Measuring Trade in Value Added for China based on the Firm-level Data

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Abstracts

With the development of globalization, the nature of world trade has changed dramatically in recent years. The production chain has changed from "made in one country" to "made in the world". The share of trade in inputs, also called vertical trade, has dramatically increased. A new statistical method, besides the traditional statistical record, "value-added trade" which is net of double-counted vertical trade is proposed. It reallocates trade flows to original input-producing industries and countries and allows to answer the question "who produces for whom". How to measure the trade in value-added is still difficult, even though there is a popular approach using II-O table. This presentation will describe a new approach from the micro-level view of angle, measuring the trade in value-added of China based on the total export-oriented industrial enterprises above designated size. The added value of enterprise which is a concept of national accounting is introduced in order to find the correlation between it and value added of trade.

Key Words: trade in value-added, processing trade, national accounting

1. Introduction

A key feature of globalization is a world of vertically-integrated and fragmented supply chains through production sharing based on international division of labor. The production process for one final goods has been fragmented into several stages and involved several countries. So the goods and services may cross borders several times at different processing stages, which is a complex value chain. For instance, the main value of one country's exports may come from raw material (inputs) imported from several other countries, meanwhile, the value of imports probably contains that of its original exports produced in the country. On this background, conventional trade statistics which is recorded on a gross basis may not appropriately tell the whole story of international production, nor monitor the reality of its trade, imports besides exports for a specific country. The reason is that statistics of gross value may lead to "multiple counting", which records gross value when the product enters or leaves the Customs. What's worse, the repetition is much higher if the process is closer to the end part of the chain.

The international statistical community has realized the above problem, and begins to make some corresponding improvements. The basic idea is that estimating trade data doesn't involve multiple counting by taking away imports contents from exports value. Among various methods, two deserve our attention. One is improvement on recording method processing trade by IMF in "Balance of Payments and International Investment Position" sixth edition(BPM6).Another explore, so-called measuring value-added of trades, that the whole activities of the world trade is considered, has

been gradually propelled by WTO. It gives concern on the whole activities of the world trade. Its purpose is to remove the import content in export and give records on the world trade with net value, serving as a complement besides volume of trade under gross rule.

Both of the approaches are worth something but is also some limited. The approach in BPM6 that replacing conventional trade volume of processing fee can only work in limited range. The application of the input-output model is subject to its strict assumptions. As a summary, trade in value-added is worth something as a concept, but there has no perfect method to be measured. The I-O model can be used as an indirect measurement of value-added in trade, which is the most popular approach in current international study as well as further studies[1]. But in addition, we may ask whether there is another method to inspect and verify one country's value-added in its exports?

This paper intends to do this. Our fundamental ideas are as follows: first, associate one country's value-added of exports with its value-added of enterprise, then compute and analyze one country's value-added rate of exports and its determinant based on firm-lever data. No doubt that this method is also an indirect measurement but it provides some thinking for present dilemma of value-added study.

This article aimed at trade of China gives detailed proof, the process of measurement, and results as well. The structure of the paper is as follows: In a first section, the paper discussed the reason for replacing the value added of enterprise with value-added trade. In a second section, it observe total-export-oriented industrial enterprises above designated size on large samples of China and estimate indirectly the value-added rate of trade of China. In the end, this paper summarizes the meaning and limitation of this study.

2. The model and assumptions: Correlation between trade in value-added and added value of enterprises

First, trade in value-added of exports is formed in the domestic production process. So we can verify and measure trade in value-added of exports through domestic production added-value. Second, due to being not able to get basic data of processing trade enterprises, we try to investigate into total-export-oriented enterprises based on large samples to verify and measure trade in value-added of exports. Third, as an indirect estimation method, results will be underestimated to a certain degree. Fortunately, we can see where the underestimation takes place clearly. Furthermore, the underestimation is in fact limited.

3. Data and econometric approach based on micro data: estimating export of trade in value added according to added value of enterprise

Based on the ideas above, we regard trade in value-added rate of exports as a parameter that need to estimate. After gaining solutions by total-export-oriented enterprises, we can gain an estimate of trade in value-added of China on the basis of the parameter.

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[1] The recent literature includes: Daudin, G., Rifflart, C. and Schweisguth, D. (2011)，Koopman, R., Z. Wang, et al. (2011)，Johnson et al.（2012）

3.1 Data

The calculation in this paper uses the data of industrial enterprises above designated size between the year 1999 and 2008. The data of the census year(2004 and 2008) are from results of China Economic Census. The data of the rest years are from the annual industrial statistics reporting forms. A brief description on the data is given as follows.

3.2 Sample and sample level of significance：total-export-oriented enterprises

So-called total-export-oriented enterprises are enterprises whose total or most output will be exported. On the purpose of identify the enterprises with characteristic of total-oriented-export from all the enterprises above designated size, we design the index of propensity to export which is defined as the rate of an annual enterprise export delivery value to corresponding industrial sales output value. Meanwhile, we design two scope to filter so-called total-oriented-export enterprise: one is propensity to export equals 1,the other is more than or equal to 0.9.The filter results as shown in Table 1.

Careful examination on the ten years' data reveals the significant increase in the population of total-oriented-export enterprises, from more than 8000 in 1999 to close to 20000 in 2008.Its sample level of significance also increases, from 5% in 1999 to 6% in 2008.

Upon closer inspection, it is seen that either the number or sample level of significance, total-oriented-export enterprises undergo a dynamic process in which it go from low to high then somewhat dropping in growth rate. The period between 2004 and 2005 is the peak of the round of changes.

Table 1 filter results of total-export-oriented enterprises

year	Total number of enterprises *	total-export-oriented enterprises（definitions 1）		total-export-oriented enterprises（definitions 2）		comparison（definitions 2- definitions 1）	
		number of enterprise	the proportion of the total number（%）	number of enterprise	the proportion of the total number（%）	number of enterprise	the proportion of the total number（%）
1999	159935	8251	5.16	12185	7.62	3934	2.46
2000	160851	9524	5.92	13901	8.64	4377	2.72
2001	169354	10400	6.14	15206	8.98	4806	2.84
2002	179736	11531	6.42	17030	9.48	5499	3.06
2003	194078	13320	6.86	19535	10.07	6215	3.20
2004	274023	21163	7.72	30344	11.07	9181	3.35
2005	269233	19075	7.08	27440	10.19	8365	3.11
2006	298532	20269	6.79	28569	9.57	8300	2.78
2007	332505	21043	6.33	29867	8.98	8824	2.65
2008	421704	19176	4.55	28375	6.73	9199	2.18

*mean :number of enterprises above designed size with deduction ones whose basic data are unreasonable.

3.3 Definition of added value of enterprise and measurement approach

Our objection is to estimate the value-added rate of total-export-oriented enterprises. In order to do this, we must measure added-value and output. Based on the related data of industrial enterprises, referring to basic definition and measurement method supplied by "China economic census year GDP accounting method" (The National Bureau of Statistics, 2007) and "China economic non-census year GDP accounting method" (The National Bureau of Statistics, 2008) as a reference, the specific calculation method of our study is determined as follows:

Output is the summation of total industrial output value and value-added tax payable, which can be obtained by adding to each other.

Added value, according to its definition, can be calculated either by production approach or by income approach. But based on the data supplied by the industrial enterprise statistics, we can only use income approach. Namely, we first measure payment for labor, net value of production tax, depreciation on the fixed assets and operation surplus respectively.

Compared with the strict enterprise value accounting method, the method above ignore some terms that should be included in the formulas. These terms are mainly implied contents in other terms which are difficult to separate.

3.4 Results

On the basis of the final sample enterprises, we obtained total-oriented-export enterprises value-added rate during the interval between 1999 and 2008, as shown in Fig.1.It is can seen that results based on two definitions has approximately the same dynamic trend. The level of rate based on definitions 1 is higher than that of definition 2, moreover, the gap between them is widening which shows different propensity to export has a certain impact on value-added rate.

According to the results based on definitions 1, the value-added rate increase from 21.10% in 1999 to 24.22% in 2008, which is up 3.1 percentage points. The margin of increase is quite significant.

The value-added rate goes up after 2003 with noticeable increase, which indicates in the explosive growth of foreign trade (including processing trade) there is not only the change of quantity but also that of quality. The rise the value-added rate makes active contribution of it. This trend has continued, and reach the peak in 2008, seemly not affected by the financial crisis which has begun to emerge.
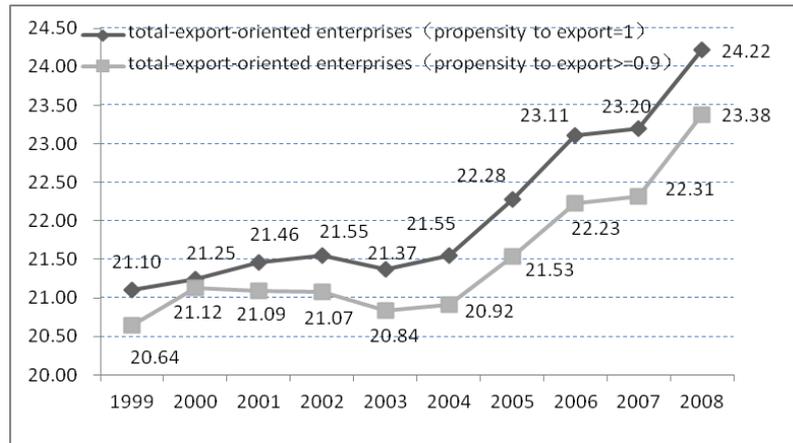
Figure1：Total-oriented-export enterprises value-added rate during the interval between 1999 and 2008

3.5 Estimation of trade in value-added of exports of China based on enterprise value-added rate

If the approximation equivalence relation with enterprises value-added rate and trade in value-added rate can be approved, we can use it as a parameter to give adjusted estimator on export in value-added. As mentioned above, the definition of total-oriented-export enterprise value-added rate corresponds to processing export instead of all merchandise export. Therefore, our analyzing thought is recon processing trade in value-added and then makes appropriate adjustments in the total export value estimation. Results are shown in Figure2.
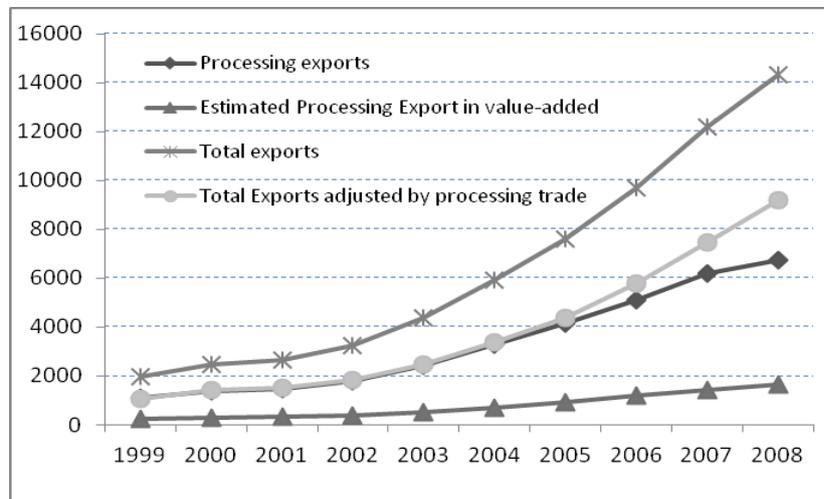

Figure 2.Chinese exports, comparison with before and after adjustment (1999-2008)

5 .Conclusion and future research consideration

We believe that the micro basis of export value-added is enterprise added value. The two kinds of added value are related to each other conceptually. If we can find eligible enterprises as samples, we can estimate corresponding export in value-added on the basis of enterprise value-added rate. In the circumstances that directly estimating trade in value-added with difficulty, this approach as an indirect estimation can be a meaningful explore.

The feasibility of our approach has been verified by the estimation obtained, which supply micro proof for estimation on trade in value-added. Being subject to the data and sample, the results we get may have systematic errors. The limitation comes from three aspects. Firstly, the substitute total-oriented-export enterprises to processing trade enterprises. Secondly, the sample enterprises are industrial enterprises above designated size (revenue from principal business over 5 million yuan), not including enterprises below designated size. Propensity to export and trade in value-added rate may be difference from each other. Thirdly, we ignore some terms when accounting the enterprise added value, which will underestimate the results. How to develop further improvement on the three aspects above is the next step for our research.

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