model is used to explain the export behavior of firms in China. At the beginning of reform and opening up of China, the market-oriented process is promoted by introducing foreign direct investment to do original equipment manufacturers (OEM) production. And China has gradually developed into the world’s largest manufacturing base and drive the growth of local firms in the process.

Half of the exports of China belong to processing trade, and half of the export of China produced by foreign direct investment enterprises since 1998. The firms consuming processing trade import raw materials from abroad and export after assembly processes. The product of these firms cannot sale in domestic market without special approval and there are special tax breaks for them. For this reason, the firms have been export firms since they were born and they have no competitiveness in the native market. The productivity of these firms isn’t higher than non-export firms. The result is that productivity paradox is shown in the data.

Lu, Lu and Tao (2010) construct a model for two-countries. It is assumed that the product is designed in a country and manufactured in another country, then the productivity of the firm sale in both of the country will perform best and the firm only sale in the manufactured country will perform worst if the market in both of the country is huge enough. We can define the firms who sale their product in domestic market as internal-demand-oriented firms and the firms who sale their product in foreign market as external-demand-oriented firms. The market expansion of the former firms is to export and the market expansion of the latter firms is to develop the domestic market. The enterprises sale their product both in the domestic and foreign market will be the best firms with the highest productivity which is defined as market-integrated firms. Correspondingly, internal-demand-oriented firms and external-demand-oriented firms are market-separated firms.

We can see the export firms are few and most of the firms are non-export firms in China as other countries. The difference is that there are some firms export all of their products which mean that their sales are equal to exports. We call this kind of firms as full-export firms and the other export firms are semi-export firms. It shows that the domestic market and foreign market is separated for the firms located in China. The internal-demand-oriented firms face a separated global market since there are sunk costs if they wanted to enter the foreign market. As the research of Jingtao Yi (2009) shows, sunk cost is an important factor when firms decided to export. However, the fact that the sunk cost when full export decided to enter the domestic market is ignored.

First of all, the processing trade policies restrict the firms in export market. If the processing trade firms want to sale their product in domestic market, not only need to pay tax, but also need to request government for approval. It is policy barrier which can add sunk cost for the firms. Secondly, the products produced for the foreign market may not applicable for domestic. If they want to shift the market, they may need to transform the original product. For example, the voltage is requested to 220v in China. The household appliances produced for the foreign market may be requested to 110v. If the firms want to sale them in China, they need to transform the machines to satisfy the use habits in China. And sunk cost can appear in this case. Third, the same products in manufacturing may different in the different market for the reasons like band and so on. For instance, a pair of shoes can be a famous product after export with simple package. But if the manufacturer want to sale it in domestic market, it may become a counterfeit goods for lack of patented or brand authorized. Obtain the authorities many produce sunk cost. If the firms want to construct a new product, they may need to pay marketing costs. So there are sunk costs faced by full export firms who want to enter the domestic market.

Because of the sunk cost faced by internal-demand-oriented firms and external-demand-oriented firms, they can be concluded in the same kind which we call them market-separated firms. And the expansion aim is to become a market-integrated firms who sale their product both in domestic and foreign market. Combined with heterogeneous-firm trade model, we can forecast that the higher the TFP is, the more likelihood the market-separated firms to become a market-integrated firm.

3. Data and Description

In this research, we use the Industry Enterprise Statistics Database sourced from National Bureau of Statistics of China. We focus in enterprises in Manufacture of Communication Equipment, Computers and other Electronic Equipment from 2004 to 2006 for two reasons. First, we need to limit the sample in a suitable size. Secondly, it is an important industry with many processing trade enterprises. Third, the First Economic Census of China happened in 2004 and there are huge enterprises founded in the census. It is better to compare the sample since 2004. Finally, we think it is better to avoid the financial crisis period.

The export behavior can be measured as three kinds. Internal-demand-oriented firms

can be measured as non-export enterprises in which the exports are zero. External-demand-oriented firms can be measured as full-export enterprises in which the exports are equals to the sales. They are market-separated firms. Market-integrated firm can be measured as semi-export enterprises in which the exports are higher than zero and lower than sales. As it is shown in table one, more than 73% of domestic funded enterprises is non-export ones. But it is different in foreign direct investment enterprises. The same share is no more than 30% both in enterprises with funds from Hong Kong, Macao and Taiwan and foreign funded enterprises. Furthermore, the share of full-export enterprises is really high especially in foreign direct investment enterprises. The share of full-export enterprises is about 20% in foreign funded enterprises and about 30% in enterprises with funds from Hong Kong, Macao and Taiwan. But only about 3% of domestic enterprises are full-export ones. If we observe the variation trend, we can see that the share of non-export enterprises in domestic funded enterprises decreased and, at the same time, the share of full-export enterprises in foreign direct investment enterprises decreased too.

Table 1 Num. of Enterprises with different export behaviors and ownership in Manufacture of Communication Equipment, Computers and other Electronic Equipment in China in 2004-2006

Year	Ownership	Non-export		Semi-export		Full-export		Total	
		Num. of Enterprises(unit)	Share in total （%）	Num. of Enterprises(unit)	Share in total （%）	Num. of Enterprises(unit)	Share in total （%）	Num. of Enterprises(unit)	Share in total （%）
2004	Domestic Funded	3217	73.8	1013	23.2	128	2.9	4358	100
2005		3042	73.2	992	23.9	120	2.9	4154	100
2006		3121	73.2	1004	23.6	136	3.2	4261	100
2004	Enterprises with funds from Hong Kong, Macao and Taiwan	484	21.8	1041	46.8	697	31.4	2222	100
2005		561	25.9	977	45.1	629	29	2167	100
2006		557	26.2	969	45.6	600	28.2	2126	100
2004	Foreign Funded Enterprises	489	20.1	1391	57.1	557	22.9	2437	100
2005		629	25.6	1334	54.2	496	20.2	2459	100
2006		666	26	1397	54.6	494	19.3	2557	100

Total factor productivity (TFP) is important indicator in heterogeneous-firm trade model. We use income from sales measuring output and consider intermediate input as well as labor and capital as input. We use the price indexes special for the right industry to adjust the measures separately. And we use Solow residual as the TFP measure.

Table.2 TFP with different export behaviors and ownership in Manufacture of Communication Equipment, Computers and other Electronic Equipment in China in 2005-2006

Ownership	Export Behaviors	5%	25%	50%	75%	95%	Mean	Variance
Domestic Funded Enterprises	Non-export	-0.5711	-0.1574	-0.0015	0.1607	0.5951	0.0027	0.1819
	Semi-export	-0.4314	-0.1203	-0.0049	0.1216	0.4526	-0.0043	0.1143
	Full-export	-0.6129	-0.1843	-0.0238	0.1455	0.4729	-0.0107	0.1449
Enterprises with funds from Hong Kong,	Non-export	-0.6220	-0.1764	-0.0023	0.1631	0.6563	0.0019	0.2141
	Semi-export	-0.4587	-0.1447	-0.0019	0.1487	0.4917	0.0034	0.1308

Macao and Taiwan	Full-export	-0.6150	-0.1900	-0.0228	0.1233	0.5165	-0.0493	0.1725
Foreign Funded Enterprises	Non-export	-0.6680	-0.2105	-0.0304	0.1735	0.6333	-0.0230	0.2173
	Semi-export	-0.4646	-0.1309	0.0072	0.1758	0.5944	0.0262	0.1388
	Full-export	-0.5480	-0.1561	0.0053	0.1689	0.5984	0.0098	0.1863

4. Emprical analysis

In this paper, the empirical model is transformed into the following form:

$$Y_{it} = C + \beta_1 Y_{i(t-1)} + \beta_2 TFP_{it} \tag{1}$$

$$Y = \begin{cases} 0, & market-separated\ firm \\ 1, & market-integrated\ firm \end{cases} \tag{2}$$

Here,Y indicates the export behavior. Non-export and full-export enterprise are market-separated enterprise valued as 0 and semi-export enterprise valued as 1, Y_{it} indicates the i enterprise's export behavior in t year. If the coefficient β_1 of $Y_{i(t-1)}$is significantly positive, it means that the entry cost exists. TFP indicates i enterprise's TFP in t year. If the coefficient β_2 is significantly positive, it means that the higher the TFP is, the higher the probability of enterprise becomes market-integrated enterprises. TFP is measured as Solow Residual.

Considering the possible impact of enterprises' ownership, we design two sets of programs to control ownership in this paper. The first program assumes that if the enterprise ownership is different, the probability is different to change the export behaviors. But the impacts of TFP and sunk costs are the same. Ownership becomes the independent variables in the model expressed by OS:

$$Y_{itk} = C + OS_k + \beta_1 Y_{i(t-1)k} + \beta_2 TFP_{itk} + \varepsilon_{itk} \tag{3}$$

$$K = \begin{cases} 1, & Domestic\ Funded\ Enterprises \\ 2, & Enterprises\ with\ funds\ from\ Hong\ Kong, Macao\ and\ Taiwan \\ 3, & Foreign\ Funded\ Enterprises \end{cases} \tag{4}$$

This model is called model 1.The second program assumes that if the enterprise ownership is different, the impact of TFP and sunk costs are different. Then, three models for different types of firm ownership are built:

$$Y_{itk} = C_k + \beta_{1k} Y_{i(t-1)k} + \beta_{2k} TFP_{itk} + \varepsilon_{itk} \tag{5}$$

Domestic funded enterprises, Hong Kong, Macao and Taiwan funded enterprise and foreign funded enterprises are used in the three models which we call model 2,model 3 and model 4. Four of the models faced the problem that 0-1 variables dependent variables. Probit model is use to estimate and test.

Estimation results are shown in Table 3. The sunk costs is a significant factor from the four models. The export behavior of an enterprise in the current year is closely related to status in last year. In terms of TFP, the conclusions of the four models are not consistent. It is significant only in model 1 and model 3. It can be proved that heterogeneous-firm trade model can explain TFP is determents for the decision of enterprises that change their export behavior.

Table 3 Estimates and Tests

	Model 1 All Enterprises	Model 2 Domestic Funded Enterprises	Model 3 Enterprises with funds from Hong Kong, Macao and Taiwan	Model 4 Foreign Funded Enterprises

C	-1.358***	-1.576***	-0.994***	-0.891***
Sunk Costs	1.728***	2.202***	1.142***	1.334***
Foreign Funded Enterprises	0.138***			
Enterprises with funds from Hong Kong, Macao and Taiwan	-0.138***			
TFP	0.080***	0.020	0.163***	0.065

***Sig. of 0.01；** Sig. of 0.05，检验通过；* Sig. of 0.1。

5. Conclusions and policy implication

Heterogeneous-firm trade model does not consider the position of enterprises in the global production chain, thus ignoring the fact that processing trade enterprises has become export enterprises when they was born. But this fact is critical to understand the export activities of Chinese enterprises. The study is useful for exploring the application of heterogeneous-firm trade model for China. The main contribution of this paper is to introduce the processing trade into the heterogeneous-firm trade model. Not only take the development of internal-demand oriented in to account, but also consider the development of external-demanded oriented firms. The factors affecting the market-separately firms to become a market-integrated firm are tested. IT is shown that sunk costs significantly exist and TFP is a determinant for firms to became market-integrated firms. Policy implication of this research is clear. The government should provide policy assistance for full export enterprises as it help enterprises to export by reducing the sunk costs of enterprises to enter the domestic market.

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