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China's Gains from WTO Accession: Imports versus Exports

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China's Gains from WTO Accession: Imports versus Exports

Abstract

We examine the gains from Chinese accession to the WTO. Using Arkolakis, Costinot, and Rodríguez-Clare (2012) we provide a new quantitative welfare measure by dividing the manufacturing sector into import and export sub-sectors. We then evaluate how the increased openness caused by China's accession to the WTO effects the importing and exporting sectors. We find surprisingly, that the gains to the import sector are larger than the gains to the export sector. Moreover, the size and the dynamic pattern of such gains are different across sectors.

JEL-Codes: F100, F130.

Keywords: gains from trade, import substitution, export promotion.

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1 Introduction

Over the past two decades, China has undergone substantial trade liberalization, becoming more open to trade and making the transition from a more traditional economy to a modern industrialized economy. Specifically, China has reduced its tariff rate from the pre-1996 high rate of 33% to below 10% by 2005. China's trade dependence (measured by the ratio of exports and imports to GDP) has risen from about 35% prior to its accession to the WTO to as high as 65% afterward. In this paper, we analyze the welfare effects of this period of WTO-related trade liberalization. In particular, we focus on the question of whether the welfare gains from trade liberalization are due to gains in import or export industries. This is particularly relevant because China has undergone rapid structural transformation during this liberalization process.

In this paper, we examine the gains from Chinese accession to the WTO, both by comparing the post-WTO regime to the hypothetical state of autarky and by comparing it to the pre-WTO regime. Using techniques developed in Arkolakis, Costinot, and Rodríguez-Clare (2012) we provide a new, more detailed quantitative welfare measure by dividing the Manufacturing sector into exporting and import-substituting sub-sectors. We then evaluate how the increased openness caused by China's accession to the WTO effects these sectors. Thus, we essentially can decompose the gains from WTO accession into those due to importing and those from exporting.

Here are the main findings of our paper. Compared to autarky, most of China's import industries incurred large gains from trade, while most of its exporting industries had modest gains. By looking at welfare gains moving from pre-WTO to post-WTO regimes most of China's import industries incurred large trade gains whereas several of its exporting and relatively closed industries suffered losses.

Moreover, looking at the dynamic gains from trade, we find that most of China's gains

from trade were incurred at the early stage from 1997 to 2002 when tariffs were reduced sharply. Furthermore, by closely examining the pattern of trade versus the gains from trade, we find that across the pre-WTO and the post-WTO regimes, among import industries, ICT and Office industries enjoyed sizable gains from trade throughout and expanded exports over time. However, Chemicals and Machinery had large reductions in import intensities and experienced short-lived gains from trade. In these import industries, the gains from trade (in all but one - Office - industry) were primarily driven by enhanced importing.

We are also interested in what happened to industry-level trade dependence. We can see that Wood, Machinery, ICT and Office industries experienced the largest increase in openness to trade. Additionally, by looking at sectoral output shares reported in Table 1 (the classification of industries is defined in the next section,) one can see that there has been a structural transformation from traditional industries like Food, Textiles and Minerals industries to the more modern Machinery and ICT industries.

The remainder of the paper is organized as follows. In Section 2, we discuss China's trade liberalization process and the changes of trade patterns over time and across sectors. The gains from trade measure is presented in Section 3. We then deliver our quantitative results in Section 4, focusing on comparing gains from trade over time and across sectors, and with the underlying trade patterns. We further decompose the gains from trade by importing and exporting groups as well as by import and export intensities. Section 5 concludes.

2 Trade Liberalization and Trade Pattern

China's accession to the WTO in 2002 resulted in a large increase in international trade. In the late 1980s, China committed to opening up to the global trading system by making a sequence of policy changes which included both a broad range of tariff reductions and important institutional reforms. China has tried to live up to its WTO commitment to

liberalize trade by removing many explicit and implicit trade barriers. In particular, as part of China's accession negotiations, it has agreed to reduce tariffs in protected agricultural industries and to tighten up its regulations on the protection of Intellectual Property Rights in accordance with WTO criteria.

In addition, established tariff-rate quotas to commodities have been decreased to allow for better market access. The tariff cuts are comprehensive and have had profound impacts on industrial development. Traditional rural agriculture which featured labor-intensive production has been greatly affected. There have also been profound affects in some of manufacturing industries, for example Automobiles and ICT. Accession to the WTO has facilitated the import of advanced technology and provided an opportunity to upgrade industrial competitiveness. The effects of these policy reforms is shown in Figure 1.

Figure 1 plots import intensities (Imports/GDP), export intensities (Exports/GDP) and the trade dependence ratio (the sum of import and export intensities.) Before WTO accession the export intensity was around 19% and the import intensity about 17%. Since 2002, these figures rose to over 30% for exports and 25% for imports prior to the recession in 2008. This shows that accession to the WTO resulted in more openness to trade. One can also see that China has enjoyed a significant trade surplus since 1994 and it has continued to grow until the recession in 2008.

Between 1980 to 1996, China's effectively applied tariff rate averaged around 33%. By 1997, in anticipation of accession to the WTO, the average tariff rate was 17.5%. In 2002, when China officially joined the WTO, its effective tariff rate was 12.4% and it has been further reduced to below 10% since 2005. The average tariff rate time series is plotted in Figure 2 for 1992-2010. The data show a rapid rate of liberalization in the 1992-1997 period followed by a more gradual, but steady reduction in tariffs since 1997. We next turn our attention to industry level changes.

For simplicity, we focus on 18 two-digit manufacturing industries. For convenience, we

give a brief name to each of these sectors. For example, Chemicals (labelled as "scode" 8) includes chemicals, chemical products and medicines industries, whereas the ICT sector (scode 16) includes communication, computers and electronic equipment industries. The complete list is given as follows, ordered by the scodes (with the corresponding ISIC codes provided):

A Primary: agriculture, hunting, forestry and fishing (ISIC A01 to B05)

Q Mining: mining and quarrying (ISIC C10 to C14)

1 Food: foods and beverage (ISIC D15)

2 Tobacco: tobacco (ISIC D16)

3 Textile: textile (ISIC D17)

4 Garment: textile wearing apparel, leather and related products (ISIC D18 to D19)

5 Wood: timber, wood products and furniture (ISIC D20)

6 Paper: paper, media and printing (ISIC D21 to D22)

7 Petroleum: coke, petroleum and nuclear fuel(ISIC D23)

8 Chemicals: chemicals, chemical products and medicines (ISIC D24)

9 Rubber: rubber and plastics (ISIC D25)

10 Minerals: Non-metallic mineral products (ISIC D26)

11 Metals: ferrous and non-ferrous metals (ISIC D27)

12 Metal Products: fabricated metal products (ISIC D28)

13 Machinery: general and special purpose machinery (ISIC D29)

14 Transport: railroad, motor vehicles, and transport equipment n.e.c. (ISIC D34 to D35)

15 Electrical: Electrical machinery and equipment n.e.c. (ISIC D31)

16 ICT: communication, computers and electronic equipment n.e.c. (ISIC D32)

17 Office: office, medical, cultural and measuring instruments (ISIC D30, D33)

18 Others: manufacturing n.e.c. and recycling (ISIC D36 to D37)

M Manufacturing: total manufacturing (ISIC D15 to D37)

U Utility: electricity, gas and water supply (ISIC E40 to E41)

N Construction: construction (ISIC F45)

S Tertiary: services (ISIC G50 to Q99)

In order to study the industry-specific policy effects, we examine the industry-by-industry tariff rate changes and discuss their effects. Figure 3 shows the effective tariff rates in each of the two digit industries by their scodes in 1997, 2002 and 2007. We see that the levels of tariffs vary significantly across manufacturing industries. For example, in the benchmark year of 2002, the rate was as high as 48% in the Tobacco industry and as low as 5.5% in the Metal industry. In addition we see that in every industry tariffs are reduced over time. The amount of tariff reduction varies across industries. From 1997 to 2007, we see drops of more than 50% in the Textile, Paper, Transport, ICT and Office industries (scodes 3, 6, 14, 16 and 17), whereas Petroleum and Metals industries (scodes 7 and 11) feature very modest reductions.

We next turn our attention to looking at the trade patterns in China from 1992 to 2010. We are interested in sectoral import and export intensities which are reported for benchmark year 2002 in columns 3 and 4 of Table 2. The results may be best illustrated by Figure

4 which plots import and export intensities by sector. So, in industries such as Mining, Chemicals, Machinery, ICT, and Office industries which are above the 45 degree line we have more imports than exports. We will refer to these industries or sectors as "import" sectors. On the contrary, eight industries are below the 45 degree line and have more exports than imports: Textile, Garment, Wood, Paper, Rubber, Metal products, Electrical, and Others. We will call these sectors "exporting" sectors. Finally, the remaining sectors which are close to the 45 degree line and have both import and export intensities lower than 10%; (Food, Tobacco, Petroleum, Minerals, Metals, and Transport) we will call autarky or balanced trade sectors. In the last two columns of Table 2, we also provide the comparable Import and Export values measured by using an alternative source, the OECD-STAN database (for trade flows) along with CEIC (for sectoral output). As shown in Appendix Figure A, the relative positions of most industries do not change much using this different data source, though a few industries now have relatively large intensities; especially those to be classified by the category of balanced trade.[1]

Using the data of obtained from OECD and CEIC databases, the dynamic pattern of trade of each industry is depicted in Figure 5. The pattern suggests that our industrial divisions based on the relative import/export intensities are consistent over time, at least around 2002. The differences between the two intensities persist, though the difference in values may change moving from pre-WTO to the post-WTO regime. In most cases, the industries classified into importing and exporting categories do change their relative intensities over time. Two exceptions are Metals and Machinery industries which experienced sharp declines of imports.

[1] A possible reason is that the sectoral output reported by CEIC is derived from China Statistical Yearbook (CSY) of different versions, in which only firms of a large scale are surveyed. However, the trade flows provided by OECD-STAN database are constructed by China's customs and all imported commodities are included. The inconsistency may result in a bias of trade intensities.

3 Gains from Trade

Consider a generalized Armington model with Spence-Dixit-Stiglitz preferences, constant markup over a single production input, labor, and an import demand system with constant elasticity. We assume iceberg trade costs. Factor markets are perfectly competitive whereas goods markets are monopolistically competitive.

In particular, let π_i be the import penetration ratio in sector i and τ_i be the trade cost. Denote the trade elasticities (or productivity distribution shape parameters) as ε_i, which are typically negative. Given the supplemented macro-level restrictions on a generalized version of Proposition 1 in Arkolakis, Costinot, and Rodríguez-Clare (2012), they show that the measure of welfare gains in such an economy in units of real income compared to autarky can then be derived as:

$$\hat{W}_i = 1 - (1 - \pi_i)^{-1/\varepsilon_i} \tag{1}$$

where the import penetration ratio under autarky is by construction zero.[2] That is, in industries with inelastic import demand, gains from trade liberalization by opening up the economy are greater.

The import penetration ratio π_i can be further decomposed into two key factors, namely, the import intensity m_i and the export intensity x_i. Straightforward analysis implies:

$$\pi_i = \frac{m_i}{1 - x_i + m_i} \tag{2}$$

where one can show that $\frac{\partial \pi_i}{\partial m_i} > 0$ and $\frac{\partial \pi_i}{\partial x_i} > 0$. That is, both types of trade intensities, exports or imports, tend to raise the import penetration ratio.

As a consequence, given $\varepsilon_i < 0$, one would expect both import and the export intensities to have positive effects on the gains from trade. Moreover, the extent to which import and the export intensities affect the gains from trade depends negatively on the absolute value of

[2] Refer to https://www.aeaweb.org/aer/data/feb2012/20091433_app.pdf

trade elasticities. Intuitively, when an industry is more open (with greater import and the export intensities), the gains from trade are higher. Should this industry have a lower trade elasticity, domestic demand is less sensitive to changes in trade costs, thus yielding higher welfare gain from trade liberalization.

It is clear that trade elasticities are crucial for actual welfare computation. In the absence of the necessary bilateral trade information to compute them, we take the figures directly from Caliendo and Parro (2015) using the comparable ISIC industrial classification.[3] Their estimate is based on a variant of a gravity-type equation, which can be derived from a variety of conventional and modern trade models. Their measure of bilateral trade costs takes non-symmetric tariffs as well as symmetric geographic factors into account. In addition, they use cross-country data to estimate the industry-specific trade elasticities, and the data cover China and its main trading partners. The results based on 99-percent samples are attached in Table 3. Thus, the trade elasticities range from -0.39 (Transport industry) to -64.85 (Petroleum industry). Manufacturing industries featuring low trade elasticities (absolute value less than 3) and include Food/Tobacco, Rubber, Minerals, Machinery and Transport. Those with high trade elasticities (absolute value larger than 10) include Wood, Paper, Petroleum, Electrical and Office industries.

We now use the input-output tables to compute the import penetration ratio in each industry, which is the ratio of imports to domestic expenditure (defined as sectoral output plus imports and net of exports). Table 4 reports these ratios for 5 years, 1997, 2002, 2005, 2007 and 2010 and includes the main industries as well as manufacturing sub-industries. Focusing on the benchmark year (2002), for manufacturing sub-industries the import penetration ratios range from 0.012 to 0.887. While industries such as Office, ICT, Electrical, Machinery and Chemicals feature relatively high import penetration ratios (greater than 0.18), those

[3] Note that there are other studies also reporting the estimate of sectoral trade elasticities; for example, Broda and Weinstein (2006) and Ossa (2015).

including Food, Tobacco, Rubber, Minerals and Others have low ratios (below 0.05.) From 1997 to 2007, import penetration ratios rose sharply by at least 50% in Office, and Others industries. Over the same period, import ratios in Tobacco and Textile fell significantly (at least 50%.)

With the information about trade elasticities and import penetration ratios, we are ready to compute welfare gains from trade (measured by percentage changes in real income) in 1997, 2002 and 2007. The results are reported in Table 5. Comparing the benchmark year (2002) with autarky, one can see that gains from trade vary a lot across industries, from a modest gain of 0.105% to a sizeable gain of 15.66%. The range in China is wide, which is mainly due to the large variation in the pre-WTO level of import penetration in China and the changes since China's accession to the WTO. Among manufacturing industries in 2002, Office, ICT and Machinery enjoyed largest gains from trade exceeding 10%., while Tobacco, Wood, Paper, Petroleum and Others had gains below 1%. Comparing the benchmark year (2002) with the pre-WTO regime (1997), 11 industries incurred gains while 7 industries suffered losses. Office, ICT, Machinery and Chemicals gained more than 1.5%, whereas Rubber and Paper lost more than 1.5%.

We finally turn to export and import intensities and report the figures in 1997, 2002 and 2007 in Table 6. Due to limited data availability, the long-term changes can be presented in Figure 5 for reference. Notice that the results derived from both of the input-output tables and OECD-CEIC databases suggest that the dynamics of export and import intensities may have different effects on the changes of trade gains. In particular, the substantial drops of import intensities in chemicals and machinery industries come along with the continuous growth of export intensities. As a result, the moderate losses of the two industries suggest that import intensities may play an essential role under post-WTO regime.

4 Quantitative Results

Table 5 summarizes the dynamic patterns of gains from trade. In column 3-5, we report the gains from trade in 1997, 2002 and 2007 compared to the hypothetical state of autarky. The results indicate that three of the import industries, Chemicals, Machinery and ICT, incurred the largest gains throughout, amounted to 5.1-15.1% real income increase compared to the corresponding autarky levels. While the initial gain of another importing industry (Office) in 1997 was not as large (2.1), the gains rose substantially since China's accession to the WTO in 2002 (to 15.6 and 9.1). There are seven industries whose gains from trade have never reached 1.5, including four exporting industries (Garment, Wood, Paper and Metal products) and three autarky industries (Tobacco, Petroleum and Minerals) where their gains from trade are by definition small. In summary, we have:

Result 1: (Gains from Trade Compared to Autarky) *Most of China's importing industries incurred large gains from trade compared to autarky, whereas most of its exporting industries had modest gains.*

The next question is how China's accession to the WTO affected its gains from trade. We further report in column 6-7 of Table 5 the gains from trade in 2002 and 2007 compared to the pre-WTO regime in 1997. We find that four import industries (Chemicals, Machinery, ICT and Office) posted the largest trade gains from the pre-WTO regime in 1997 to the post-WTO regime in 2002. Such gains range from 1.5 to 13.6% in real income. In contrast, three exporting industries (Wood, Paper and Rubber) posted welfare losses from trade due to the requirements for openness by the WTO. While the relatively closed industries (Tobacco and Petroleum) incurred small losses, only one import industry posted negative but modest losses. We can thus conclude:

Result 2: (Trade Gains Before and After the Accession to the WTO) *Most of China's*

importing industries incurred large trade gains from the pre- to the post-WTO regime, whereas several of its exporting and relatively closed industries suffered losses.

We further compare the trade gains from the pre-WTO regime in 1997 to the post-WTO regime in 2002 versus the post-WTO regime in 2007. To do this consider the last two columns of Table 5. We see, for example, that the ICT industry gained 2.6 from 1997 to 2002 and 4.2 from 1997 to 2007. This tells us that the ICT industry gained significantly in the early period of liberalization and these gains continued through the post-accession period. Examination of Table 5 shows that this pattern is relatively rare. Most industries achieved most of their gains from trade in the early (1997-2002) period and that these gains slowed down or were even reversed in some cases. If we look at Chemicals, for example, we see that in the early period they gained 1.6 and their total gains (1997-2007) were smaller, 0.5. This tells us that in the later period gains from trade were much smaller and perhaps even negative. That is, the sizable gains from trade liberalization in China seem relatively short-lived, excluding the two relatively modern ICT and Office industries (posting a large gain of 4.2 and 7.1%, respectively).

This is not surprising because tariffs had been reduced sharply at the early stage years before 2002. By grouping all importing industries into the importing sector and all exporting industries into the exporting sector, we obtain an average trade gain of 1.0% and 0.03%, respectively, over the period from 1997 to 2002. Over a longer term from 1997 to 2007, the gains from trade in the exporting sector remained at 0.03% but those in the import sector dropped to 0.67%. Thus, we have:

Result 3: (Dynamic Gains from Trade) *Most of China's gains from trade liberalization were incurred at the early stage from 1997 to 2002 when tariffs were reduced sharply.*

We now look at how China's export intensities changed over time since its accession to the WTO. Focusing on the import industries, we find that all of their export intensities were

rising. Turning to the exporting industries, we find that, such patterns were mixed, possibly rising (textile, wood and metal products), flat (rubber and electrical), falling (others) or eventually falling (garment). The above findings imply:

Result 4: (Export Intensities) *After its accession to the WTO, China's export intensities in most import industries were rising but those in exporting industries experienced mixed patterns.*

Using what we learned from Result 2, Result 3 and Result 4, we examine trade and industrial transformation in several key import industries. We find that all four import industries experienced rising export intensities compared to the pre-WTO regime. Only the ICT and Office industries enjoyed sizable gains from trade, while the other two import industries either faced small gains from trade (Chemicals) or losses (Machinery). This is because of their different dynamic patterns of imports: both Chemicals and Machinery incurred drops in import intensities shortly after China's accession to the WTO (see equations (1) and (2)). We thus have:

Result 5: (Pattern of Trade vs. Gains from Trade) *From 1997 to 2007 when changing from the pre- to the post-WTO regime, among import industries,*

1. The *ICT and Office industries enjoyed sizable gains from trade throughout and expanded exports over time;*

2. *Despite their expanded exports, Chemicals and Machinery had large reductions in import intensities and experienced short-lived gains from trade.*

We next turn to determining whether the gains from trade liberalization experienced by the importing industries can be attributed to increased importing or exporting. To do this we decompose the welfare gains from the pre-WTO regime of 1997 to the post-WTO

regime of 2002 using counterfactual analysis. That is, we compute the gains from trade with either the export intensities or the import intensities fixed at the pre-WTO regime figure in 1997 (see columns 3 and 4 of Table 7). A larger gain with fixed export intensities indicates that enhanced importing is a more important driver of welfare gains resulting from trade liberalization. If gains are larger gain with fixed import intensities then export expansion is more crucial. Examination of Table 7 reveals that across all manufacturing industries, enhanced importing is relatively more important for explaining the resulting gains from trade. Looking at the four import industries, three industries (Chemicals, Machinery and ICT) had trade gains primarily driven by enhanced importing with only the Office industry caused by export expansion. We arrive at the following conclusion:

Result 6: (Counterfactual Analysis) *From 1997 to 2007 when changing from the pre- to the post-WTO regime, among import industries, the gains from trade in all but one (Office) industry were primarily driven by enhanced import activity rather than export expansion.*

5 Concluding Remarks

In this paper, we have examined the gains from Chinese accession to the WTO in 2002. We have provided a new quantitative measure by dividing the manufacturing sector into exporting and import-substituting sub-sectors and decomposed the gains from trade measure into import and export expansion channels.

We find that, relative to autarky, most of China's import industries incurred large gains from trade, with most of its exporting industries seeing modest gains. While most of China's importing industries incurred large trade gains from the pre-WTO to the post-WTO regime, several of its exporting and relatively closed industries suffered losses. Moreover, we find that most of China's gains from trade were incurred at the early stage from 1997 to 2007 when tariffs were reduced sharply. Across the pre-WTO and the post-WTO regimes, two of

the import industries (ICT and office industries) enjoyed sizable gains from trade throughout and expanded exports over time, while the other two (chemicals and machinery) had large reductions in import intensities and experienced short-lived gains from trade. Furthermore, in the these importing industries, counterfactual analysis suggests that the gains from trade in all but one (Office) industry were primarily driven by expanded importing rather than export expansion.

Our results pose a challenging question for future research: What are the underlying forces leading to larger gains from tariff reduction in import industries? We can think of four possible channels. Three are the classical channels: relative factor abundance, intensity of factor shares and the relative prices of inputs and outputs. A fourth possibility, technology trade along a vertically integrated world production chain, seems to us to be an important channel to investigate. We plan to do this using a dynamic, calibrated trade model.

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Data Appendix

This appendix describes the data sources and explains how we reach concordance of the data from different sources. Our main focus is on bilateral trade flows, outputs of manufacturing industries, and tariff rates at the 2-digit level. For this purpose, we select the data with detailed information at more than the 2-digit level and make aggregation on a comparable basis.

First, the bilateral trade data are obtained from OECD-STAN bilateral trade database, in which the nominal values under current prices are reported in thousands of US dollars. The sectors are defined in terms of 2-digit ISIC-Rev.3 industry code and total trade in goods for end-use in each sector is considered. The available time-series spans from 1992 to 2014 but our analysis mainly focuses on the trade between China and the world during 1992 to 2008. In order to compute sectoral import penetration ratios, we still seek data from outer sources because OECD database does not provide the value of output at sub-industry level in China. Hence, we resort to gross value of output at a similar sub-industrial level from CEIC's China premium database. It is one of the well-accepted sources since its data are mainly derived from official publications of China; CSY for example. However, there is a potential measurement problem when we are using the sectoral gross output as a substitute. The reason is that the industry survey only investigates enterprises above the designated size, which is 5 million RMB in annual revenue. As a result, the computed import penetration ratios by combining the two databases may overestimate the true ratios due to the data limitation.

An alternative to address this issue is using the input-output tables provided by the Chinese Input-output Association. The tables were made every three to five years from 1987 and they are regularly published by National Bureau of Statistics of China. The data to be used are limited to the tables of 1997, 2002, 2005, 2007, and 2010 because only information

about net exports is available for tables before 1997. The division of manufacturing industries varies from year to year; for example, manufacturing is divided into 73, 72, 17, 81, and 39 sectors in the five years, respectively. Even though the information is incomplete, we proceed data concordance and aggregation according to Standard Industrial Classification Codes of the version 2002 by National Bureau of Statistics. The results summarized in Tables 2 may justify our concern. The values reported in columns 5 and 6 are in general larger than the values in columns 3 and 4. Although the numbers may be not accurate, the industrial ranking based on their import and export intensities are consistent with each other in most of the industry cases. In order to take the measurement problem into account, we only present the computed import penetration ratios (Table 4) and gains from trade (Table 5) from using the input-output tables. On the other hand, we include the long-term pattern of import and export intensities from using the OECD and CEIC databases in Figure 5 as a reference.

Finally, the data related to tariff at the 2-digit ISIC-Rev.3 industry level are from the World Integrated Trade Solution (WITS) and the Trade Analysis and Information System (TRAINS) databases. The duty type that we select is the include effectively applied rates evaluated by the ad-valorem equivalent. We take a simple average for a broad industry classification whenever it includes multiple industries. For example, the tariff rates of the primary sector shown in Figure 3 are derived from a simple average of the tariff rates of the agriculture, forestry, and fishing industries.

Table 1: Share of total output by industries

Scode	Industry	1997	2002	2005	2007	2010
A	Primary	0.123	0.091	0.073	0.060	0.055
Q	Mining	0.034	0.033	0.034	0.036	0.039
1	Food	0.062	0.041	0.048	0.046	0.049
2	Tobacco	0.007	0.005		0.005	0.005
3	Textile	0.046	0.029	0.029	0.031	0.026
4	Garment	0.030	0.021	0.023	0.022	0.019
5	Wood	0.011	0.013	0.011	0.013	0.012
6	Paper	0.022	0.022	0.020	0.018	0.017
7	Petroleum	0.016	0.019	0.023	0.026	0.024
8	Chemicals	0.055	0.046	0.074	0.055	0.055
9	Rubber	0.021	0.022		0.020	0.020
10	Minerals	0.044	0.019	0.029	0.028	0.032
11	Metals	0.039	0.049	0.058	0.075	0.066
12	Metal Products	0.025	0.019	0.019	0.022	0.020
13	Machinery	0.041	0.041	0.046	0.048	0.053
14	Transport	0.027	0.031	0.033	0.040	0.047
15	Electrical	0.033	0.023	0.030	0.033	0.037
16	ICT	0.019	0.041	0.052	0.050	0.045
17	Office	0.008	0.005	0.007	0.006	0.006
18	Others	0.014	0.009	0.009	0.013	0.011
U	Utility	0.022	0.028	0.041	0.041	0.038
N	Construction	0.087	0.090	0.074	0.077	0.082
S	Tertiary	0.212	0.301	0.267	0.235	0.245
	Total	1	1	1	1	1

Table 2: Export and import intensities by different data sources

Source		I-O table		OECD & CEIC	
Scode	Industry	Export	Import	Export	Import
A	Agriculture	0.017	0.024		
Q	Mining	0.043	0.162	0.075	0.263
1	Food	0.068	0.040	0.112	0.064
2	Tobacco	0.017	0.012	0.010	0.001
3	Textile	0.302	0.134	0.361	0.166
4	Garment	0.419	0.065	0.909	0.071
5	Wood	0.169	0.048	0.214	0.123
6	Paper	0.140	0.078	0.060	0.172
7	Petroleum	0.043	0.068	0.066	0.103
8	Chemicals	0.083	0.223	0.122	0.319
9	Rubber	0.139	0.038	0.216	0.103
10	Minerals	0.072	0.034	0.106	0.042
11	Metals	0.030	0.103	0.067	0.193
12	Metal Products	0.178	0.090	0.290	0.093
13	Machinery	0.101	0.241	0.248	0.400
14	Transport	0.068	0.104	0.094	0.129
15	Electrical	0.285	0.234	0.268	0.211
16	ICT	0.383	0.429	0.309	0.402
17	Office	0.878	0.954	3.326	2.356
18	Others	0.146	0.034	0.264	0.019
U	Utility	0.006	0.034	0.009	0.003

Note: The intensities of export and import of sector i are measured by EX_i/Y_i and IM_i/Y_i in 2002 (benchmark year). The values in columns 3 and 4 are obtained from China's I-O table of 2002. On the other hand, the data of the last two columns come from OECD-STAN (for export and import flows) and China Statistical Yearbook (for gross output). The values are adjusted by using yearly exchange rate of RMB to USD provided by China Statistical Yearbook.

Table 3: Trade elasticity by industries

Scode	Industry	Trade elasticity
A	Primary	-9.11
Q	Mining	-13.53
1	Food	-2.62
2	Tobacco	
3	Textile	-8.10
4	Garment	
5	Wood	-11.50
6	Paper	-16.52
7	Petroleum	-64.85
8	Chemicals	-3.13
9	Rubber	-1.67
10	Minerals	-2.41
11	Metals	-3.28
12	Metal Products	-6.99
13	Machinery	-1.45
14	Transport	[-1.84, -0.39]
15	Electrical	-12.91
16	ICT	-3.95
17	Office	[-12.95, -8.71]
18	Others	-3.98
	Aggregate	-4.49

Table 4: Import penetration ratios based on I-O tables

Panel A: Import penetration ratio of main industries

Scode	Industry	1997	2002	2005	2007	2010
A	Primary	0.016	0.024	0.042	0.046	0.057
Q	Mining	0.104	0.145	0.175	0.266	0.269
M	Manufacturing	0.107	0.156	0.182	0.130	0.109
U	Utility	0.000	0.042	0.001	0.001	0.000
N	Construction	0.003	0.003	0.003	0.004	0.003
S	Tertiary	0.015	0.021	0.041	0.031	0.025
	Total	0.065	0.087	0.114	0.093	0.082

Panel B: Import penetration ratios of manufacturing sub-industries[1]

Scode	Industry	1997	2002	2005	2007	2010
1	Food	0.037	0.041	0.038	0.042	0.039
2	Tobacco	0.015	0.012		0.003	0.004
3	Textile	0.104	0.161	0.122	0.046	0.039
4	Garment	0.078	0.100	0.072	0.047	0.040
5	Wood	0.057	0.055	0.056	0.031	0.036
6	Paper	0.108	0.083	0.101	0.061	0.054
7	Petroleum	0.119	0.066	0.250	0.067	0.066
8	Chemicals	0.152	0.195	0.176	0.166	0.141
9	Rubber	0.077	0.042		0.064	0.069
10	Minerals	0.012	0.035	0.019	0.017	0.013
11	Metals	0.101	0.096	0.100	0.072	0.061
12	Metal Products	0.072	0.099	0.111	0.040	0.033
13	Machinery	0.185	0.211	0.200	0.173	0.141
14	Transport	0.087	0.100	0.096	0.092	0.100
15	Electrical	0.142	0.247	0.208	0.145	0.104
16	ICT	0.337	0.410	0.507	0.451	0.353
17	Office	0.233	0.887	1.065	0.705	0.594
18	Others	0.045	0.039	0.167	0.150	0.222
M	Manufacturing	0.107	0.156	0.182	0.130	0.109

[1] The maximum numbers of manufacturing sectors available are 71, 71, 17, 80, and 39 in I-O tables of 1997, 2002, 2005, 2007, and 2010, respectively.

Table 5: Gains from trade (change in real income) relative to the autarky level

Changes in real income (%)		Gains			Dynamics	
Scode	Industry	1997	2002	2007	Δ(97to02)	Δ(97to07)
A	Primary	0.179	0.263	0.516	0.084	0.337
Q	Mining	0.830	1.148	2.259	0.318	1.429
1	Food	1.437	1.580	1.614	0.143	0.177
2	Tobacco	0.563	0.450	0.130	-0.113	-0.433
3	Textile	1.340	2.138	0.579	0.798	-0.761
4	Garment	0.993	1.291	0.590	0.298	-0.403
5	Wood	0.513	0.491	0.270	-0.022	-0.243
6	Paper	0.692	0.522	0.383	-0.170	-0.309
7	Petroleum	0.195	0.105	0.106	-0.090	-0.089
8	Chemicals	5.126	6.713	5.641	1.587	0.515
9	Rubber	4.676	2.554	3.897	-2.122	-0.779
10	Minerals	0.514	1.486	0.725	0.972	0.211
11	Metals	3.203	3.041	2.243	-0.162	-0.960
12	Metal Products	1.060	1.477	0.578	0.417	-0.482
13	Machinery	13.16	15.11	12.25	1.950	-0.910
14	Transport	4.828[1]	5.587	5.101	0.759	0.273
15	Electrical	1.182	2.168	1.202	0.986	0.020
16	ICT	9.87	12.51	14.10	2.640	4.230
17	Office	2.052	15.66	9.110	13.608	7.058
18	Others	1.144	0.985	4.013	-0.159	2.869

[1] As shown in Table 3, the estimate of trade elasticity in the transport industry is between 0.39–1.84. The first estimate is to the industry of motor vehicles and trailers only, whereas the second is to the industry of rest of transport equipments. Here, the gains are measured by using the value 1.84 to the aggregate transport industry.

Table 6: Export and import intensities by I-O tables

		Export intensities			Import intensities		
Scode	Industry	1997	2002	2007	1997	2002	2007
A	Primary	0.017	0.017	0.014	0.016	0.024	0.048
Q	Mining	0.057	0.043	0.022	0.113	0.162	0.354
1	Food	0.056	0.068	0.050	0.037	0.040	0.041
2	Tobacco	0.032	0.017	0.005	0.014	0.012	0.003
3	Textile	0.184	0.302	0.326	0.094	0.134	0.032
4	Garment	0.354	0.419	0.314	0.054	0.065	0.034
5	Wood	0.131	0.169	0.221	0.053	0.048	0.025
6	Paper	0.154	0.140	0.152	0.103	0.078	0.055
7	Petroleum	0.057	0.043	0.036	0.127	0.068	0.069
8	Chemicals	0.077	0.083	0.097	0.165	0.223	0.180
9	Rubber	0.157	0.139	0.169	0.070	0.038	0.057
10	Minerals	0.034	0.072	0.065	0.012	0.034	0.017
11	Metals	0.062	0.030	0.084	0.106	0.103	0.071
12	Metal Products	0.131	0.178	0.201	0.067	0.090	0.033
13	Machinery	0.059	0.101	0.145	0.214	0.241	0.178
14	Transport	0.058	0.068	0.100	0.090	0.104	0.091
15	Electrical	0.225	0.285	0.251	0.129	0.234	0.127
16	ICT	0.306	0.383	0.519	0.352	0.429	0.396
17	Office	0.266	0.878	0.663	0.223	0.954	0.805
18	Others	0.143	0.146	0.127	0.040	0.034	0.155

Table 7: Counterfactual on Gains from trade by fixing export and import intensities to the 1997-level

Source		Counterfactual		Benchmark[1]
		fixing x_i	fixing m_i	
Scode	Industry	Δ(97–02)	Δ(97–02)	Δ(97–02)
A	Primary	0.083	0.000	0.084
Q	Mining	0.333	-0.012	0.318
1	Food	0.124	0.018	0.143
2	Tobacco	-0.106	-0.009	-0.113
3	Textile	0.513	0.210	0.798
4	Garment	0.176	0.106	0.298
5	Wood	-0.043	0.022	-0.022
6	Paper	-0.162	-0.010	-0.170
7	Petroleum	-0.089	-0.003	-0.090
8	Chemicals	1.552	0.028	1.587
9	Rubber	-2.070	-0.094	-2.122
10	Minerals	0.915	0.021	0.972
11	Metals	-0.065	-0.100	-0.162
12	Metal Products	0.342	0.059	0.417
13	Machinery	1.398	0.518	1.950
14	Transport	0.706	0.046	0.759
15	Electrical	0.839	0.090	0.986
16	ICT	1.598	0.932	2.640
17	Office	4.252	5.749	13.608
18	Others	-0.162	0.004	-0.159

[1] The benchmark values are derived from column 6 of Table 5.

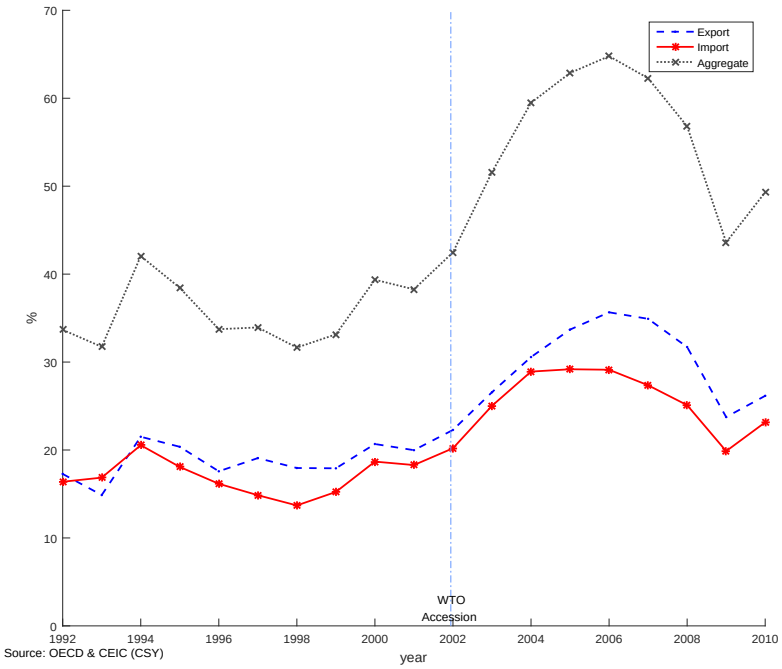

Figure 1: Export and import intensities and trade dependence

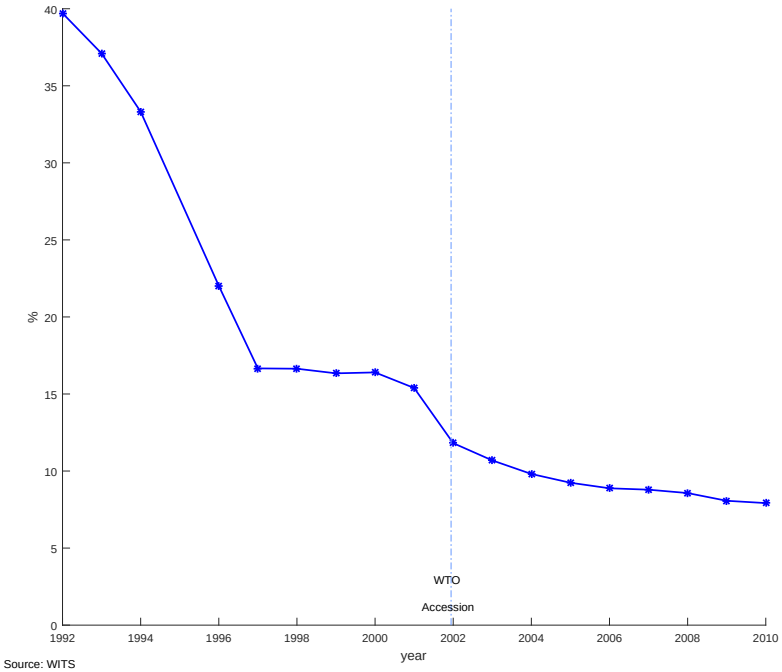

Figure 2: The average tariffs of primary, mining, and manufacturing industries

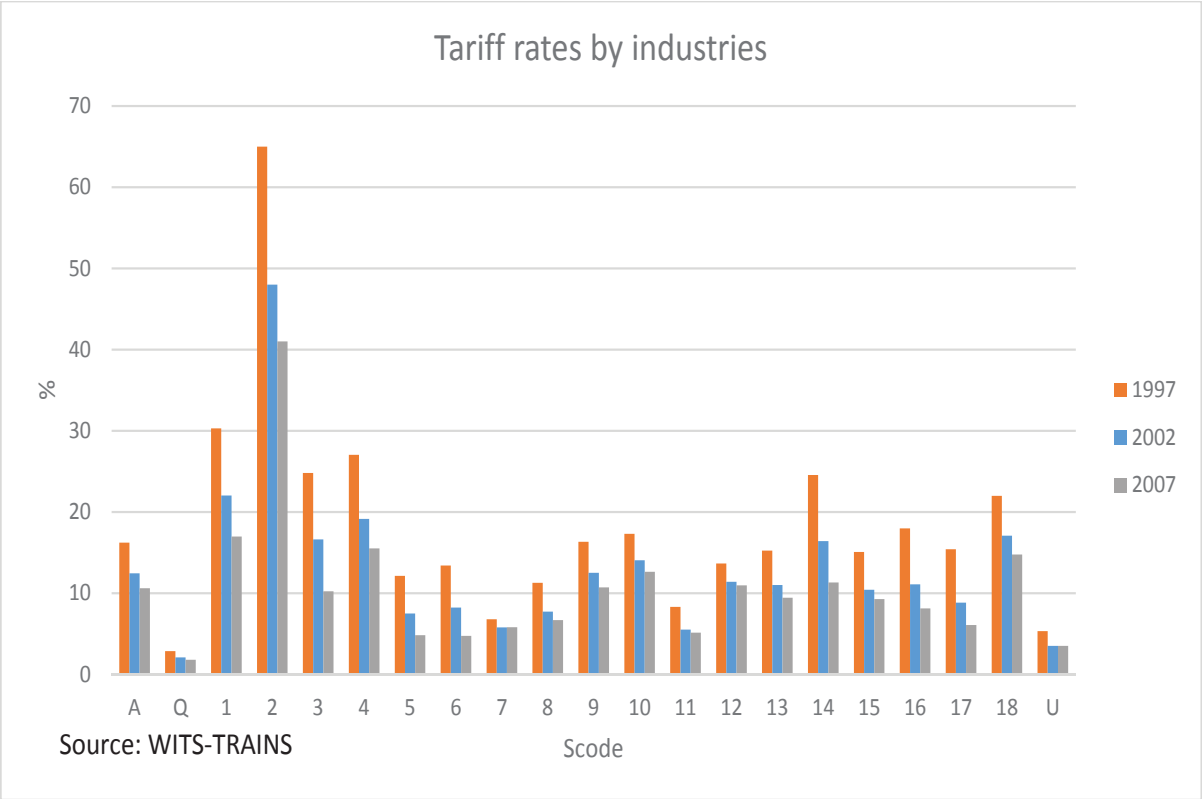

Figure 3: Tariff rates by industries in 1997, 2002, and 2007

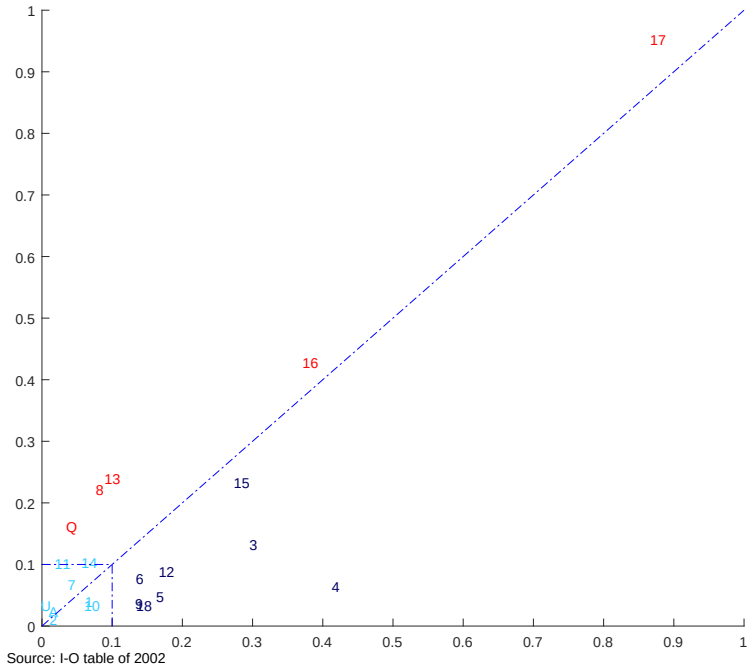

Figure 4: Export (x-axis) and import (y-axis) intensities by sectors

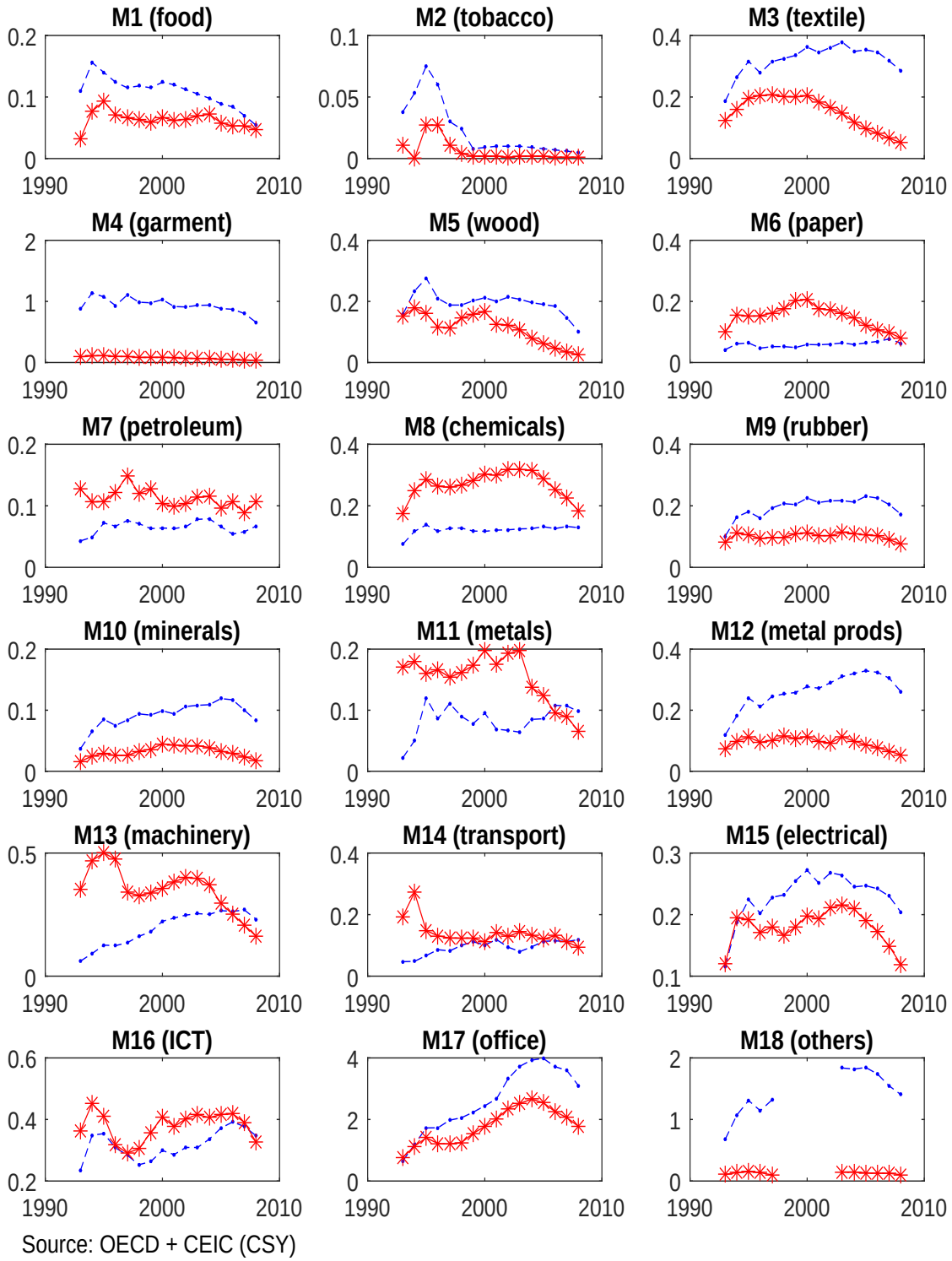

Figure 5: Export (blue) and import (red) intensities by sectors across time

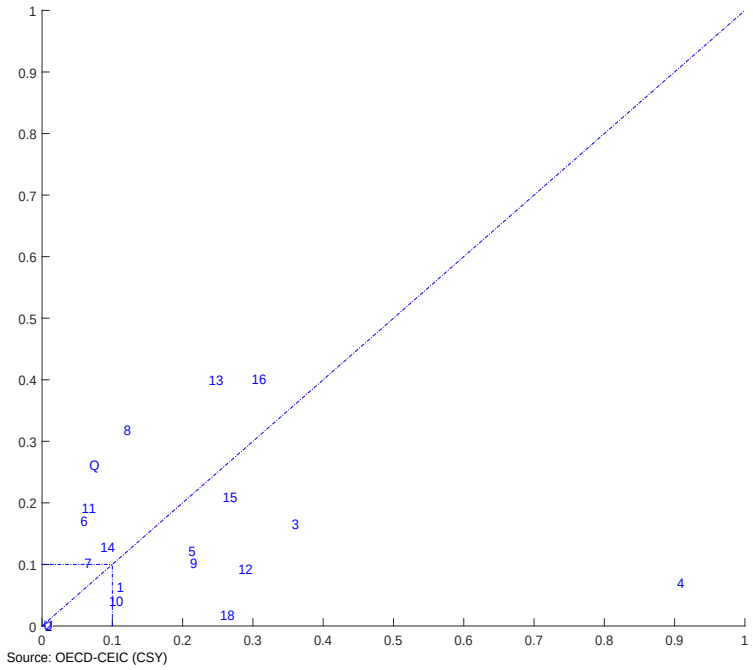

Figure A: Export (x-axis) and import (y-axis) intensities by sectors