Trade Effects of the Chinese Manufacturing Production Subsidies

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Abstract

In this paper, we assess the Chinese manufacturing production subsidies from year 2002 to year 2006. Empirical evidence shows that a percentage increase of the subsidy ratio to a firm leads to a seven percent decrease of its export unit price. If we restrict analysis to the major destinations, the effect doubles. Relying on this empirical findings, I construct counter factual proportional changes of the Chinese manufacturing sector-destination price indexes. With a quantitative trade model, emphasized the terms of trade effect and the profit shifting motive, I find that a removal of the subsidies in year 2006 brings the changes of the Chinese manufacturing exports from -9.06% to 3.74%, different across the sectors and the destinations and a welfare loss of China 2%. The model implied welfare gains to its major trade partners ranges form 0.22% (Taiwan) to 0.01% (United Kingdom).

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1 Introduction

What leads to the rapid growth of trade of China in the past few decades? How it affects the world? These two issues receive focus not only in the every day but in the academic. In this paper, I assess the Chinese production subsidies, which are recorded in the Annual Survey of Industrial Firms from the National Bureau of Statistic of China (NBS data, hereafter). Specifically, this paper try to empirically estimate how do these production subsidies of China to its manufacturing sectors affect the product exort prices, which I obtain from matching the NBS data with the Chinese Custom data (the Custom data, heredater) and how do they affect the world through the aggregate price index under a quantitative trade model with World Input-Output Database (WIOD, hereafter) which is wildly used to assess the trade policy.[1]

Empirically, I find that the polices of Chinese subsidies coincide with the new trade model-implied welfare maximization that minimizes the terms of trade effect and maximizes the profit-shifting or the delocation (Home market) effect. At the firm level characteristics, besides the size of a firm, the state capital, and the investment, we additionally find that the product sophistication positively associates with the subsidy status. In contrast, the processing ratio and the export intensity are negatively or uncorrelated with the subsidies. Further, a percentage increase of the firm-level subsidy ratio leads to a 7% decrease of the unit price of its HS-6 digit varieties. This effect is double when only the samples exported to the major destinations that took more than 2% of the total exports of China in 2002 are used. However, the effects on entering a new market is insignificant.

I then use the empirical results combining with the NBS data and the Custom data in 2006 to built counter factual proportional changes of the destination-sector-specified price indexes which implied by the CES utility function. I take these price indexes into

[1]Costinot and Rodríguez-Clare (2014) and Ossa (2016) give a survey.

a multi-countries and multi-sectors quantitative trade model based on Ossa (2014) and use the exact hat algebra method that is proposed by Dekle et al. (2007) to simulate a counter factual world with zero subsides, using the manufacturing trade flows of seven major destinations plus China and the rest of the world which are obtained from the WIOD. The results show that the removal of the subsidies brings the Chinese sector-destination export sales changes from -9.06% (the Industry of Transportation Equipment to Germany) to 3.74% (the industry of Pulp, Paper, Paper, Printing and Publishing to Japan) and leads to a 2% welfare loss, although the welfare effects are small to the foreign destinations, ranging from a increase of welfare 0.22% (Taiwan) to 0.01% (United Kingdom), which due to the small consumption shares of the Chinese varieties in 2006.

One of the major difference of my method from the literature that attmpts to quantify the subsidies, to the best of my knowledge, is that I do not hypothesize a universal subsidy ratio which is either simulated by targeting macro ratios as Defever and Riaño (2015) or obtained by the average from the aggregate data like Ossa (2015). Using the exact hat algebra and the CES price index, I derive the direct effects of the subsidies on the price index as the sales share weighed sum of the price effects of the firm-level changes of the subsidies ratio. With this expression, I use the detailed firm-level NBS data combined with the firm-HS 8-digit-destination level Chinese custom data to construct the counter factual proportional changes of the price indexes, incorporating the empirical results of the subsidies effects on the unit prices.

This paper contributes to the literature that assesses the industrial policies of China and their impacts. For example, Rodrik (2006), Schott (2008), and Jarreau and Poncet (2012) looking at the implication of the expansion of varieities and the moving up of the quality ladders of Chinese exports to other countries. Girma et al. (2009) empirically test the effects of the production subsidies on firm-level export sales and entry. Wang and Wei (2010) assesses the policy of the industrial zones on the export unit price. Dai et al. (2016) focus on the contribution of the processing trade on the export growth of China. Chen and Swenson (2007) discuss the spillover of the FDI. Feng et al. (2016) address the trade liberalization (WTO accession) to enhance the export value of the Chinese firms. Hsieh and Ossa (2016) quantify the trade effect of the Chinese industrial productivity growth to the world. Pierce and Schott (2016) analyze the effect of U.S. granting Permanent Normal Trade Relations to China on its manufacturing employment. Amiti et al. (2016) empirically measures the effect of the WTO entry of China on U.S. manufacturing CES price index.

The rest of paper is structured as follows. In the section 2, I review the related literature. Section 3 gives a description of the data sets. Section 4 provides the structural frame work used to form the empirical models. The summary statistics and the empirical results are in Section 5. In the section 6 and the section 7 I explain how I construct the price indexes, the full model, and the calibration and simulation.

2 Related Literature

Among the papers cited in the introduction, this paper is deeply related to the empirical work of Girma et al. (2009). Girma et al. (2009) use the NBS data set to test the effects of the production subsidies of China. They find that the subsidies have a significant effect on the firm-level aggregate export sales with the magnitude that doubling the subsidies leads to a ten percent increase of the export. The effect on entry in minor. Moving a step forward from their paper, using the both NBS data and the Custom data, I look at the effects of the subsidies on the HS 6-digit-destination level. In this way, the effects on the intensive margin is coming from the increase of the sales of the existing varieties or the entry of the new varieties can be distinguished. Further, I bring the empirical findings to quantify the trade effects of these subsidies.

The framework of our quantification is based on the seminal works of Ossa. Ossa (2011) and Ossa (2014) use the quantification trade model and the exact hat algebra to compute the optimal trade policies. Ossa (2015) use the data of year 2007 to quantify the competion of the location subsidies among the U.S. states. Hsieh and Ossa (2016) quantify the trade effects of the productivity growth of China. In this paper, they find that the accumulated productivity growth of China from 1995 to 2007 brings welfare effects to the world from -0.2% to 0.2% different across countries. Relying on their model, I incorporate the subsidies and the price indexes I construct from the data to simulate the counter factual scenario.

This paper is also closed to Amiti et al. (2016) which look at the WTO entry on the Chinese export price indexes to the United States. They empircally build the Chinese export price index following the Feenstra (1994) with the estimation of the intensive (prices and shares) and extensive (entry) margins. Due to the subsidies are heterogeneous across the firms, not like the WTO policy that apply to all exporters, my method relies on the model more than theirs. In the following section, the data used is described.

3 Data Description

Three major data sources are used in this paper: the Chinese Custom data, the NBS data, and the WIOD databse. The data period is from year 2002 to year 2006.[2] The Custom data covers all the Chinese exports of a year in the HS 8-digit level with the information of the destination, the trade regime (the ordinary trade, the processing with assembly, and etc.), and the basic information of a exporter such as the name, the phone number, and the zipcode of the firm's location. The NBS data which includes firms with annual sales exceed five million RMB approximately represents 90% of the Chinese manufacturing

[2]The account of the subsidies in the NBS data is not provided after year 2006.

gorss output over the periods (Girma et al. (2009)) and accounts for about 98% of the total manufacturing exports in the Custom data (Dai et al. (2016)). The number of firms increases from 181,557 in 2002 to 301,961 in 2006. This data includes the details of a firm's balance sheet and also the firm's basic information such as the industries the firms belongs to, which are catogrized by the 4-digit Chinese Industrial Classification (CIC, hereafter).[3] The WIOD database provides an input-output table for 35 ISIC Rev.3 sectors of the 40 countries plus the rest of the world.[4] These three data sets are wildly used by the related literature.

To reconcile these tree datasets, the NBS data and the Custom data are firstly matched by the firm names, the phone numbers, and the zip codes, which is the process proposed by Yu (2014) (the matched data, hereafter). Overall, about 40% of the exporters and 53% of the export value are matched in the NBS data.[5] Further, we use the concordances provided by the World Bank and Dean and Lovely (2010) to map among the 4-digit ISIC Rev.3 codes, the 6-digit HS6 codes, and the 4-digit CIC codes.[6]. The manufacturing sectors are defined by the 2-digit ISIC Rev.3 from 15 to 37. Among the 40 countries that have independent IO table in the WIOD, in the work of quantification, I focus on the top seven destinations of Chinese manufacturing exports in year 2002 according to the Custom data. These destinations include the United States, Japan, Korea, Germany, Netherlands, the United Kingdom, and Taiwan, which I give a summary in Table 1. The remaining countries are aggregated to the rest of the world.

[3]For a introduction of the NBS data, please refer to Brandt et al. (2014).

[4]Please refer to Dietzenbacher et al. (2013) and Timmer et al. (2015) for the detail of the construction of the database.

[5]The detail of matching is decribed in the Appendix A.

[6]Please refer to *http://wits.worldbank.org* and *http://faculty.som.yale.edu/peterschott*

Table 1: Trade share for Selected Destinations in 2002

	Export	Import
United States	20.7	8.0
Japan	9.4	19.0
Korea	4.4	12.5
Germany	4.3	6.8
Netherlands	3.1	0.6
United Kingdom	2.4	1.1
Taiwan	2.0	11.5

Data source: the Chinese Custom Data.

4 Basic Framework for Analysis

To guide our analysis, the assumptions of a typical new trade model with multi-sector and multi-country are considered. Before the framework is presented, the notations used are explained here. We use the superscripts to denote countries and the subscripts to denote varieties and sectors. When there are two superscripts, the first one refers the sourcing country and the second one denotes the destination country. Specifically, the alphabet c in the superscripts denotes China. The subscript g represents a variety and k and s indicate sectors (industries). Further, ω refers a set of varieties. Last, due to the existence of the iceberg transportation cost, the quantity a producer produces is different from the quantity it can be delivered to a consumer. Hence, the $\tilde{y}$ is used to refer the quantity that is delivered, different from y which denotes the output.

The utility function has two tires. The upper-tier is Cobb-Douglas which nests the sector consumption $\prod_k {C_k^i}^{\mu_k^i}$ with $\sum_k \mu_k^i$ equaling to 1. The lower-tier utility is CES aggregating all the varieties in a country i as $\left(\int_{g\in\omega_k^i} \tilde{y}_g^{\frac{\sigma_k-1}{\sigma_k}}\, dg\right)^{\frac{\sigma_k}{\sigma_k-1}}$, where σ_k is the sector-specified elasticity of substitution and $\tilde{y}_g$ is the consumption of a variety g. The utility maximization yields the CES price index of a sector k in a country i as:

$$\mathbb{P}_k^i = \left(\int_{g\in\omega_k^i} p_g^{1-\sigma_k} dg\right)^{\frac{1}{1-\sigma_k}} \tag{1}$$

and a demand of a variety that is exported from the county i to a country j:

$$p_g^{ij}\tilde{y}_g^{ij} = \left(\frac{p_g^{ij}}{\mathbb{P}_k^j}\right)^{1-\sigma_k} E_k^j, \tag{2}$$

where E_k^j is the sector expenditure of the the country j which equals to $\mu_k^j E^j$.

The market structure is monopolistic competition and the cost function is linear. To transport goods from i to j, the producer face a sector-specified iceberg transportation cost τ_k^{ij}. The profit-maximization and the CES demand implies a firm g charges a price with a constant markup of the unit cost Θ_k^i:

$$p_g^{ij} = \frac{\sigma_k}{\sigma_k - 1}\frac{\xi_g \tau_k^{ij}\Theta_k^i}{\phi_g}, \tag{3}$$

where ξ_g is one minus the rate of the production subsidies and ϕ_g is the productivity of the firm. The assumption of monopolistic competition brings a distortion in the economy, which provides a room for trade policies. As can be seen in the equation (3), a smaller elasticity of substitution implies a larger distortion. The policy maker, hence, has incentive to subsidize those sectors.

With this distortion, in a model like Krugman (1980) with free entry, this subsidies promote entry to the subsidized sectors by delocating firms in other countries or other sectors (delocation effect or home market effect). In a model without free entry such as Ossa (2014), this polciy shifts the porfits (profit-shifting effect). However, in both cases the subsidies bring a negtive terms of trade effect which lower the sector export prices. Hence, the subsidies can bring larger welfare gain if the policy maker can maximize the former and minimize the later.[7] To test whether the production subsidies of China fits any model implied motives, I follow Hsieh and Ossa (2016) to decompose the welfare

[7] Campolmi et al. (2014) prove that in the Krugman model the delocation effect domoniates the terms of trade effect starting from the inefficient free trade equilibrium.

effect of the subsidies as follows.

With the first tier Cobb-Douglas utility, the utility of the consumer can be expressed as $\frac{E^i}{\prod_k \mathbb{P}_k^{i\,\mu_k^i}}$, where E^i is the final expenditure of the country i. Taking the log change, we can state the final consumption as $dlnE^i = dln\Theta^i + \sum_k \gamma_k^i \left(dln\Pi_k^i - dln\Theta^i\right)$, where Θ^i is the factor payment and Π_k^i is the profit for the sector k, which is zero under the case of the free entry. γ_k^i is the profit share of the sector k which equals to $\frac{\Pi_k^i}{E^i}$. The assumption of the CES demand leads to the log change of the price index as $dln\mathbb{P}_k^i = \sum_k \sum_j \delta_k^{ji} dlnP_k^{ji}$. δ_k^{ji} is the consumption share of the country j's export at the country i. The P_k^{ji} is the price index of the sector k in the country j's export to the country i. Finally, the monopolistic competition implies that $dlnP_k^{ji} = dln\Theta^j + dln\xi_k^j - \frac{1}{\sigma_k - 1} dlnM_k^i$. The M_k^i is the mass of firms which is a constant under the case of no entry. The welfare change of a country i for a small change of the subsidies from the country j starting from the zero subsidies for the case of free entry is:

$$\frac{dU^i}{U^i} = \sum_k \sum_j \mu_k^i \delta_k^{ji} \underbrace{\left[\frac{d\Theta^i}{\Theta^i} - \left(\frac{d\Theta^j}{\Theta^j} + \frac{d\xi_k^j}{\xi_k^j}\right)\right]}_{\text{Terms of Trade Effect}} \underbrace{- \sum_k \sum_j \mu_k^i \delta_k^{ji} \frac{1}{\sigma_k - 1} \frac{dM_k^i}{M_k^i}}_{\text{Delocation Effect}}. \tag{4}$$

Instead, by abandoning the free entry condition, the welfare change becomes:

$$\frac{dU^i}{U^i} = \underbrace{\sum_k \sum_j \mu_k^i \delta_k^{ji} \left[\frac{d\Theta^i}{\Theta^i} - \left(\frac{d\Theta^j}{\Theta^j} + \frac{d\xi_k^j}{\xi_k^j}\right)\right]}_{\text{Terms of Trade Effect}} \underbrace{- \sum_k \gamma_k^i \left(\frac{d\Pi_k^i}{\Pi_k^i} - \frac{d\Theta^i}{\Theta^i}\right)}_{\text{Profit-Shifting Effect}}. \tag{5}$$

The decomposition above shows that the welfare effect of the subsidies of a country j on a country i could be positive if the country j subsidizes the sector that is relatively export orientation which has larger δ_k^{ji}. On the contrary, if the subsidies go to the import orientation sector of the country j, it brings a stronger negative terms of trade effect to the country i. Further, the magnitude of the delocation effect and the profit-shifting effect rely on the values of the elasticity of substitution. If the country j subsidizes the sectors with lower σ_k, the relative heterogeneous sectors, the delocation effect and the profit shifting effect will be larger due to the empirical fact that countries value their own varieties more than the imported varieties and the lower σ_k implies a higher profit. The equations (2) to (5) lead the empirical work in the following sections.

5 Production Subsidies of China

5.1 Summary of the Production Subsidies

Table 2: Summary Statistics: Production Subsidies of China 2006

IO Industries (ISIC3 2-digit)	Total Production Subsidies	Subsidy-to-Sales Ratio	Mean Subsidy	Mean Subsidy Ratio
Food, Beverages and Tobacco (15-16))	822,063,168	0.27%	248,358	4.1%
Textiles and Textile Products(17-18)	288,770,752	0.01%	68,171	1.4%
Leather, Leather and Footwear(19)	44,482,916	0.09%	74,262	1.4%
Wood and Products of Wood and Cork(20)	164,121,536	0.52%	223,599	2.9%
Pulp, Paper, Paper , Printing and Publishing(21-22)	220,136,192	0.26%	154,808	3.9%
Coke, Refined Petroleum and Nuclear Fuel(23)	837,574,720	0.44%	3,068,039	2.8%
Chemicals and Chemical Products(24)	1,208,664,064	0.35%	289,362	3.0%
Rubber and Plastics(25)	159,859,632	0.15%	89,809	2.3%
Other Non-Metallic Mineral(26)	1,061,883,648	0.74%	308,239	4.9%
Basic Metals and Fabricated Metal(27-28)	1,453,432,960	0.23%	345,070	2.8%
Machinery, Nec(29)	510,164,256	0.18%	129,846	2.4%
Electrical and Optical Equipment(30-33)	1,075,473,920	0.17%	231,883	2.6%
Transport Equipment(34-35)	651,109,824	0.26%	338,415	2.2%
Manufacturing, Nec; Recycling(36-37)	102,199,992	0.14%	74,653	2.4%
Total	8,599,938,048	0.25%		

Unit: US dollars. The exchange rate is 0.125428 US dollar per RMB at 2006 from WIOD data set.
Data source: NBS data set.

Table 1 and Table 2 provide a first glance of the production subsidies from the NBS data in the year 2006, which by the accounting rules, these subsidies contain the rebates of the value-added tax except for the export tax rebates, preferential loans, and monetary or non-monetary grants.[8] In year 2006, 8.6 billion U.S. dollars subsidies were distributed

[8]Please refer to the accounting rules of the subsidy income from the Chinese government: the No.3 of Caikuai(2000) and the No. 18 of Caikuai(2006).

by the Chinese government to the manufacturing firms in the NBS data. This number equals to the GDP of Albania in 2006, which ranked 119 among 192 economies by IMF. According to the total amounts, the industry of Basic Metals and Fabricated Metal recieved the most subsidies, followed by the industry of Chemical Products and the industy of Elactrical and Optical Equipment. In contrast, Leather, Leather and Footwear, Manufacturing, Nec; and Recycling, and Rubbber and Plastics are the bottom three. The thrid colum reports the Subsidy-to-sales ratio at the industrial level, defined as the total subsidies to a industry over the total sales revenue of the industry, which is used by Ossa (2015) that implied by a model with free entry condition.[9] Under this meausre, Other Non-Metallic Mineral have the most subsidies and Textiles and Textile Products recieves the less.[10] The column (4) and (5) of the table 1 report the mean of the amount of the subsidies that a firm receives in the data and the mean of the subsidy ratio of a firm, which defined as subsidy income divided by the cost of good sales plus the sales expense, which is implied by the equation (2). Table 2 summarizes the subsidies to the exporters. Overall, the exporters obtain about 39% of the total subsidies. In the industry of Transportation Equipment, of Electrical and Optical Equipment, of Leather, Leather and Footwear, of Machinery, Nec., and of Textiles and Textile Products, the exporters take more than half of the subsidies.

5.2 Motives of Subsidies

To further ask the question that do the subsidies of the Chinese government fit any model-implied motives, we run the following regression:

$$S_{fpkt} = \alpha_0 + \alpha_1 \mathbb{X}_k + D_{pt} + \epsilon_{fpkt}, \tag{6}$$

[9] Ossa (2015) use the subsidies and the sales for U.S. states.

[10] According Ossa (2015), the mean subsidy-to-sale ratio to the manufacturing of the United States across states is 0.7%.

Table 3: Summary Statistics: Production Subsidies of China 2006 (Exporters)

IO Industries (ISIC3 2-digit)	Ratio to Exporters	Subsidy-to-Sales Ratio	Mean Subsidy	Mean Subsidy Ratio
Food, Beverages and Tobacco (15-16))	37%	0.26%	308,807	1.4%
Textiles and Textile Products(17-18)	54%	0.10%	61,560	0.8%
Leather, Leather and Footwear(19)	60%	0.09%	63,346	0.9%
Wood and Products of Wood and Cork(20)	19%	0.26%	117,832	1.5%
Pulp, Paper, Paper , Printing and Publishing(21-22)	25%	0.19%	258,356	1.7%
Coke, Refined Petroleum and Nuclear Fuel(23)	40%	0.45%	9,290,383	1.3%
Chemicals and Chemical Products(24)	31%	0.23%	289,361	1.3%
Rubber and Plastics(25)	37%	0.11%	90,095	1.0%
Other Non-Metallic Mineral(26)	19%	0.47%	340,083	2.4%
Basic Metals and Fabricated Metal(27-28)	25%	0.12%	263,538	0.8%
Machinery, Nec(29)	56%	0.17%	162,628	1.2%
Electrical and Optical Equipment(30-33)	60%	0.14%	298,550	1.3%
Transport Equipment(34-35)	66%	0.27%	543,057	1.1%
Manufacturing, Nec; Recycling(36-37)	48%	0.11%	52,953	0.8%
Total	39%			

Unit: US dollars. The exchange rate is 0.125428 US dollar per RMB at 2006 from WIOD data set.

Data source: NBS data set.

where the dependent variable S_{fpkt} denotes three different measures of the subsidies in the different regressions. For the first regression, it refers a firm's subsidy status which equals one to refer the firm that locates at a province p receiving the subsidies. In the second specification, we use the firm's subsidy income level which is the log of one plus subsidy income as a regressand. In the third model, a firm's subsidy ratio which is the log of one plus the subsidy income divided by the cost of sales plus the sales expense is used. $\mathbb{X}_k$ are a series of the sectors' characteristics which are summarized in the Table 4. Following the implications of the equation (3) and the equation (4), the first controlled variable is the elasticity of substitution of the IO sectors which is calibrated by Hsieh and Ossa (2016) using the NBS data with the implication of the equation (3) that industrial value added is proportional to the industrial factor payments with a ratio as $\frac{\sigma_k}{\sigma_{k-1}}$. The second variable is the average of the IO sectors' expenditure shares of the Chinese imports of the 40 countries listed in the WIOD. This variable captures the sector mean of δ_k^{ci} in the equation (4) and (5) across the countries. The third variable is the expenditure shares of the Chinese sectors on the import, which equals to $1 - \delta_k^{cc}$ for a sector k. Additionally,

Table 4: Summary of Variables

IO Industries (ISIC3 2-digit)	σ	Consumption Share(%)	Import Share(%)	Share as Inputs(%)
Food, Beverages and Tobacco (15-16))	3.3	0.009	2.4	45.4
Textiles and Textile Products(17-18)	6.1	0.205	11.6	71.9
Leather, Leather and Footwear(19)	6.1	0.172	11.4	55.8
Wood and Products of Wood and Cork(20)	4.6	0.110	5.4	95.8
Pulp, Paper, Paper , Printing and Publishing(21-22)	16.1	0.086	6.6	95.2
Coke, Refined Petroleum and Nuclear Fuel(23)	6.5	0.059	17.7	97.2
Chemicals and Chemical Products(24)	11.4	0.146	9.4	91.8
Rubber and Plastics(25)	6.3	0.191	9.5	93.4
Other Non-Metallic Mineral(26)	3.5	0.065	4.5	92.5
Basic Metals and Fabricated Metal(27-28)	3.1	0.166	7.9	96.6
Machinery, Nec(29)	8.0	0.060	7.5	66.0
Electrical and Optical Equipment(30-33)	3.5	0.413	25.1	73.5
Transport Equipment(34-35)	7.4	0.061	6.1	62.3
Manufacturing, Nec; Recycling(36-37)	3.1	0.645	4.8	68.6

Data of σ is from Hsieh and Ossa (2016). The reminders are from WIOD year 2002.

the capital intensity at the two-digit CIC sectors and the share of total output of a Chinese IO sector that is used for the input to other Chinese sectors are included to see the motives of the subsidizing a specific production factors and of the input-output linkage. To reduce the concerns of the endogeniety, all the share variables and the capital intensity are constructed using the data of 2002. The last variable in the equation (6) D_{pt} is the Province-Year fixed effects which try to control the difference across the provinces of China, such as the distribution of the industries across the provinces. The results are reported in the Table 5.

In The Table 5, the results are qualitatively similar across three different dependent variables. The more heterogeneous sectors have larger probability to be subsidized. Those sectors also enjoy larger amounts of the subsidies and higher subsidy ratios. As discussion in the section four, this results imply a higher delocation effect or profit-shifting effect. The coefficients of the average consumption share are negative. This shows that the subsidies go to the sectors that relatively less export orientation. On the contrary, the sectors that spend more on imports obtain higher subsidies. These result in a smaller

Table 5: CIC 2-digit Sector Characteristics and the Subsidies

	(1) Subsidy Status$_{fkt}$	(2) ln(Subsidy Income$_{fkt}$)	(3) ln(Subsidy Ratio$_{fkt}$)^b
Elasticity of Substitution$_k$	-0.00673***	-0.0126***	-0.0000956***
	(0.000490)	(0.000592)	(0.0000102)
Consumption Share$_{k,2002}$	-24.49***	-42.96***	-0.375***
	(2.053)	(1.984)	(0.0501)
Import Share$_{k,2002}$	0.888***	1.167***	0.00742***
	(0.0443)	(0.0505)	(0.00119)
Capital Intensity$_{k,2002}$	0.00319***	0.00594***	0.0000255***
	(0.000110)	(0.000148)	(0.00000271)
Share as Input$_{k,2002}$	0.0734***	0.234***	0.00235***
	(0.00977)	(0.0115)	(0.000219)
Province-Year Fixed Effects	Y	Y	Y
Cons	-1.597***		
	(0.0286)		
N	1130902	1130902	1117230
R^2	0.0501^a	0.035	0.007

Robust standard errors in parentheses

^{a} Pseudo R-squared

^{b} In fact, it is ln(1+Subsidy Ratio$_{fkt}$)

* $p < .1$, ** $p < .05$, *** $p < .01$

benefits of the terms of trade effect to other countries. Further, the industrial output that used more by other sectors as inputs and the relatively capital intensive sectors receive more subsidies. In the real world, many policies could lead to these findings. For example, to subsidize the infant industry will probably lead to the outcomes that are observed in the regression. The small R-squares in the table 5 stands for a potential impact of the firm-level characteristics on receiving the subsidies, which are investigated in the following paragraphs.

5.3 Firm-level Characteristics on Receiving Subsidies

In the literature, Girma et al. (2009) use a Probit model to see the firm-level determinants of the subsidies. Their results tell that the probability of a firm to receive subsidies is associated with the export status, the sales revenue, and the government relationships which include the state capital, the state ownership, and the level of the administrative division that a firm is affiliated with. Through the interviews of the officials, the scholars, and the owners of the bussiness, Lee et al. (2014) find that the subsidies, besides the relationship with the government, usually come with the requirement or as rewards to extra investment in capital or labor. Not exhaustive, I categorize the policies which are gathered from the government documents into two major categories: policies where that the recipients are clearly defined by the central government and policies where that the central government only gives a guideline and the local governments have the right to make the rules and select firms.

For the first category, they are, for example, the value-added tax rebates on the imported equipments for producing exports (No. 146 of Caihui (2002)), the value-added tax rebates on the product of the intergreted circuit (No. 25 of Caishui (2000); No. 70 and No. 140 of CaiShui (2002)), and the value-added tax rebates on the self-used imports of firms that locate in the special economic zones, Pudong, and Suzhou industrial parks (No.135 of Guohan (1995)). Different from the subsidies in the first category that has clear standard, the subsidies in the second category are diverse and vary across the local governments in terms of the forms, the amounts of the subsidies, and the ways to subsidize. However, most of the rules emphasize either that the firms reach a certain size (the revenue, the amount of the investment, or the tax contribution), or the firms are recognized as frims with high and new technology.[11][12] Additionally, in both catogories, some subsidies go to the purposes that are not related to the production performance, such as the grants toward the profit-losing state-owned firms, to integrate the state-owned firms, and the subsidies to reduce the pollution.[13] Noteworthily, the income tax subsidies to the exporters that export more than 70% of their exports in the ecomoic zones, which is dicussed by Defever and Riaño (2015) and the exemption of the import-related taxes of the processing trade are not recorded as the subsidy income.

To further investigate the issue, the matched data, hence all samples are exporters, are used to run the following regression model:

$$S_{fpkt} = \alpha_0 + \alpha_1 \mathbb{X}_{fpkt-1} + D_p + D_k + D_t + \epsilon_{fpkt},$$

where S_{fpkt} is defined similarly as in the equation (6). D_p, D_k, and D_t refer the CIC 4-digit industry fixed effects, the province fixed effects, and the year fixed effects respectively. To reduce the concerns of the reverse causality, the variables on the right hand side are lagged for one period. The results of the subsidy status are presented in the Table 6. The regressions of the subsidy incomes and of the subsidy ratios are in the Appendix B.

The first six variables in the regressions of the Table 6 confirm the findings of Girma et al. (2009) that firms in large size in terms of sales, export sales, and employment are associated with a larger amount of subsidies. State capital are also positively related to the subsidy status. Following their paper, we use the welfare payments as a instrumental

[11]The central government has a gnenral rule to identify whether a firm is a high and new technolgy firm. The provinces are the ones in charge. Plese refer to No. 324 Guokefa (2000) and No. 172 Fuokefa (2008)

[12]For example, Shandong province provides 50% interest rate subsidies to the slected firms which meet the high value-added and high technology requiremnt (No.35 of Lucaiqi(2015)); Shenzen have similar policy which additionally includes the firms that registered capital is above 10 million RMB (No. 103 of Shenjingmaoxinxijingxie (2015)).

[13]The central government has specific budget for subsdizing the profit-losing state-owned firms. Please see Girma et al. (2009)

Table 6: Subsidy Probability

	Subsidy Status$_{ft}$			
	(1)	(2)	(3)	(4)
ln(TFP$_{ft-1}$)	0.0286***	0.0246***	0.0235***	0.0222***
	(0.00838)	(0.00837)	(0.00845)	(0.00846)
ln(Sale$_{ft-1}$)	0.0247**	0.0386***	0.0205**	0.0124
	(0.00977)	(0.00965)	(0.00991)	(0.00999)
ln(export$_{ft-1}$)	0.0145***		0.0225***	0.0223***
	(0.00158)		(0.00164)	(0.00165)
ln(Employment$_{ft-1}$)	0.0762***	0.0812***	0.0955***	0.0981***
	(0.00760)	(0.00760)	(0.00771)	(0.00772)
ln(Welfare Payments$_{ft-1}$)	0.0183***	0.0181***	0.0129***	0.0131***
	(0.00203)	(0.00203)	(0.00206)	(0.00206)
ln(State Capital$_{ft-1}$)	0.0156***	0.0153***	0.0130***	0.0126***
	(0.00219)	(0.00219)	(0.00221)	(0.00221)
ln(Investment$_{ft-1}$)	0.0227***	0.0219***	0.0303***	0.0277***
	(0.00403)	(0.00402)	(0.00408)	(0.00410)
Profit-losing Dummy$_{ft-1}$	-0.0689**	-0.0694**	-0.0315	-0.0362
	(0.0277)	(0.0277)	(0.0280)	(0.0281)
$\frac{Export_{ft-1}}{Sales\ Revenue_{ft-1}} > 70\%$		0.00420		
		(0.0116)		
ln(Processing Ratio$_{ft-1}$)			-0.681***	-0.783***
			(0.0224)	(0.0276)
ln(Max Product Sophisticated Index$_{ft-1}$)			0.192***	0.176***
			(0.0235)	(0.0236)
ln(Imported Intermediate Inputs Value$_{ft-1}$)				0.00767***
				(0.00121)
Cons.	-2.129***	-2.204***	-2.351***	-2.285***
	(0.203)	(0.204)	(0.206)	(0.206)
N	81773	81773	81773	81773
pseudo R^2	0.121	0.120	0.132	0.132

Robust standard errors in parentheses

All specifications include CIC 4-digit industry fixed effects, province fixed effects, and year fixed effects.

* $p < .1$, ** $p < .05$, *** $p < .01$

variable of the subsidies along with the state capital in the future analysis, and hence this variable is included in the regressions. In the first model, the investment which is the change of a firm's fixed assets at the original price plus the depreciation in the NBS data and the profit-losing dummy which equals one refering a firm earning negtive profits at time t are additionally added. The coefficients show that the investment are positively correlated with the subsidy status in all specficiations. The profit-losing dummy is negatively correlated with the subsidy status but are not robust. This echoes the findings of Lee et al. (2014) that the subsidies are more like a reward than a help to the bankrupt firms.

In the regression models (2) to (4) we ask how are the subsidies in the NBS data relted to the three major policies and phenomena that recieve focuses in the literature for the trade of China. The first one is the income tax subsidies with a requirement of the export intensity over 70%, which is anaylized in Defever and Riaño (2015).[14] This is tested in the model (2) by the dummy which equals one to stand for a firm's export intensity, defined as the ratio of the export sales to the sales revenue, exceeds 70%. The second policy is the exemption of the import tariff for the processing trade, which has been discussed in many papers such as Dai et al. (2016). We use the processing export ratio as a measurement in the column (3). The last is the level of the product sophistication that is first aware by (Rodrik, 2006). He finds that the Chinese export is much more sophisticated, measured by the overlap with the varieties of the exports of the high income countries, than it should have been in the past few decades and suggests a possibility of the policy supports from the Chinese government. To check his hypothesis, the product sophistication index which is the exporters' GDP per capita weighed export flows at HS 6-digit product, proposed by Hausmann et al. (2007) and constructed by Jarreau and Poncet (2012) using the 1997 BACI world trade data is included in the regression (4).[15] A HS 6-digit variety have a larger value of the index if it is exported more by high income countries. I use the maximum of the indexes among all varieties a firm exports at the

[14] This policy was abolished in year 2008.

[15] The product sophistication index for a HS 6-digit product g is defined as $\sum_j \frac{X_g^j/X^j}{\sum_j X_g^j/X^j} Y_j$, which X_g^j is the country j's export of the product g and Y_j is the per capita income of the country.

time t as the firm-level measurement. Additionally, the value of the intermediate inputs, which the intermediate goods are identified by the BEC classification, are included.

For the results, the coefficient of the export intensity dummy in the regresion (2) is insignificant, and the coefficients of the processing ratio in the regression (3) and the regression (4) are negative. Contrarily, the coefficient of the product sophistication are positively associated with the production subsidies. This shows that the subsidies in the NBS data are not associated with the income tax subsidies, as the discussion in the previous paragraph. Also, the policis of subsidies probably favor the ordinary trade and the relatively sophisticated products which would bring relatively more productivity growth that is implied by Yu (2014) which finds that the ordinary trade brings more productivity growth for a exporter and Rodrik (2006) that exporting relatively sophisticated products leads a higher economic growth. Further, the coefficient of the imported intermediate inputs value is positive, which echos the policies for the rebate of the value-added tax, discussed previously. In the following subsection, I estimate the effects of the subsidies on the unit prices and entry.

5.4 The Subsidy Effects on the Unit Prices and Entry

To look at the subsidy effect on the unit prices, we start from taking the log of the equation (2). The price of a variety can be expressed as:

$$ln\, p_g^{ij} = ln\, \frac{\sigma_k}{\sigma_k - 1} + ln\, \tau^{ij} + ln\, \xi_g + ln\, \Theta_k - ln\, \phi_g.$$

I, therefore, write down the empirical model:

$$ln\, p_{gofkit}^{ci} = \alpha_0 + \alpha_1 ln\, S_{ft} + \alpha_2 ln\, \phi_{ft} + \alpha_3 ln \mathbb{X}_{ft}^{p} + D_{goi} + D_{kit} + \epsilon_{gofkit}, \tag{7}$$

Table 7: The Subsidy Effects on the Unit Price

	ln(Unit Value$_{gfit}$)		
	OLS		(GMM-IV)
	(1)	(2)	(3)
	All Samples	All Samples	All Sample
ln(Subsidy Ratio$_{ft}$)	0.0113	-1.063***	-7.399**
	(0.0854)	(0.404)	(3.163)
ln(TFP$_{ft}$)	0.00845***	0.00843***	0.00703***
	(0.00125)	(0.00125)	(0.00140)
ln(Average Wage$_{ft}$)	0.00145	0.00153	-0.0000271
	(0.00202)	(0.00202)	(0.00217)
ln(Import Intermediate Inputs Unit Value$_{ft}$)	0.00244***	0.00244***	0.00218***
	(0.000690)	(0.000690)	(0.000704)
ln(Managerial Expense$_{ft}$)	0.00189	0.00190	0.00213
	(0.00136)	(0.00136)	(0.00138)
ln(Investment$_{ft}$)	0.00109*	0.000893	0.00117*
	(0.000653)	(0.000655)	(0.000661)
ln(Employment$_{ft}$)	0.00580**	0.00580**	0.00618**
	(0.00246)	(0.00246)	(0.00248)
New Entrants Dummy$_{gfkit}$	0.0174***	0.0174***	0.0162***
	(0.00156)	(0.00156)	(0.00165)
ln(Subsidy Ratio$_{ft}$)×ln(Investment$_{ft}$)		0.135***	
		(0.0500)	
Product-Destination-Year FE	Y	Y	Y
Variety-Destination FE	Y	Y	Y
N	1111272	1111272	1111090
R^2	0.972	0.972	0.972
Hansen J P-Value			0.400
Kleibergen-Paap F Statistic			154.8

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

where the independent variable is the unit price of a variety g which is defined as a HS 6-digit product k exported under a trade regime o of a firm f to a country i at time t. Importantly, the products exported under the processing trade are treated as the different varieties from the varieties exported under ordinary trade within a firm. Under the processing trade regime, a firm mainly assembles the intermediate inputs for the clients and has different quality of inputs from the varieties exported under the ordinary trade, which has been documented in the literature such as Manova and Zhang (2012).

The dependent variable in the empirical model equation (7) S_{ft} is the measure of the subsidies which is defined as the subsidy income divided by the cost of sales plus the sales expense.[16] In the Appendix B, I test the different definitions of the subsidies. ϕ_g is the productivity measured by the method of Levinsohn and Petrin. $\mathbb{X}^P_{ft}$ denotes a sets of the firm-level variables that are controlled. They are the average wage of a firm which is the total wage payment divided by the number of workers and the imported intermediate inputs price that is captured by the import share-weighed unit value of a firm's HS 6-digit intermediate imports. These two variables are used to control the firm-specified unit costs of the production. I also include the managerial expense and the investments as an approximation of the fixed costs of the production, which might affect the unit prices through the choice of the quality. As the implication of the determinants of receiving subsidies in the previous regressions, the variables of the firm size which are the employment, the sales revenue, the imported intermediate inputs value, and the exports are controlled in different specifications for the robustness check. Further, I control the new entrants by a dummy. A new entrants might have a lower productivity and hence a higher unit price due to the learning when I restrict the comparison within a variety of a firm. The last two variables D_{goi} and D_{kit} are the variety fixed effects and the HS 6-digit-destination-time effects. The former fixed effects control the variety-level time invariant characteristics such as the average quality of a variety; the later one controls the product-market-specified time variant variables such as the change of the tariff. The Table 7 and the Table 8 provide the results.

The column (1) of the Table (7) is the OLS regression. The coefficient of the subsidies is insignificant. The explaination in our mind is the product quality. It is well-known that

[16] As mentioned before, one plus subsidy ratio is used when we take the log.

Table 8: The Subsidy Effects on the Unit Price

	ln(Unit Value$_{gfit}$) (GMM-IV)		
	(1)	(2)	(3)
	Top 7 Destinations	All Samples	All Sample
ln(Subsidy Ratio$_{ft}$)	-14.64***	-7.447**	-8.003***
	(5.480)	(3.126)	(3.082)
ln(TFP$_{ft}$)	0.00550**	0.00703***	0.00164
	(0.00219)	(0.00137)	(0.00136)
ln(Average Wage$_{ft}$)	-0.000394	-0.0000493	-0.00330
	(0.00305)	(0.00216)	(0.00211)
ln(Imported Intermediate Inputs Unit Value$_{ft}$)	0.00291***	0.00218***	0.00331***
	(0.00102)	(0.000700)	(0.000907)
ln(Managerial Expense$_{ft}$)	0.00572***	0.00213	-0.000123
	(0.00189)	(0.00134)	(0.00144)
ln(Investment$_{ft}$)	0.00274***	0.00118*	0.000646
	(0.000982)	(0.000648)	(0.000672)
ln(Employment$_{ft}$)	0.00532	0.00616**	-0.00283
	(0.00345)	(0.00245)	(0.00288)
New Entry Dummy$_{gfkit}$	0.0155***	0.0162***	0.0166***
	(0.00244)	(0.00155)	(0.00167)
ln(Sales Revenue$_{ft}$)			0.0271***
			(0.00436)
ln(Imported Intermediate Inputs Value$_{ft}$)			-0.000823**
			(0.000334)
ln(Export$_{ft}$)			0.0000704
			(0.000344)
Product-Destination-Year FE	Y	Y	Y
Variety-Destination FE	Y	Y	Y
N	554217	1111090	1111088
R^2	0.962	0.972	0.972
Hansen J P-Value	0.232	0.313	0.458
Kleibergen-Paap F Statistic	57.40	132.4	163.2

Clustered standard errors at the HS6-Firm-Destination level in parentheses in model (1) and (3).
Clustered standard errors at the HS6-Destination-Year level in parentheses in model (2).
* $p < .1$, ** $p < .05$, *** $p < .01$

the unit prices are associated with the product quality. In the literature of the endogenous choice of the product quality such as Kugler and Verhoogen (2011), a reduction of the production costs, either on the fixed costs or on the unit costs, leads to a choice of higher quality. Therefore, in the regression (2), a interaction term of the subsidy and the investments is included. After controlling the interaction term, the coefficient of the subsidy ratio becomes significantly negative. The effect of subsidies on quality will be a extension for the future study.

To futher avoid the issue of the quality and assert the causality, in the regression (3), following Girma et al. (2009), I use the log welfare and log state capital as instrument variables for the subsidy ratio. These two variables are supposed to be correlated with the subsidies, which can be seen in the regression results in the Table 6 and the results in the Table 14 and Table 15 in the Appendix B and uncorrelated with the unit prices after the firm size and the unit costs are controlled. The Hansen J statistic and Kleibergen-Paap F statistic are reported for supporting the validity of the instruments.

The regression (3) shows that the a percentage decrease of the subsidy ratio is associated with a 7.4% decrease of the unit price. The effect is double in the regression (1) of the Table 8 when only the varieties exported to the major destinations are considered. This probably because the varieties exported to these markets are supposed to face more serious competition and hence the effects of the subsidies are stronger. In the regression (2) of the Table 8 the error terms are clustered at HS 6-digit-Destination-Year level to allow the correlation for the varieties from the firms exported to the same destinations. In the last regression of the table 8 all the size variables that are associated with the subsidy status are included. The magnitude of the coefficient changes only a little bit from -7.4 to -8.0.

Not only having impacts on the intensive margin, the subsidies could also promote a firm to entry a new market. To investigate this problem, we form a sample sets that contain all the observations in the NBS data that at least are matched once with the Custom data at the variety-level over the sample period. I further tailor the data set to focus on the varieties that are not exported in the previous year to a destination. Hence, the observations in the data set are a firm's variety that are first exported to the

Table 9: The Subsidy Effects on Entry

	$\text{Entry}_{gfit}\|_{Entry_{gfit-1}=0}$			
	(1)	(2)	(3)	(4)
	OLS	GMM-IV	OLS	GMM-IV
$\ln(\text{Subsidy Income}_{ft})$	0.000246	0.0190		
	(0.000533)	(0.0281)		
$\ln(\text{Subsidy Ratio}_{ft})$			-0.0888	2.918
			(0.126)	(4.458)
$\ln(\text{TFP}_{ft})$	0.0208***	0.0214***	0.0206***	0.0213***
	(0.00171)	(0.00195)	(0.00171)	(0.00195)
$\ln(\text{Average Wage}_{ft})$	0.0369***	0.0366***	0.0367***	0.0386***
	(0.00290)	(0.00294)	(0.00290)	(0.00402)
$\ln(\text{Managerial Expense}_{ft})$	0.0198***	0.0177***	0.0197***	0.0193***
	(0.00205)	(0.00368)	(0.00205)	(0.00215)
$\ln(\text{Imported Intermediate Inputs Unit Value}_{ft})$	0.00428***	0.00339**	0.00433***	0.00434***
	(0.00103)	(0.00170)	(0.00103)	(0.00103)
$\ln(\text{Investment}_{ft})$	-0.000386	-0.00115	-0.000306	-0.000189
	(0.00105)	(0.00155)	(0.00105)	(0.00107)
$\ln(\text{Employment}_{ft})$	0.0927***	0.0908***	0.0926***	0.0934***
	(0.00370)	(0.00483)	(0.00370)	(0.00381)
$\text{Export Status}_{ft-1}$	0.0498***	0.0509***	0.0486***	0.0504***
	(0.00456)	(0.00492)	(0.00456)	(0.00533)
HS6-Destination-Trade Regime-Year FE	Y	Y	Y	Y
HS6-Firm-Destination FE	Y	Y	Y	Y
N	613895	613848	613977	613930
R^2	0.443	0.441	0.443	0.442
Hansen J P-Value		0.808		0.616
Kleibergen-Paap F Statistic		48.52		111.5

Robust Cluster standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$

destination or that are going to export in the future. As critics to the literature of the entry of the export market, this is in fact looking at the effects on entry timing. An entry E^{ci}_{gofkit} is a dummy variable with value one when a variety of a firm enters a market at time t. The empirical model is:

$$E^{ci}_{gofkit} = \alpha_0 + \alpha_1 ln\, S_{ft} + \alpha_2 ln\, \phi_{ft} + \alpha_3\, Export\, Status_{ft-1} + \alpha_4 ln \mathbb{X}^p_{ft} + D_{goi} + D_{kit} + \epsilon_{gofkit}, \tag{8}$$

where $Export\ Status_{t-1}$, a firm's export status at $t-1$, is included besides all the variables used in the unit price regression. It is a dummy to refer that a firm exports other than this variety in the previous year. This variable captures the export experience of the firms and is hence associated with the entry costs. As discussion in Greenaway and Kneller (2007), the lag term of entry is the most crucial and robust variable to explain the current entry. The results are in the Table 9. Different from the effects on the unit prices, the subsidy effects on entry seems to be insignificant. One possible reason for this results is that the comparison in the Table 9 is restricted within a variety, which means that the coefficient is identified by the samples that re-entry the market over the sample period. In the Table 18 of the Appendix B, I focus the comparison within a product-destination-trade regime cell. The results are still insignificant. This is probably because the subsidies are associated with the firm size. The large firms can overcome the fixed exporting costs by their own and hence the subsidies do not play a role on promoting entry.

To sump up, I find that the the production subsidies of China: (1) at the sector level, the subsidies coincide with the model-implied welfare maximization, which are given to the relatively heterogeneous and import-orientation sectors; (2) the size, the state ownership, the regime of the export, the intermediate goods import value, and the sophistication of the product of a firm are positively related to the subsidy status; (3) The subsidies lower the unit prices of the firms but have no significant effect on entry. To evaluate the subsidies, in the following sections I construct the changes of price indexes of China.

6 The Price Index

To construct the price index of Chinese export to the major destinations, we rewrite the price index of a sector k in a country i as follow:

$$\mathbb{P}_k^i = \left\{ \sum_j \left[\left(\sum_{g \in \omega_k^{ji}} p_g^{ji\,1-\sigma_k} \right)^{\frac{1}{1-\sigma_k}} \right]^{1-\sigma_k} \right\}^{\frac{1}{1-\sigma_k}}, \tag{9}$$

where $\left(\sum_{g \in \omega_k^{ji}} p_g^{ji\,1-\sigma_k} \right)^{\frac{1}{1-\sigma_k}}$ is the aggregate price index of the varieties exported by a country j and is further denoted as P_k^{ji}. Using the exact hat algebra, the proportional change of the price index of the sector k of the Chinese export to the country i between the counter factual state and the current state can be expressed as:

$$\begin{aligned} \frac{P_k^{\prime ci}}{P_k^{ci}} &= \left[\sum_{g \in \omega_k^{ci}} \left(\frac{p_{gk}^{ci}}{P_k^{ci}} \right)^{1-\sigma_k} \left(\frac{p_g^{\prime cc}}{p_g^{cc}} \right)^{1-\sigma_k} \right]^{\frac{1}{1-\sigma_k}} \\ &= \underbrace{\left[\sum_{g \in \omega_k^{ci}} \delta_g^{ci} \left(\frac{\xi_g'}{\xi_g} \right)^{1-\sigma_k} \right]^{\frac{1}{1-\sigma_k}}}_{\text{P.E.}:\Lambda_k^{ci}} \underbrace{\frac{\Theta_k'}{\Theta_k}}_{\text{G.E.}}, \end{aligned} \tag{10}$$

where from the first line to the second line the equation (3) and equation (4) are used. δ_g^{ci} is the share of a Chinese variety g that is exported to the destination i to the total Chinese export to the destination i. The notation with the apostrophe refers the counter factual values. Hence, the $\frac{\xi_g'}{\xi_g}$ is the proportional change of the one minus subsidy ratio that leads to the change of the variety price, implied by the model. The subsidies affect the price index through two channels. First, they directly lower the prices of the subsidized varieties and hence lower the price index, which is the first part of the second line of the equation (9), denoted as Λ_k^{ci}. Second, the subsidies raise the factor prices under the general equilibrium, which is notated as $G.E.$ in the equation. I calculated the Λ_k^{ci} from the data with my empirical results, and $G.E.$ is determined by a quantitative trade model.

To apply the data and our empirical findings to the equation (9), I reformulate the equation as:

$$\begin{aligned}\frac{P_k'^{ci}}{P_k^{ci}} &= \frac{\Theta_k'}{\Theta_k}\left[\sum_{g\in\omega_k^{ci,m}}\delta_g^{ci}\left(1+\frac{\xi_g'-\xi_g}{\xi_g}\right)^{1-\sigma_k}+\sum_{g\in\omega_k^{ci,um}}\delta_g^{ci}\left(1+\frac{\xi_g'-\xi_g}{\xi_g}\right)^{1-\sigma_k}\right]^{\frac{1}{1-\sigma_k}}\\ &= \frac{\Theta_k'}{\Theta_k}\left[\sum_{g\in\omega_{k,\tilde{\xi}\neq 0}^{ci,m}}\delta_g^{ci}\left(1+f(\tilde{\xi}_g')\right)^{1-\sigma_k}+\sum_{g\in\omega_{k,\tilde{\xi}\neq 0}^{ci,um}}\delta_g^{ci}\left(1+f(\tilde{\xi}_g')\right)^{1-\sigma_k}+\sum_{g\in\omega_{k,\tilde{\xi}=0}^{ci}}\delta_g^{ci}\right]^{\frac{1}{1-\sigma_k}},\end{aligned} \tag{11}$$

where the superscription m denotes the observations that are matched and the um represents the data that are unmatched. $f(\tilde{\xi}_g')$ is the empirical effects of the subsidies on the unit prices. For the non-subsidized firms, it equals to one and hence the share weighed sum of those varieties are just the aggregate sales share of the non-subsidized firms. In the Table 7 and the Table 8, I report the estimation of the effects of the subsidy ratio on the unit prices. To fit the model, in the Table 15 of the Appendix B, the effects of $\tilde{\xi}$ is additionally reported. It shows that a percentage increase of the ξ_g results in a 12.8 percentage increase of the unit prices for the major destinations. For the domestic varieties, the average subsidy effect across the destinations, a percentage increase of the $\tilde{\xi}$ leads to 7 percentage increase of the unit prices, which is reported in the column (3) of the Table 15 is used. Combining these results with the σ_k in the Table 4 and the δ_g^{ci} from the data, I can construct the price changes under the counter factual scenario after solving the data matching issue, using the formula (10).

In year 2006, 14,010 manufacturing exporters in the NBS data are subsidized. 10,013

Table 10: Data Summary: Matched Ratio

IO Industries (ISIC3 2-digit)	Matched Amounts	Matched Firms
Food, Beverages and Tobacco (15-16))	54	64
Textiles and Textile Products(17-18)	55	69
Leather, Leather and Footwear(19)	67	70
Wood and Products of Wood and Cork(20)	63	70
Pulp, Paper, Paper , Printing and Publishing(21-22)	62	61
Coke, Refined Petroleum and Nuclear Fuel(23)	58	50
Chemicals and Chemical Products(24)	58	69
Rubber and Plastics(25)	55	74
Other Non-Metallic Mineral(26)	45	62
Basic Metals and Fabricated Metal(27-28)	66	72
Machinery, Nec(29)	58	73
Electrical and Optical Equipment(30-33)	86	79
Transport Equipment(34-35)	64	70
Manufacturing, Nec; Recycling(36-37)	67	77
Total	67	71

of them are matched with the Custom data. The Table 10 gives a summary of the matching quality. The matched ratios are different across sectors. In the industry of Electrical and Optical Equipment, 86% of subsidies is matched. However, for the industry of Other Non-Metallic Mineral, the ratio is about 45%. Overall, the matched subsidies accounts for 67% of total subsidies to the exporters. The column two reports the match ratios by the number of firms. In most of the sectors, these ratios are larger then the ones reported in the column one. One of the explanations is that the major category of firms that are not matched is those which conduct their exports and imports trough the intermediaries. They are either small so that they need intermediaries to overcome the fixed cost of trade or big and hence have their own intermediaries to conduct trade. Due to the size is a important factor for receiving subsidies as can be seen in the regression of the Table 14, the matched ratio defined by the number of matched firms tends to be larger than defined by the amounts of matched subsidies. For these unmatched subsidized firms, I have the data of their subsidies and the export sales from the NBS data but lack the information of their export destinations.

To deal with this issue, I look those firms within a province as one firm. I then use

Table 11: Estimated Short-run Changes of the Price Indexes Λ_k^{ci} (%)

IO Industries (ISIC3 2-digit)	Min		Max		Λ_k^{cc}
Food, Beverages and Tobacco (15-16))	0.8	(GBR)	1.8	(USA)	1.4
Textiles and Textile Products(17-18)	0.4	(TWN)	0.5	(JPN)	0.6
Leather, Leather and Footwear(19))	0.2	(JPN)	0.6	(DEU)	0.0
Wood and Products of Wood and Cork(20)	0.4	(KOR)	0.7	(USA)	2.8
Pulp, Paper, Paper , Printing and Publishing(21-22)	0.3	(JPN)	0.9	(TWN)	0.7
Coke, Refined Petroleum and Nuclear Fuel(23)*	0.3	(USA)	2.0	(KOR)	2.5
Chemicals and Chemical Products(24)	0.9	(USA)	1.2	(DEU)	1.1
Rubber and Plastics(25)	0.5	(TWN)	0.8	(NLD)	0.8
Other Non-Metallic Mineral(26)	1.2	(JPN)	1.8	(KOR)	3.9
Basic Metals and Fabricated Metal(27-28)	0.6	(TWN)	1.1	(USA)	1.3
Machinery, Nec(29)	0.5	(JPN)	0.8	(NLD)	0.8
Electrical and Optical Equipment(30-33)	0.3	(USA)	1.2	(JPN)	1.6
Transport Equipment(34-35)	0.4	(TWN)	2.1	(DEU)	1.3
Manufacturing, Nec; Recycling(36-37)	0.4	(DEU)	0.7	(TWN)	1.1

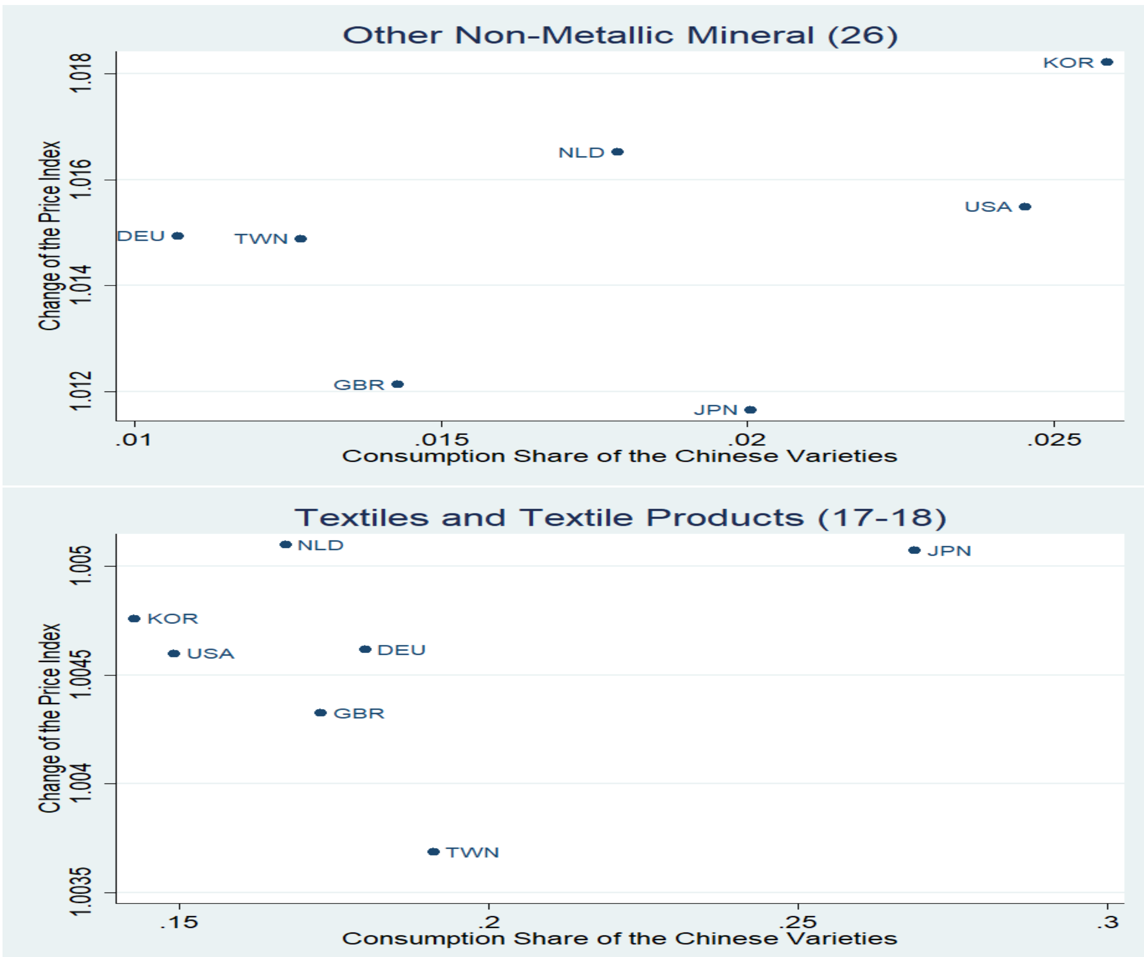
* no export recorded in the data to 2 countries: GBR and DEU.

the Custom data to break down the unmatched trade flows for each IO sector in each province and calculate the export shares to each destination. These shares are used to weigh the aggregate unmatched subsidized firms' export in the same province to obtain an approximation of the trade flows to the destinations. Mathematically, it can be stated as:

$$\delta_{kp}^{ci,um} = \frac{1}{\mathbf{X}_k^{ci}} \frac{\mathbf{X}_{kp}^{ci,um}}{\mathbf{X}_{kp}^{c,um}} \mathcal{X}_{kp}^{um}, \tag{12}$$

where the bold font letters denote the values from the Custom data and the calligraphy font ones refer to the values from the NBS data. p refers to a province. Further, the subsidy incomes and the cost of the sales plus the sales expense of those unmatched subsidized firms are aggregated at the province level and the average subsidy ratios are computed. Ideally, it would be better to divide the unmatched firms by the data observed characteristics as detail as possible. For example, it is doable to categorize firms in the NBS data and the trade flows in the Custom data by zip code and ownership. However, this leads to a biased because the intermediaries might not share the same characteristics with their clients. An aggregation at the province level would reduce this concern as long

Figure 1: The Change of the Price Indexes in the Short Run, Selected Industries.



The values on the vertical axis represent Λ_k^{ci} in the equation (10).

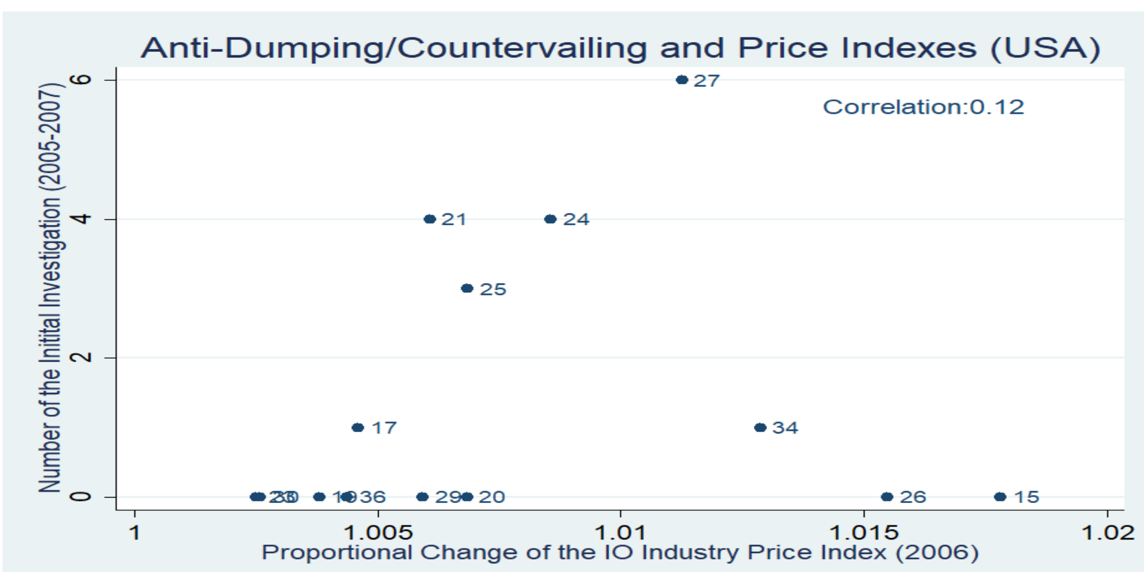
as those firms use the intermediaries located in the same province.

The column one and two in the Table 11 report the calculation of the Λ_k^{ci} in the equation (10) to the 7 major destinations under the counter factual that the subsidies are removed. The column three summarizes the domestic. It shows that, in a very short run, the subsidies affect the sector price indexes most in the industry of Other Non-Metallic Mineral both for the foreign destinations and the domestic. For the foreign destinations, the values range from 1.2% to Japan to 1.8% to Korea. For the domestic, it leads a 3.9% increase if the subsidies are removed. In contrast, the effect on the industry of Textiles, and Textile Products is the smallest. However, as shown in the equation

(9), the overall effects should be weighed by the destination consumption shares on the Chinese varieties and the sector elasticity of substitution.

In the Figure 1, I draw the scatter graph between the change of the price indexes and the consumption share of the Chinese varieties of the foreign destinations for these two industries. As can be seen, though the textile industry has smaller changes of the price indexes, the consumption shares of the destinations on the Chinese varieties are around ten times larger. Therefore, the subsidies on the textile industry will lead to a larger effect on the aggregated price indexes of the destinations than the subsidies on the Other Non-Metallic Mineral industry based on that the elasticity of substitutions of these two industries are closed. The graphs for other sectors are in the Appendix B. At this place, a question arises. If the subsidies had affected the price indexes, did any evidence that the foreign governments react the subsidies?

Figure 2: The Change of the Price Indexes and the Anti-Dumping/Countervailing Measures of USA



In the figure 2, I draw the graph that I put the changes of the price indexes of the US industries on the horizontal line and the number of files of the initial investigation of anti-dumping or countervailing measures from year 2005 to year 2007 on the vertical line. The data comes from the website of the U.S. Customs and Border Protection.[17] In many cases, the anti-dumping investigation came together with the countervailing investigation. Thus, I count those files as one. The graph, however, shows a small correlation with the value 0.12. The industry of Transport Equipment (34), the industry of the Food, Beverages and Tobacco, and the industry of Other Non-Metallic Mineral have the largest changes of the price indexes under my calculation but with only one or zero investigation. In reality, this could be due to many reasons such as the characteristics of these industries in USA or the major exporters' ownership of those in China. A further discussion is out of the scope of this paper and leave for a future research. In the following section, I introduce the full model.

7 A Model

Due to the lack of evidence of effects on the subsidies on entry, I incoprate a factor neutral subsidy into a model based on Ossa (2016) which emphasizes the terms of trade and the profit-shifting to quantify the trade effects. The model is multi-country and multi-sector. At the utility functions, the assumptions are as the description in the section 2: the first tier is Cobb-Douglas and aggregates the consumption across sectors. The second tier nests the varieties in a sector in a CES framework.

With the equation (1), the equation (3), and the notation of the number of firms $M_k^{e,j}$, the aggregate CES price index of the sector k of a country i is:

$$\mathbb{P}_k^i = \left[P_k^{ci\,1-\sigma_k} + \sum_j M_k^{e,j} \left(\frac{\sigma_k}{\sigma_k - 1} \frac{\tau_k^{ji} \Theta_k^j}{\phi_k^j} \right)^{1-\sigma_k} \right]^{\frac{1}{1-\sigma_k}}, \tag{13}$$

where P_k^{ci} is the price index of the Chinese varieties. Because the subsidies are heteroge-

[17] http://adcvd.cbp.dhs.gov/adcvdweb/.

neous, it cannot be aggregated at other price indexes. ϕ_k^j is the sector level productivity of a country j and the Θ_k^j is the unit cost of the producer which is

$$\Theta_k^i = w^{j\alpha_k^j} \overline{r}^{1-\alpha_k^j}. \tag{14}$$

In the baseline case, we consider the interest rate r^i is fixed to capture the attempt to encourage the capital accumulation. The aggregate profits of the sector is:

$$\Pi_k^i = \frac{1}{\sigma_k} \sum_j M_k^{e,i} \left(\frac{p_k^{ij}}{\mathbb{P}_k^j} \right)^{1-\sigma_k} E_k^j = \frac{1}{\sigma_k} \sum_j M_k^{e,i} \left(\frac{\sigma_k}{\sigma_k - 1} \frac{\tau_k^{ij} \Theta_k^i}{\phi_k^i \mathbb{P}_k^j} \right)^{1-\sigma_k} E_k^j. \tag{15}$$

Implied by the Cobb-Douglas form of the unit cost in the equation (13), the aggregate labor payments for the country i is:

$$w^i \overline{L}^i = \sum_s \alpha_s^i (\sigma_s - 1) \Pi_s^i + \sum_s \alpha_s^i SI_s^i, \tag{16}$$

where SI_s^i as the subsidies from a country i to the its sector k. Similarly, the capital payments is:

$$\overline{r} K^i = \sum_s (1 - \alpha_s^i)(\sigma_s - 1) \Pi_s^i + \sum_s (1 - \alpha_s^i) SI_s^i. \tag{17}$$

The sector expenditure can be expressed as:

$$E_k^i = \mu_k^i \left[w^i \overline{L}^i + \overline{r} K^i + \sum_s \Pi_s^i - \sum_s SI_s^i - \Omega^i \right]. \tag{18}$$

where the Ω^i is the international transfer which equals to the net export NX^i, equaling to $\sum_j \sum_s \sigma^s \Pi_s^{ij} - \sum_j \sum_s \sigma_s \Pi_s^{ji}$.

The model is solved by the exact hat algebra proposed by Dekle et al. (2007). Define the proportional change of the counter factual value to the current value $\frac{Y'}{Y}$ as $\hat{Y}$ and the sector trade flow X_k^{ij} as $M_k^{e,i}\left(\frac{p_k^{ij}}{\mathbb{P}_k^j}\right)^{1-\sigma_k} E_k^j$, the equilibrium conditions can be stated as follows.

Combined with the equation (9), the equation (12) is restated as:

$$\hat{\mathbb{P}}_k^i = \left[\sum_j \delta_k^{ji} \hat{w}^{j\,\alpha_k(1-\sigma_k)} \Lambda_k^{ji\,1-\sigma_k}\right]^{\frac{1}{1-\sigma_k}}, \quad \Lambda_k^{ji} = 1 \quad \forall j \neq c, \tag{19}$$

where δ_k^{ji} is $\frac{X_k^{ji}}{\sum_j X_k^{ji}}$ and Λ_k^{ci} is the partial effect of the subsidies we have calculated in the section five. The aggregate profits of a sector k of a country i is

$$\hat{\Pi}_k^i = \sum_j \delta_k^{ij} \left(\frac{\hat{w}^i \Lambda_k^{ij\,\alpha_k^i}}{\hat{\mathbb{P}}_k^j}\right)^{1-\sigma_k} \hat{E}_k^j, \quad \Lambda_k^{ij} = 1 \quad \forall i \neq c. \tag{20}$$

The equation (15), the labor demand, is:

$$\hat{w}^i = \sum_s \gamma_s^i \hat{\Pi}_s^i, \tag{21}$$

where γ_s^i equals to $\frac{\sum_j \alpha_k^i \frac{\sigma_s - 1}{\sigma_s} X_s^{ij}}{\sum_s \sum_j \alpha_k^i \frac{\sigma_s - 1}{\sigma_s} X_s^{ij} + \sum_s \alpha_s^i SI_s^i}$. The capital demand is:

$$\hat{K}^i = \sum_s \rho_s^i \hat{\Pi}_s^i, \tag{22}$$

where ρ_s^i equals to $\frac{\sum_j (1-\alpha_k^i) \frac{\sigma_s - 1}{\sigma_s} X_s^{ij}}{\sum_s \sum_j (1-\alpha_k^i) \frac{\sigma_s - 1}{\sigma_s} X_s^{ij} + \sum_s (1-\alpha_s^i) SI_s^i}$. The sector expenditure (17) is:

$$\hat{E}_k^i = \frac{\mu_k^i}{E_k^i}\left[w^i \overline{L}^i \hat{w}^i + \overline{r} K^i \hat{K}^i + \sum_s \Pi_s^i \hat{\Pi}_k^i - \Omega^i\right], \tag{23}$$

where $w^i \overline{L}^i$, $\overline{r} K^i$, and Π_k^i respectively equal to $\sum_s \alpha_s^i \frac{(\sigma_s - 1)}{\sigma_s} X_s^i + \sum_s \alpha_s^i SI_s^i$, $\sum_s (1-\alpha_s^i) \frac{(\sigma_s - 1)}{\sigma_s} X_s^i + \sum_s (1-\alpha_s^i) SI_s^i$, and $\sum_s \frac{1}{\sigma_s} X_s^i$ which are from the equations (15), (16), and (14).

For the equilibrium, the equations (18), (19), and (21) can be inserted into the equation (22) to restate the equation into a relationship between the sector expenditures and the wage. With the equation (20), it forms a system with $N + S{\times}N$ equations, which N is the number of countries and S is the number of the industries. The equilibrium, hence, is a series of $\hat{w}^i$ and $\hat{E}^i_k$ that solve the equation (20) and the equations (18), (19), (21), and (22). As it can be seen, all the coefficients of the equations can be calculated by using the sector trade flows X^{ij}_k obtained from the WIOD after the parameters α, μ, and σ are calibrated.

Besides the $\{\sigma_k\}$ that are obtained from the Hsieh and Ossa (2016), two additional sets of parameters α^i_k and μ^i_k are calibrated from the WIOD data base. We obtain the labor shares $\{\alpha^i_k\}$ from the Socio Economic Accounts of the WIOD, dividing gross value added into labor compensation.[18] μ^i_k can be simply calculated as $\frac{\sum_j X^{ji}_k}{\sum_s \sum_j X^{ij}_s - \sum_s SI^i_s - \Omega^i}$. Furthermore. due to the focus of this paper is on the manufacturing sectors, I crop the trade flows from the WIOD data following Ossa (2014) by simply subtracting the amounts to the industries other than the ISIC r3 2-digit 15 to 37. The simulation results are reported in the next section.

8 Simulation Results

The simulation results are shown in the Table 12 to the Table 14. In a counter factual world, the removal of the subsidies brings the negative effect on the welfare of China. However, it enhances the welfare of their trade partners. For a overlook, the effects are stronger to China's neighboring destinations with the strongest effects on Taiwan. However, the magnitude is small. The effect of term of trade is calculated by the equation

[18] Several industries of some countries report a negative capital compensation such as the textild industry of Japan. In this case, we replace the labor share of this industry as the maximun labor share value in our calibration that does not exceed the one, which is 0.96.

Table 12: The Welfare Implications 2006 (%)

	Expenditure	Aggregate Price	Welfare	Terms of Trade	Profit Shifting
China	-1.25	0.77	-2.02	0.37	-2.39
United States	0.13	0.08	0.06	0.02	0.04
Japan	0.26	0.12	0.15	0.02	0.13
Korea	0.28	0.13	0.15	0.02	0.13
Germany	0.14	0.08	0.06	0.01	0.05
Netherlands	0.23	0.08	0.15	0.01	0.14
United Kingdom	0.09	0.08	0.01	0.01	0
Taiwan	0.33	0.11	0.22	0.03	0.19
ROW	0.16	0.05	0.12	0.01	0.11

(5) with a modification:

$$TOT^i = \sum_k \sum_j \mu_k^i \delta_k^{ji} \left[\alpha_k^i \left(\frac{d\Theta^i}{\Theta^i} + \frac{d\xi_k^{ii}}{\xi_k^{ii}} \right) - \alpha_k^j \left(\frac{d\Theta^j}{\Theta^j} + \frac{d\xi_k^{ji}}{\xi_k^{ji}} \right) \right], \tag{24}$$

where $\frac{d\xi_k^{ii}}{\xi_k^{ii}}$ equals to zero unless i equals to c; and $\frac{d\xi_k^{ji}}{\xi_k^{ji}}$ equals to zero unless j equals to c. The results show that most of the welfare effects came from the profit shifting.

Table 13: The Welfare Implications 2006 (%)

	Wage	Capital
China	-1.20	-1.30
United States	0.14	0.17
Japan	0.22	0.28
Korea	0.21	0.33
Germany	0.12	0.14
Netherlands	0.14	0.23
United Kingdom	0.09	0.12
Taiwan	0.22	0.38
ROW	0.16	0.17

The Table 13 reports the effects on the production factors. For the trade partners of China, the nominal wages increase from 0.14% to 0.22%. The capital stocks increase 0.12% to 0.38%. For China, the wage decreases 1.2% and the capital stock drops 1.3%. The Table 14 presents the changes of the sector-destination trade flows of China when the subsidies are removed. The first column reports the maximum value and the second column reports the minimum value without considering the rest of the world. The column three is the change of the Chinese domestic output. As can be seen, in some sectors for some destinations, the exports rise in the counter factual world. This is because the drop of the wage and the current situation that less varieties to those destinations receive the subsidies. In the aggregate, the sector trade flows decrease from 0.09% to 2.53%.

Table 14: Changes of the Sector Exports of China 2006 (%)

IO Industries (ISIC3 2-digit)	Max		Min		China	Aggregate
Food, Beverages and Tobacco (15-16))	-0.75	(GBR)	-2.89	(USA)	-1.34	-1.29
Textiles and Textile Products(17-18)	1.55	(TWN)	0.58	(NLD)	-1.23	-0.09
Leather, Leather and Footwear(19))	1.95	(JPN)	0.39	(DEU)	-1.15	-0.24
Wood and Products of Wood and Cork(20)	1.00	(KOR)	-0.30	(USA)	-1.50	-1.36
Pulp, Paper, Paper , Printing and Publishing(21-22)	3.74	(JPN)	-4.82	(TWN)	-1.48	-1.32
Coke, Refined Petroleum and Nuclear Fuel(23)*	2.42	(GBR)	-1.48	(NLD)	-2.71	-2.53
Chemicals and Chemical Products(24)	-4.24	(USA)	-6.97	(DEU)	-2.56	-2.30
Rubber and Plastics(25)	0.86	(GBR)	-2.56	(JPN)	-1.32	-0.97
Other Non-Metallic Mineral(26)	-1.14	(JPN)	-2.59	(KOR)	-1.45	-1.40
Basic Metals and Fabricated Metal(27-28)	0.14	(TWN)	-1.21	(USA)	-1.40	-1.26
Machinery, Nec(29)	0.69	(JPN)	-1.26	(DEU)	-1.57	-1.08
Electrical and Optical Equipment(30-33)	0.66	(USA)	-1.18	(JPN)	-2.30	-1.06
Transport Equipment(34-35)	0.19	(TWN)	-9.06	(DEU)	-1.78	-1.42
Manufacturing, Nec; Recycling(36-37)	0.15	(DEU)	-0.14	(TWN)	-1.72	-0.23

9 Conclusion

This paper quantify the manufacturing production subsidies of China. Answering the two question in the introduction, I find that the production subsidies do play a role on the growth of the trade of China. However, the welfare effects on its trade partners are small. There still many aspects that I did not address in this paper and can be studied in the future, which includes the issue of the quality, the input-output linkage, and the selection effects which is emphasized by Melitz (2003).

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Appendix A: Data

Yu (2014) uses the name, and the zip code and last seven-digit phone number two ways to match the firms in the two data sets. Due to lack of the zip code information in our NBS data set, we differently use the name, the 4-digit city code, the last seven-digit phone number, and the name of the legal representative of a firm to match two data sets. Three sub-data sets are formed from the NBS data set first: the observations with unique names, the observations with unique legal representative-city code-phone number pairs, and the observations with unique city code-phone number pairs. In the NBS data set, some firms have more than one observations per year. Also, some firms are located at the same offices with and without the same legal representative. The two data sets are first matched by the name. The unmatched data are matched next by legal representative-city code-phone number and then city code-number. After these three steps, the unmatched data are matched by the observations with non-unique legal representative-city code-phone number and city code-phone number data. We manually identify those remaining firms. The data are further cleaned by the method of Yu (2014). The criteria are:(1) missing key variables; (2) the number of workers are less then eight; (3) total fixed assets are greater than the total assets; (4) the net value of fixed assets are greater than the total assets; or (5) liquid assets are greater than the total assets.

Appendix B: Alternative model and Robustness Check

Table 15: Subsidy Intensity: Subsidy Ratio

	ln(Subsidy Ratio$_{ft}$			
	(1)	(2)	(3)	(4)
ln(TFP$_{ft-1}$)	0.000358***	0.000359***	0.000344***	0.000342***
	(0.0000604)	(0.0000601)	(0.0000603)	(0.0000602)
ln(Sale$_{ft-1}$)	-0.000729***	-0.000754***	-0.000733***	-0.000749***
	(0.0000778)	(0.0000769)	(0.0000769)	(0.0000782)
ln(export$_{ft-1}$)	-0.0000269**		-0.00000593	-0.00000668
	(0.0000124)		(0.0000128)	(0.0000128)
ln(Employment$_{ft-1}$)	0.000323***	0.000323***	0.000370***	0.000374***
	(0.0000644)	(0.0000646)	(0.0000651)	(0.0000656)
ln(State Capital$_{ft-1}$)	0.0000957***	0.0000939***	0.0000890***	0.0000880***
	(0.0000277)	(0.0000279)	(0.0000278)	(0.0000279)
ln(Welfare Payments$_{ft-1}$)	0.0000720***	0.0000708***	0.0000585***	0.0000590***
	(0.0000186)	(0.0000185)	(0.0000186)	(0.0000186)
ln(Investment$_{ft-1}$)	0.000270***	0.000268***	0.000292***	0.000286***
	(0.0000381)	(0.0000383)	(0.0000392)	(0.0000393)
Profit-losing Dummy$_{ft-1}$	0.000123	0.000126	0.000208	0.000199
	(0.000220)	(0.000220)	(0.000221)	(0.000222)
$\frac{Export_{ft-1}}{Sales\ Revenue_{ft-1}} > 70\%$		-0.000200*		
		(0.000107)		
ln(Processing Ratio$_{ft-1}$)			-0.00159***	-0.00181***
			(0.000154)	(0.000209)
ln(Max Product Sophisticated Index$_{ft-1}$)			-0.000173	-0.000206
			(0.000324)	(0.000324)
ln(Imported Intermediate Inputs Value$_{ft-1}$)				0.0000166
				(0.0000104)
N	81795	81795	81795	81795
R^2	0.024	0.024	0.025	0.025

Robust standard errors in parentheses

All specifications include CIC 4-digit industry fixed effects, province fixed effects, and year fixed effects.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 16: Subsidy Intensity: Subsidy Level

	$ln(Subsidy\,Income_{ft})$			
	(1)	(2)	(3)	(4)
ln(TFP$_{ft-1}$)	0.0639***	0.0591***	0.0562***	0.0545***
	(0.0112)	(0.0113)	(0.0112)	(0.0112)
ln(Sale$_{ft-1}$)	0.165***	0.178***	0.155***	0.142***
	(0.0139)	(0.0138)	(0.0139)	(0.0140)
ln(export$_{ft-1}$)	0.0145***		0.0252***	0.0246***
	(0.00232)		(0.00235)	(0.00235)
ln(Employment$_{ft-1}$)	0.175***	0.183***	0.204***	0.207***
	(0.0110)	(0.0110)	(0.0110)	(0.0110)
ln(Investment$_{ft-1}$)	0.0557***	0.0545***	0.0640***	0.0598***
	(0.00562)	(0.00562)	(0.00562)	(0.00565)
ln(Welfare Payments$_{ft-1}$)	0.0285***	0.0280***	0.0209***	0.0213***
	(0.00294)	(0.00294)	(0.00293)	(0.00293)
ln(State Capital$_{ft-1}$)	0.0325***	0.0318***	0.0290***	0.0282***
	(0.00441)	(0.00442)	(0.00439)	(0.00439)
Profit-losing Dummy$_{t-1}$	-0.0491	-0.0485	-0.0000665	-0.00747
	(0.0340)	(0.0340)	(0.0339)	(0.0339)
$\frac{Export}{Sales}_{ft-1} > 70\%$		-0.0319**		
		(0.0163)		
ln(Processing Ratio$_{ft-1}$)			-0.907***	-1.082***
			(0.0308)	(0.0410)
ln(Max Product Sophisticated Index$_{ft-1}$)			0.269***	0.243***
			(0.0328)	(0.0330)
ln(Imported Intermediate Inputs Value$_{ft-1}$)				0.0132***
				(0.00197)
N	81808	81808	81808	81808
R^2	0.173	0.172	0.182	0.182

Robust standard errors in parentheses

All specifications include CIC 4-digit industry fixed effects, province fixed effects, and year fixed effects.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 17: The Subsidy Effects on the Unit Price

	ln(Unit Value$_{gfit}$) GMM-IV		
	(1)	(2)	(3)
	All Samples	Top 7 Destinations	All Samples
ln(1-Subsidy Ratio$_{ft}$)	6.556**	12.83***	7.033***
	(2.740)	(4.652)	(2.669)
ln(TFP$_{ft}$)	0.00702***	0.00566***	0.00187
	(0.00140)	(0.00217)	(0.00138)
ln(Average Wage$_{ft}$)	-0.000198	-0.00107	-0.00333
	(0.00221)	(0.00327)	(0.00214)
ln(Imported Intermediate Inputs Unit Value$_{ft}$)	0.00201***	0.00240**	0.00319***
	(0.000722)	(0.00110)	(0.000917)
ln(Managerial Expense$_{ft}$)	0.00199	0.00551***	-0.000179
	(0.00138)	(0.00190)	(0.00144)
ln(Investment$_{ft}$)	0.00133**	0.00323***	0.000836
	(0.000675)	(0.00107)	(0.000695)
ln(Employment$_{ft}$)	0.00664***	0.00648*	-0.00193
	(0.00250)	(0.00355)	(0.00304)
New Entry Dummy$_{gfkit}$	0.0163***	0.0158***	0.0167***
	(0.00164)	(0.00246)	(0.00166)
ln(Sales Revenue$_{ft}$)			0.0260***
			(0.00468)
ln(Imported Intermediate Inputs Value$_{ft-1}$)			-0.000856**
			(0.000340)
ln(Export$_{ft}$)			0.0000456
			(0.000346)
HS6-Destination-Year FE	Y	Y	Y
HS6-Firm-Destination FE	Y	Y	Y
N	1111090	554217	1111088
R^2	0.971	0.960	0.971
Hansen J P-Value	0.564	0.467	0.643
Kleibergen-Paap F Statistic	101.5	39.67	107.0

Clustered standard errors at the Hs6-Firm-Destination level in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 18: The Subsidy Effects on the Unit Price

	ln(Unit Value$_{gfit}$) GMM-IV		
	(1)	(2)	(3)
	All Samples	Top 7 Destinations	All Samples
ln(Subsidy Income$_{ft}$)	-0.0364**	-0.0773***	-0.0408***
	(0.0148)	(0.0284)	(0.0152)
ln(TFP$_{ft}$)	0.00860***	0.00931***	-0.000378
	(0.00126)	(0.00174)	(0.00153)
ln(Average Wage$_{ft}$)	0.00435*	0.00776**	-0.000700
	(0.00233)	(0.00375)	(0.00219)
ln(Imported Intermediate Inputs Unit Value$_{ft}$)	0.00331***	0.00485***	0.00511***
	(0.000781)	(0.00108)	(0.00110)
ln(Managerial Expense$_{ft}$)	0.00620***	0.0136***	0.00285
	(0.00229)	(0.00380)	(0.00205)
ln(Investment$_{ft}$)	0.00219***	0.00465***	0.00141*
	(0.000792)	(0.00133)	(0.000763)
ln(Employment$_{ft}$)	0.0116***	0.0166***	-0.00316
	(0.00336)	(0.00566)	(0.00282)
New Entry Dummy$_{gfkit}$	0.0150***	0.0105***	0.0155***
	(0.00187)	(0.00346)	(0.00184)
ln(Sales Revenue$_{ft}$)			0.0459***
			(0.00475)
ln(Imported Intermediate Inputs Value$_{ft}$)			-0.00123***
			(0.000377)
ln(Export$_{ft}$)			0.000394
			(0.000394)
HS6-Destination-Year FE	Y	Y	Y
HS6-Firm-Destination FE	Y	Y	Y
N	1111094	554202	1111055
R^2	0.972	0.962	0.971
Hansen J P-Value	0.687	0.254	0.861
Kleibergen-Paap F Statistic	153.4	49.94	147.4

Clustered standard errors at the HS6-Firm-Destination level in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

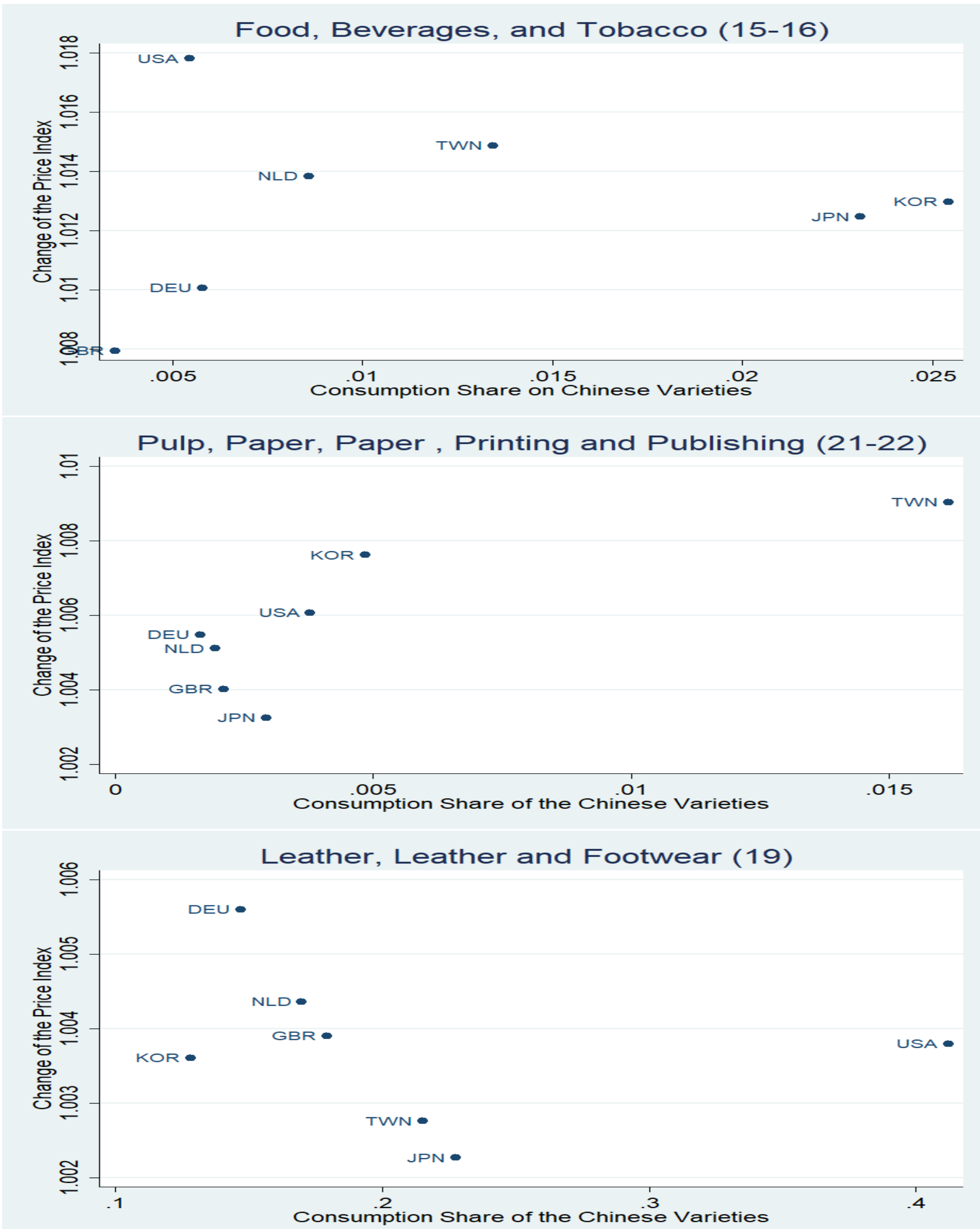
Table 19: The Subsidy Effects on Entry

	$\text{Entry}_{gfit}\|_{Entry_{gfit-1}=0}$	
	(1)	(2)
	OLS	OLS
ln(Subsidy$_{ft}$)	-0.0000552	
	(0.000220)	
ln(Subsidy Ratio$_{ft}$)		-0.00951
		(0.0607)
ln(TFP$_{ft}$)	0.00354***	0.00347***
	(0.000632)	(0.000632)
ln(Average Wage$_{ft}$)	-0.0164***	-0.0166***
	(0.00120)	(0.00120)
ln(Managerial Expense$_{ft}$)	-0.00282***	-0.00277***
	(0.000683)	(0.000681)
ln(Imported Intermediate Inputs Unit Value$_{ft}$)	-0.000633*	-0.000612*
	(0.000336)	(0.000336)
ln(Investment$_{ft}$)	0.00445***	0.00445***
	(0.000441)	(0.000440)
ln(Employment$_{ft}$)	-0.00803***	-0.00806***
	(0.000799)	(0.000798)
HS6-Destination-Trade Regime FE	Y	Y
Year FE	Y	Y
N	941293	941395
R^2	0.071	0.071

Robust standard errors in parentheses

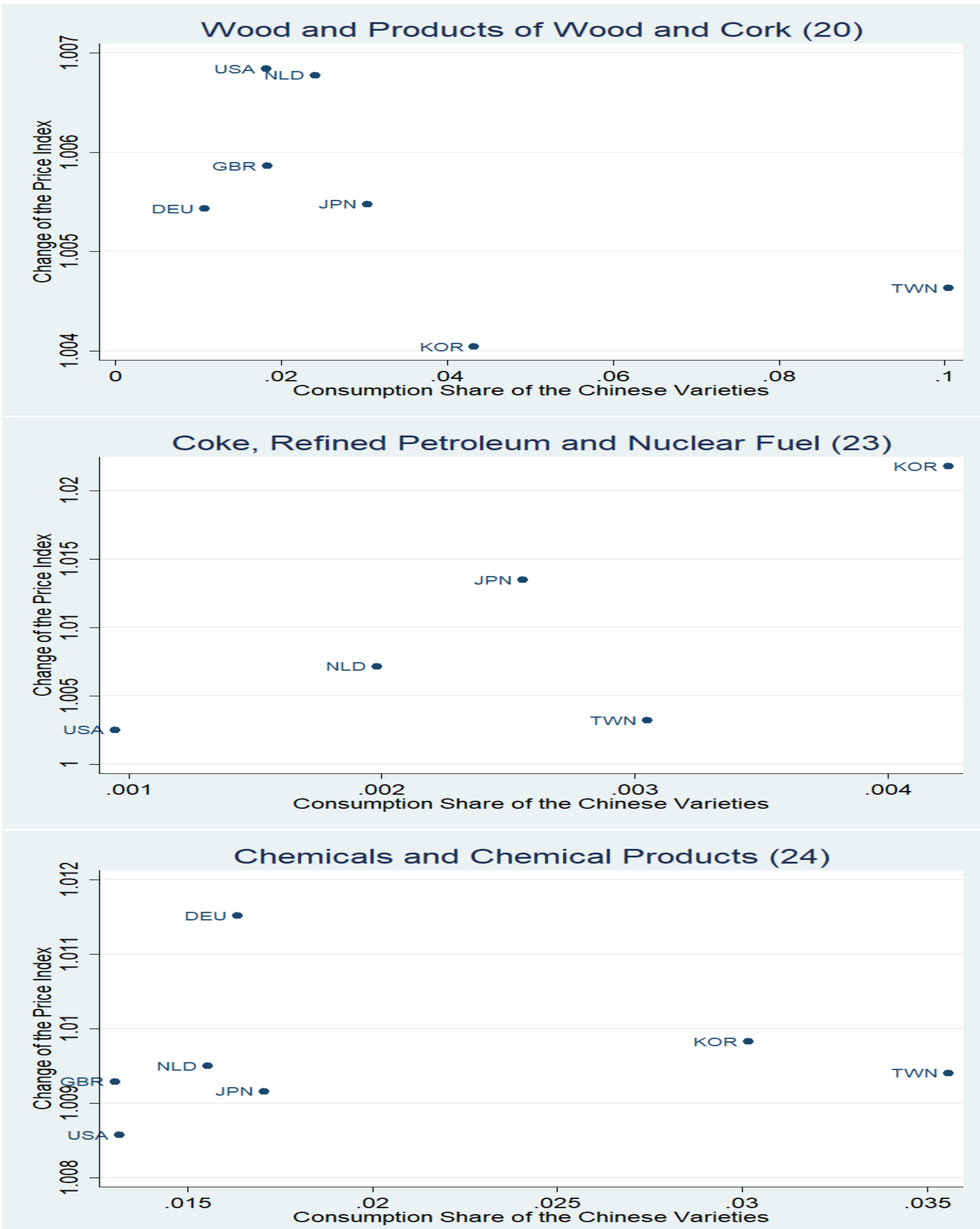
* $p < .1$, ** $p < .05$, *** $p < .01$

Figure 3: The Change of the Price Indexes in the Short Run, Selected Industries.



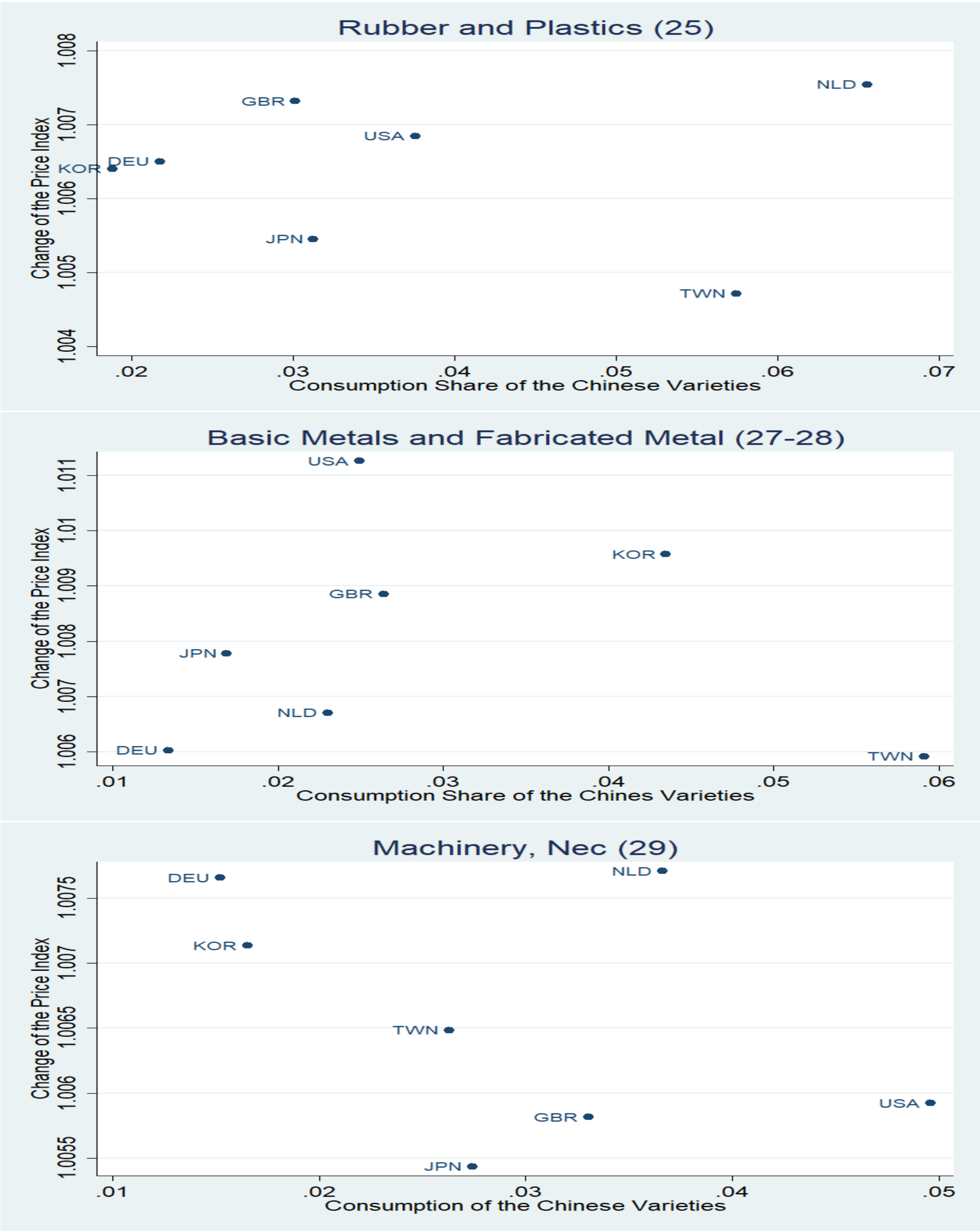
The values on the vertical axis represent Λ_k^{ci} in the equation (10).

Figure 4: The Change of the Price Indexes in the Short Run, Selected Industries.



The values on the vertical axis represent Λ_k^{ci} in the equation (10).

Figure 5: The Change of the Price Indexes in the Short Run, Selected Industries.



The values on the vertical axis represent Λ_k^{ci} in the equation (10).

Figure 6: The Change of the Price Indexes in the Short Run, Selected Industries.

The values on the vertical axis represent Λ_k^{ci} in the equation (10).