Unbalanced Trade and Wasted Goods Import*

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Abstract

The paper studies how the trade imbalance can affect the incentive of a country to import wasted goods. Given an unbalanced trade structure between two countries, we show that the heavy goods' shipping cost will dis-proportionally decrease under the assumption that a ship must return its origin country, a key feature of the international transportation sector. We also show in the data that wasted goods is one of the most heavy goods. So a trade surplus will increase the import of heavy goods and wasted goods due to a low transportation cost. We use this theory to explain why China is the largest wasted good import country. After estimating a gravity equation, we find that a 1% increase of the trade surplus can lead Chinese import of heavy goods increase by 0.04% to 0.06% and import of wasted goods increase by 0.12% to 0.14%.

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1 Introduction

China is the largest wasted goods imported country. In 2016, China imported 45m tons of scrap metal, waste paper and plastic, together worth over $18bn. Such import business come with huge costs, however. Imports of waste are often dirty, poorly sorted or contaminated with hazardous substances. Even when such waste is safely imported, it is not always recycled properly.[1] Meanwhile, it is well known that China is the largest trade surplus country in the world, around $509bn per year.

The motivation of the paper starts with an observation that the China's trade surplus and wasted good import share are positively correlated. Figure 1 plots the bilateral trade imbalance measured by (export-import)/(export+import) on the x-axis and the wasted goods import share on the y-axis. Each point on the figure is a trading partner with China. We can see that there is a significant positive correlation between the two variables, which means that China imports more wasted goods from those countries with a large trade surplus. We are going to show in the next section that this pattern is not unique to China, but also holds for other countries as well. Why can we observe this correlation in the data? Does it imply that Chinese huge import of wasted goods is due to the large trade imbalance of China?

We propose a model to answer these questions. Our assumption relies on two assumptions. First, international carriers, such as container ships and airplanes, are re-used and therefore have to return to the origin (De Palma et al. (2011) and De Oliveira (2014)). As a result, the unbalanced trade between two countries will translate into asymmetric shipping costs. For example, ships leaving from China to US are always full of containers, but it is not easy to fill them when return back China. Figure 2 plots the shipping cost of a container and the trade imbalance. The x-axis is the bilateral trade imbalance between China and other countries,

[1] A more recent film, "Plastic China", examines the environmental damage caused by the country's plastic-recycling industry, which is dominated by thousands of small-scale outfits that often lack proper pollution controls.

measured by log(China export/China import) and the y-axis is the relative container shipping cost between returning back China and leaving from China. We can see that there is a positive correlation: when China runs a large trade surplus, the transportation cost of return back China is significantly lower.[2] Now let us consider the case that the ship carries 1 unit of a specific goods. The goods will occupy the capacity (weight or space) of the ship and result in a shadow cost.[3] So the shipping cost of a heavy good will be higher because it occupies more capacity and results in higher shadow cost. Given the round trip effect, when China runs a large trade surplus against the other country, the capacity constraint when returning back becomes relaxed. The shadow cost of the capacity constraint will decline and the shipping cost of the heavy goods will decline more than the light goods.

The second assumption of our model is that wasted goods are heavy goods. Our model suggests that we need to compare the weight per value of two goods. We show in the next section that wasted goods are those high weight per value goods. So our model implies that large trade surplus will induce more heavy goods import and more wasted goods as well.

We estimate an augmented gravity equation controlling the trade imbalance and the goods weight to value ratio. We identify the effect of our mechanism using several methods. First, we identify a goods weight to value ratio from Columbia's import data. Under the assumption that the weight to value ratio is an exogenous goods characteristics so this ratio should be highly correlated with Chinese imported goods as well, we examine whether China will import more heavy goods from a country with large trade surplus. Because the exogenous measure of the weight to value ratio, we can reduce the endogeneity concern.[4] Second, people may worry that exporters with different development stages may have different comparative advantages. For instance, developed countries, which usually have a large trade deficit against China, may

[2]Wong (2017) also noticed this fact.

[3]In this paper, we focus on the weight rather than the space because the data limitation. So we are going to only use the heavy and light goods in the following parts of the paper.

[4]This idea is similar as Rajan and Zingales (1998), who used US sectors' financial dependence indexes to measure other countries' sectoral financial dependence level.

export more capital intensive goods that correlate with the weight to value ratio. To fix this concern, we compare imports from similar countries. For example, US has a large trade deficit against China, while Germany does not. We want to compare whether China imports more heavy goods from US than Germany. Third, even similar countries may still have unobserved omitted variables that correlate with the trade imbalance and the comparative advantages on heavy goods at the same time. Then we try to compare the import patterns of two Chinese ports. For example, consider two Chinese ports Shanghai and Guangzhou. Shanghai runs a larger trade surplus against US than Guangzhou. We study whether Shanghai will import more heavy goods from US than Guangzhou. The comparative advantages should be very similar between Shanghai-US and Guangzhou-US. So we argue that the omitted variable problem should be small. Finally, we provide an evidence from Mexican import data. We take the peso depreciation in 1994 as an exogenous shock to the trade imbalance of Mexico and examine whether Mexico's heavy goods import significantly change before and after the shock. All these specifications suggest that a 1% increase of the trade surplus can lead the import of heavy goods increase by 0.04% to 0.06% and import of wasted goods increase by 0.12% to 0.14%.

Does the trade imbalance of China cause a large welfare loss through our mechanism? If Chinese trade is balanced, the wasted goods import can decline by 12% to 14%, which is around $2.3bn and 5.9m tons.

Our paper relates to several streams of literature. First, there is a large literature studying the welfare cost of the trade imbalance (Dekle et al. (2007) and Epifani and Gancia (2017)). Most of them focus on the channel that the trade imbalance will distort the terms-of-trade. Our paper highlights another potential channel that trade imbalance can result in welfare cost: it will increase the import of wasted goods.

Second, the paper relates to the papers of endogenous transportation cost in the trade

literature. Hummels and Skiba (2004) and Lashkaripour (2015) point out that weight is an important determinant in the international shipping. Djankov et al. (2010) and Hummels and Schaur (2013) study the shipping time and its effect on trade cost. Wong (2017) also studies the round trip effect and its effect on transportation cost. But she focus on the correlation of transportation costs across different locations while we focus on the round trip effect on different goods.

Third, the paper also relates to the literature studying the effect of trade on the pollution (Frankel (2009), Kellenberg (2009), Kellenberg (2012) and Lan et al. (2012)). Most paper test the "pollution heaven" hypothesis, a comparative advantage story. We deviate from them by showing that not only the regulation or technology difference can cause the environmental cost of trade, but unbalanced trade may also result in an environmental cost.

The paper is structured as follows. Section 2 discusses the motivation facts. Further in section 3, we develop the model, which is estimated in section 4. We then discuss the welfare loss of unbalanced trade in section 5. We conclude the paper in section 6.

2 Motivation Facts

2.1 Data

We use three data sets in our analysis. The main data set is the UN trade data from 2003 to 2014. We get the bilateral trade volume of each HS6 good and we aggregate them to get the bilateral trade imbalance.

We also employ the Chinese custom data from 2000 to 2006. This is a micro level data that records the export and import of each HS6 good at the transaction level. For each observation, we know the HS6 code, the trade volume, the destination or origin countries. Moreover, if it is an export (import) transaction, we know the port the good leaves (arrives at) China. For

each port, destination or origin country and HS6 code pair, we aggregate all the transactions in the same year. Thus we can get the port-country bilateral trade volume of each good.

To measure the value per weight of each good, we employ the transaction level data on Colombian imports in 2007-2013 period. The data has been collected and made available by the National Tax Agency. For each incoming transaction, the data reports the goods FOB value as well as the weight. We assume the Columbia weight-per-value ratio is proportional to other countries' weight-per-value ratios. Table 1 lists the top 5 and bottom 5 goods in terms of weight-per-value ratio. In the following part of our paper, we will call the high weight-per-value goods as heavy goods.

Table 1: Five Most Heavy and Light Goods

Heavy Goods	Light Goods
Bitumen and asphalt	Diamond
Limestone flux	Precious metal
Wasted Granulated slag from iron	Gold
Ceramic building bricks	Halogenated derivatives
Scrap of glass	Watch

2.2 Stylized facts

We document three stylized facts in this section which motivates our model.

Fact 1: China imports wasted goods from countries with large trade surplus

Besides the figure 1 in the previous section, we show more evidence on this point. China runs a larger trade surplus against US than Germany. The first column of table 2 lists the China's top 10 imported goods (by value) from US. We can see that among top 10 imported goods, 5 of them are wasted goods. And the rest 5 are mainly capital intensive goods.[5] In the second column, we list the China's top 10 imported goods from Germany. While only one of them is wasted goods and the rest are capital intensive goods.

[5]Ju et al. (2015) also notice that China imports lots wasted goods from US but they do not link it with the trade surplus.

Fact 2: The trade surplus and wasted goods import share are positively correlated

The x-axis of figure 4 plots the trade surplus over GDP of each country in year 2003 and the y-axis plots the wasted goods import share. As we can see, there is a significant positive correlation between these two variables.

Fact 3: Wasted goods are heavy goods

Figure 3 plots the the density of weight/US dollar ratio of each good. The wasted good is much heavier than other goods.

Given we see a positive correlation between trade surplus and wasted goods import share, we are interested to ask whether the large import share of wasted goods in China is partially driven by the large trade surplus of China.

3 Model

Consider a carrier's problem. Let i denote the name of the good. Goods are heterogeneous in terms of weight per unit. Let w_i denote the weight per unit of good i. For simplicity, we assume there are only two countries: home country and foreign country. $c_{i,HF}$ ($c_{i,FH}$) is the price of shipping 1 unit of good i from home (foreign) country to foreign (home) country. $q_{i,HF}$ ($q_{i,FH}$) is the quantity of goods that are sold from home (foreign) country to foreign (home) country. Each carrier faces a downward sloping demand curve $q_{i,HF} = c_{i,HF}^{-\xi} b_{i,HF}$ and $q_{i,FH} = c_{i,FH}^{-\xi} b_{i,FH}$. $\xi < 1$ is the inverse demand elasticity and $b_{i,HF}, b_{i,FH}$ captures the carrier-goods specific demand shifters.

Let $\phi\left(\sum_i q_{i,HF}\right)$ and $\phi\left(\sum_i q_{i,FH}\right)$ be the carrier's operating cost of shipping $\sum_i q_{i,HF}$ units of good from home country to foreign country or shipping $\sum_i q_{i,FH}$ units of good from foreign country to home country.[6] Let $p_{i,HF}$ and $p_{i,FH}$ be the FOB good i's prices of the export and

[6]We assume the carrier's operating cost only depends on the total quantities. However, our result still holds

import of home country.

We assume that a ship when leaving from home country to foreign country must come back to home country. So the problem of the carrier is

$$\max_{c_{i,HF},c_{i,HF}} \sum_i c_{i,HF}q_{i,HF} + \sum_i c_{i,FH}q_{i,FH} - \phi\left(\sum_i q_{i,HF}\right) - \phi\left(\sum_i q_{i,FH}\right)$$

$$s.t. \quad \sum_i w_i^\alpha p_{i,HF}^{1-\alpha} q_{i,HF} \leq K \tag{1}$$

$$\sum_i w_i^\alpha p_{i,FH}^{1-\alpha} q_{i,FH} \leq K \tag{2}$$

$$q_{i,HF} = c_{i,HF}^{-\xi} b_{i,HF}, \quad q_{i,FH} = c_{i,FH}^{-\xi} b_{i,FH} \tag{3}$$

where K is the capacity of the carrier. We assume 1 unit of good i will occupy the capacity of the carrier by $w_i^a p_i^{1-\alpha}$. If $\alpha = 1$, we can interpret the constraints (1) and (2) as the total weight capacity constraints of the carrier. Generally, we assume $\alpha \in [0, 1]$. It captures the fact that more expensive goods may take more careful package and needs more capacity to ship.

Let λ_{FH} be the Lagrangian multiplier of the constraint (2). The optimality condition yields that

$$c_{i,FH} \propto \phi'\left(\sum_i q_{i,FH}\right) + \lambda_{FH} w_i^\alpha p_{i,FH}^{1-\alpha} \tag{4}$$

The equation (4) says that to ship 1 unit of good i, the shipping cost has two components: the marginal operating cost to the carrier $\phi'\left(\sum_i q_{i,FH}\right)$ plus the shadow cost $\lambda_{FH} w_i^\alpha p_{i,FH}^{1-\alpha}$. The shadow cost part says that 1 unit of good i will decrease the carrier's capacity by $w_i^\alpha p_{i,FH}^{1-\alpha}$ and results in a shadow cost $\lambda_{FH} w_i^\alpha p_{i,FH}^{1-\alpha}$. If the carrier has a non-binding constraint (2), $\lambda_{FH} = 0$ and vice versa.

for any other convex cost function.

In the remaining part, we are going to focus on the import of the home country. Denote the trade cost **per value** (iceberg cost) of good i of home country's import as $\tau_{i,FH}$. It has two parts: ad-valorem tariff $(t_{i,FH}+1)$ and **per unit** shipping cost $c_{i,FH}$.

$$\tau_{i,FH} = 1 + t_{i,FH} + \frac{c_{i,FH}}{p_{i,FH}} \tag{5}$$

Let $\bar{\phi}_{i,FH} = \frac{\phi'_{FH}}{p_{i,FH}}$ be the carrier's marginal operating cost per value of good i.

$$\tau_{i,FH} \propto 1 + t_{i,FH} + \bar{\phi}_{i,FH} + \lambda_{FH}\left(\frac{w_i}{p_{i,FH}}\right)^{\alpha} \tag{6}$$

The above equation suggests that the iceberg cost of good i when home imports not only depends on the tariff and the carrier's marginal cost $t_{i,FH} + \bar{\phi}_{i,FH}$, but also depends on the shadow cost λ_{FH} times the weight-to-value ratio $\left(\frac{w_i}{p_{i,FH}}\right)^{\alpha}$. When importing a heavy goods (high $\frac{w_i}{p_{i,FH}}$), the carrier needs more capacity to take care of the good i, so the ship cost will be more expensive.

When home country runs a large trade surplus against the foreign country, more ships tend to have $\lambda_{FH} = 0$. So if home country runs a larger trade surplus against the foreign country, the average λ_{FH} will decline, which will induce that the heavy goods will enjoy a larger trade cost decline than the light goods.

The heavy goods import share is higher if the home country runs a large trade surplus.

3.1 Equations to estimate

We focus on the Chinese import and estimate the following gravity equation

$$\begin{aligned} \ln I_{i,nt} &= -\sigma \ln \tau_{i,nt} + \theta \ln GDP_{nt} + \eta_{it} + \eta_{in} + \varepsilon_{i,nt} \\ &= \beta \ln \text{Imbalance}_{nt} \times \left(\frac{w_i}{p_i}\right) + \theta \ln GDP_{nt} + \eta_{it} + \eta_{in} + \varepsilon_{i,nt} \end{aligned} \tag{7}$$

where n is the origin country. $I_{i,nt}$ is the import good i of China from country n in year t. Imbalance_{nt} is the trade surplus China runs against country n in year t. $\frac{w_i}{p_i}$ is the weight-to-value ratio of good i. We control the GDP per capita of origin countries, country-goods fixed effect η_{in} and goods-year fixed effect η_{it}. According to our theory, we expect that $\beta > 0$. We measure the trade imbalance using the $\text{Export}_{nt}/\text{Import}_{nt}$.

The weight-to-value ratio may be endogenously determined. To solve this problem, we use the weight-to-value ratio from the Columbia's import data. We assume that the Columbia's weight-to-value ratio is highly correlated with Chinese import's weight-to-value ratio but is not correlated with other fundamental economic conditions which may affect the Chinese import value. Given the weight-to-value ratio is not correlated with the trade patterns of China, the endogeneity problem is reduced. For example, trade imbalance and the imports of a good can be determined by some omitted variables. However, we are examining whether trade imbalance has a greater effect on the import of heavy goods.

People may think that the fixed effects η_{in} and η_{it} in the equation (7) capture some omitted variables but does not eliminate the endogeneity problem. For example, China usually run a large trade surplus against developed countries and the comparative advantage of those developed countries are exporting machines (which may be heavy goods) to China. So we

estimate the following country-difference gravity equation

$$\ln\left(\frac{I_{i,nt}}{I_{i,jt}}\right) = \beta \ln \frac{\text{Imbalance}_{nt}}{\text{Imbalance}_{jt}} \times \left(\frac{w_i}{p_i}\right) + \theta \ln \frac{GDP_{nt}}{GDP_{jt}} + \eta_{it} + \eta_{in} + \eta_{ij} + \varepsilon_{i,nt} \tag{8}$$

where j is another origin country. Equation (8) compares two similar countries and China runs different trade surplus against country j and n. The dependent variable of the above equation is the relative import of good i from country j and n. Our model suggests that the heavy good import from these two countries should be positively related to the trade surplus difference. The estimation strategy depends on choosing exporters that are similar. For example, we do not want to compare US with India. So we eliminate those country pairs that do not fall into the same World Bank income classifications. Endogeneity is reduced because effects of heavy goods trade volume on trade imbalance are likely to be much smaller between similar countries.

One may still worry about the trade imbalance and the relative import share are both determined by some unobserved comparative advantages even within similar countries. As a robustness check, we then proceed to the Chinese custom data and look at whether the port imbalance is correlated with the heavy goods import. The gravity equation is as follows

$$\ln I_{i,mnt} = \beta \ln \text{Imbalance}_{mnt} \times \left(\frac{w_i}{p_i}\right) + \theta \ln GDP_{nt} + \eta_{it} + \eta_{imn} + \varepsilon_{i,nt} \tag{9}$$

where m is a port in China. $I_{i,mnt}$ is good i's import of port m from country n. Imbalance_{mnt} is the export from port m to country n divided by the total import of port m from country n. Our model suggests that β should be positive.

We also estimate a equation similar as (8) at the port level.

$$\ln\left(\frac{I_{i,mnt}}{I_{i,hnt}}\right) = \beta \ln \frac{\text{Imbalance}_{mnt}}{\text{Imbalance}_{hnt}} \times \left(\frac{w_i}{p_i}\right) + \theta \ln GDP_{nt} + \eta_{it} + \eta_{imn} + \varepsilon_{i,nt}$$

where m and h are two different ports in China. The dependent variable is the relative import of good i from same country n between two Chinese ports m and h. And the right hand side variable is the relative trade imbalance of ports m and h against country n. We can interpret the above equation as follows: Suppose ships are more likely to return to the same port when they are back China.[7] If more ships leave for country n from port m than port h, the port m will import more heavy goods from country n than the port h. The endogeneity problem is reduced because the ports are all from China and the export country is fixed. Trade imbalance across different ports are less likely to be affected by heavy goods trade volume difference.

4 Empirical Results

4.1 Main results

We show the estimation result of equation (7) in table 3. Column 1 reports the estimation result of the standard gravity equation with product-year and product-country fixed effects. The import value increases with the exporter's GDP with an elasticity around 0.2%. Column 2 reports the result including the interaction term of the trade imbalance and weight-to-value ratio. The result is consistent with our model prediction. If there are two goods, and one is 1% heavy (in terms of weight-to-value ratio) than the other, a 1% increase in the imbalance will result in China import 0.06% more heavy goods than the light good. While the coefficient on the GDP does not change too much. The 3rd column reports the result allowing the coefficient for developed countries to be different. It suggests that the coefficient of the developed countries is significantly higher than the coefficient of the developing countries.

Table 4 shows the estimation result of equation (8). We separate the countries into two

[7] A ship usually has regular travel routine and takes a few ports as its home ports.

groups according to their development stages. Countries whose GDP per capita is greater than $12000 are called developed countries and the rest are called developing countries. In the developed countries group, we choose US as the benchmark country and other developed countries are compared with US. While we choose Vietnam as the benchmark country in the developing country group. Column 1 reports the result without controlling the the interaction term of the trade imbalance and weight-to-value ratio. The coefficient of the GDP is around 1.49. Column 2 shows the result when controlling the interaction term of the trade imbalance and weight-to-value ratio. The result implies that when comparing two similar countries, if one country runs 1% more trade deficit against China than the other country, it will export 0.1% more heavy goods to China. The third column allows different coefficients for developed countries and developing countries. It suggests that the coefficient is around 0.12% for developing countries and the coefficient of developed countries 0.036% lower.

Then we change the independent variable in equations (7) and (8) to be $\text{lnImbalance}_{nt} \times \text{waste_goods_indic}$ The indicator is 1 if good i is waste goods and 0 otherwise. Table 5 shows the results. Column 1 and 2 reports the estimations of equation (7) and column 2 allows different elasticity between two groups of countries. We can see that when the trade imbalance of a country increases by 1%, China will import 0.14% more wasted goods from this country. The elasticity is not significantly different between developed and developing countries. Column 3 shows the first difference regression result of equation ((8). The result implies that when the relative trade imbalance increases 1% between two similar countries, the wasted goods import share will increase by 0.22%. We again allow different effects between developed and developing countries. And it suggests that the developed countries' elasticity is smaller which is consistent with the result in table 3.

Trade agreement may change the trade imbalance as well as the bilateral trade volume of a specific goods. In the next step, we restrict our sample to those countries who are in WTO

and re-estimate equation (7). The estimations are shown in the first two columns of table 6. Column 1 uses the independent variable $\text{lnImbalance}_{nt} \times \left(\frac{w_i}{p_i}\right)$ and column 2 replaces the independent variable to $\text{lnImbalance}_{nt} \times$waste_goods_indicator. We see significant results in both specifications. Column 3 and 4 shows the estimation of equation (8) using the restricted sample. The results are statistically and economically significant as well.

4.2 Estimating the Chinese port data

We then proceed to the Chinese port data. Table 7 reports the estimation results. Column 1 and 2 show the results of equation (7). We can see that when one port runs 1 more percent trade surplus, the heavy goods import share will relatively increase 0.02%. This effect is not significantly different between developed and developing countries. Column 3 and 4 show the results of equation (9). Our results suggest that the trade surplus different between two Chinese ports can predict the import of heavy goods. The elasticity is around 0.004. The elasticity is robust when allowing heterogeneous effects in different countries.

4.3 Evidence from the Mexican import data

Our result does not only hold for Chinese import data but also for other countries' import. This section shows the estimation results using Mexican import data. Mexico's Peso depreciated over 50% in 1994 causing a large trade surplus. Figure 5 shows the Mexican trade surplus to GDP (solid line) and the exchange rate (dashed line) from 1993 to 1997. As we can see, the trade surplus to GDP ratio increases by 0.5% following the exchange rate depreciation. We consider that the exchange rate fluctuation is an exogenous shock to the trade imbalance. We then estimate the following gravity equation

$$\ln\left(\frac{I_{i,nt}}{I_{i,nt-1}}\right) = \beta \ln \frac{\text{Imbalance}_{nt}}{\text{Imbalance}_{nt-1}} \times \left(\frac{w_i}{p_i}\right) + \theta \ln \frac{GDP_{nt}}{GDP_{nt-1}} + \eta_{it} + \eta_{in} + \varepsilon_{i,nt} \qquad (10)$$

The right hand side variable is the Mexican import growth rate of good i from country n. The left hand side is the trade imbalance change due to the exogenous exchange rate shock. The above equation suggests that because of the Peso depreciation, Mexico will export more and run a larger trade surplus. And when the trade surplus increases more, Mexico will import more heavy goods than the light goods.

Table 8 shows the results of the Mexican import data. We use a 5-years window: 1992-1996. So we have 2 years' observations before and after the exchange rate shock. Column 1 and 2 report the estimations of equation (7) and column 2 allows heterogeneous elasticity of developed countries. We find that the trade imbalance will cause the heavy goods import share increases by 0.06%. And this effect is slightly lower in developed countries. The next two columns show the result of equation (10). If the growth rate of the trade surplus increases by 1%, column 3 suggests that the growth rate of heavy goods import share will increase by 0.04% than the growth of light goods import.

5 Discussion

6 Conclusion

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Tables and Figures

Table 2: Top 10 imported goods

	China-US	China-Germany
1	Monolithic integrated circuit	Bus
2	Soy bean	Trasmission
3	Aircraft	Aircraft
4	Car	Electric Sunroof
5	Copper scrap	Coupe
6	Waste cotton	Wine
7	Waste cardboard	Radioactive compactors
8	Brewing residue	Heavy goods vehicles
9	Aluminum scrap	Copper scrap
10	Turbojet engine parts	Antiserum

Notes: This table shows the Chinese top 10 imported goods from US and Germany in 2013.

Table 3: Gravity Regression: 162 exporters

	import	import	import
weight*imbalance		0.0641***	0.0017
		(26.34)	(.46)
developed*weight*imbalance			0.0946***
			(22.41)
ln_gdp	0.206***	0.250***	0.250***
	(4.68)	(10.70)	(10.70)
Product-year FE	Y	Y	Y
Product-Country FE	Y	Y	Y
N	1045992	1045992	1045992

Notes: This table shows the estimation results of equation (7) using the Chinese import data. T-value is reported in the parenthesis. *** denotes the coefficient is significant at 1% level. Developed=1 if GDP per capita is above 12,000 USD.

Table 4: First Difference Gravity Regression

	Δimport	Δimport	Δimport
weight*Δimbalance		0.0977***	0.124***
		(32.30)	(23.99)
developed*weight*Δimbalance			-0.036***
			(-6.28)
Δln_gdp	1.492***	1.521***	1.488***
	(150.35)	(152.81)	(132.05)
Product-year FE	Y	Y	Y
Product-Country FE	Y	Y	Y
N	872959	872959	872959

Notes: This table shows the estimation results of equation (8) using the Chinese import data. T-value is reported in the parenthesis. *** denotes the coefficient is significant at 1% level. Developed=1 if GDP per capita is above 12,000 USD.

Table 5: Gravity equation: wasted goods

	import	import	Δimport	Δimport
waste*imbalance	0.143***	0.154***		
	(8.21)	(6.41)		
developed*waste*imbalance		-0.0189		
		(.63)		
waste*Δimbalance			0.221***	0.395***
			(10.48)	(8.99)
developed*waste*Δimbalance				-0.226***
				(-4.51)
ln_gdp	-0.186***	-0.186***	1.608***	1.609***
	(-5.44)	(5.44)	(123.50)	(123.56)
Product-year FE	Y	Y	Y	Y
Product-Country FE	Y	Y	Y	Y
N	1083734	1083734	905824	905824

Notes: This table shows the estimation results of the wasted goods import using the Chinese import data. T-value is reported in the parenthesis. *** denotes the coefficient is significant at 1% level. Developed=1 if GDP per capita is above 12,000 USD.

Table 6: Gravity Equation: Restricted Sample

	import	import	Δimport	Δimport
weight*imbalance	0.0268***			
	(10.21)			
weight*Δimbalance			0.0716***	
			(8.45)	
waste*imbalance		0.132***		
		(7.02)		
waste*Δimbalance				0.202***
				(8.45)
ln_gdp	0.572***	0.145***	1.612***	1.545***
	(23.30)	(3.93)	(108.48)	(82.19)
Product-year FE	Y	Y	Y	Y
Product-Country FE	Y	Y	Y	Y
N	978209	1011944	790283	819660

Notes: This table shows the estimation results of the countries joined the WTO. T-value is reported in the parenthesis. *** denotes the coefficient is significant at 1% level. Developed=1 if GDP per capita is above 12,000 USD.

Table 7: Gravity Equation: Port Data

	import	import	Δimport	Δimport
weight*imbalance	0.0200***	0.0194***		
	(48.59)	(43.16)		
developed*weight*imbalance		0.00227		
		(1.30)		
weight* Δimbalance			0.00403***	0.00447***
			(3.40)	(3.03)
developed*weight* Δimbalance				-0.00121
				(-.50)
ln_gdp	-0.0783	-0.070	2.789***	2.789***
	(.71)	(.63)	(11.35)	(11.35)
Product-year FE	Y	Y	Y	Y
Port-Year FE	Y	Y	Y	Y
Port-Country FE	Y	Y	Y	Y
Port-Product FE	Y	Y	Y	Y
N	4099227	4099227	1727032	1727032

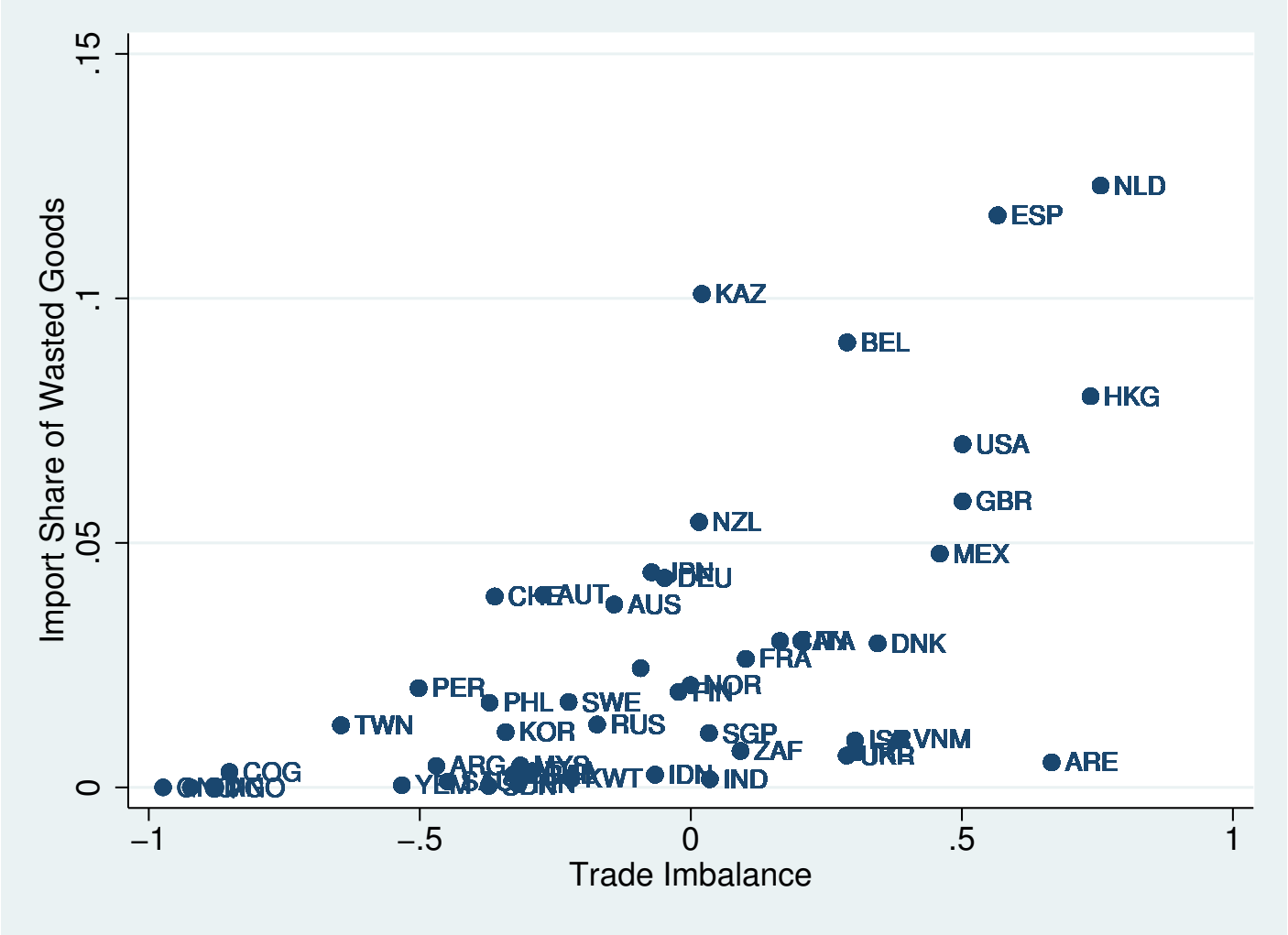
Notes: This table shows the estimation results of the Chinese port data. T-value is reported in the parenthesis. *** denotes the coefficient is significant at 1% level. Developed=1 if GDP per capita is above 12,000 USD.

Table 8: Gravity Equation: Mexico Data

	import	import	Δimport	Δimport
weight*imbalance	0.0579***	0.141***		
	(21.25)	(5.25)		
developed*weight*imbalance		-0.0843**		
		(-3.11)		
weight*Δimbalance			0.0420***	0.441***
			(13.57)	(5.19)
developed*weight*Δimbalance				-0.399***
				(-4.70)
ln_gdp	1.646***	1.644***	0.819***	0.827***
	(16.55)	(16.53)	(2.17)	(2.19)
Product-year FE	Y	Y	Y	Y
Product-Country FE	Y	Y	Y	Y
N	160781	160781	119387	119387

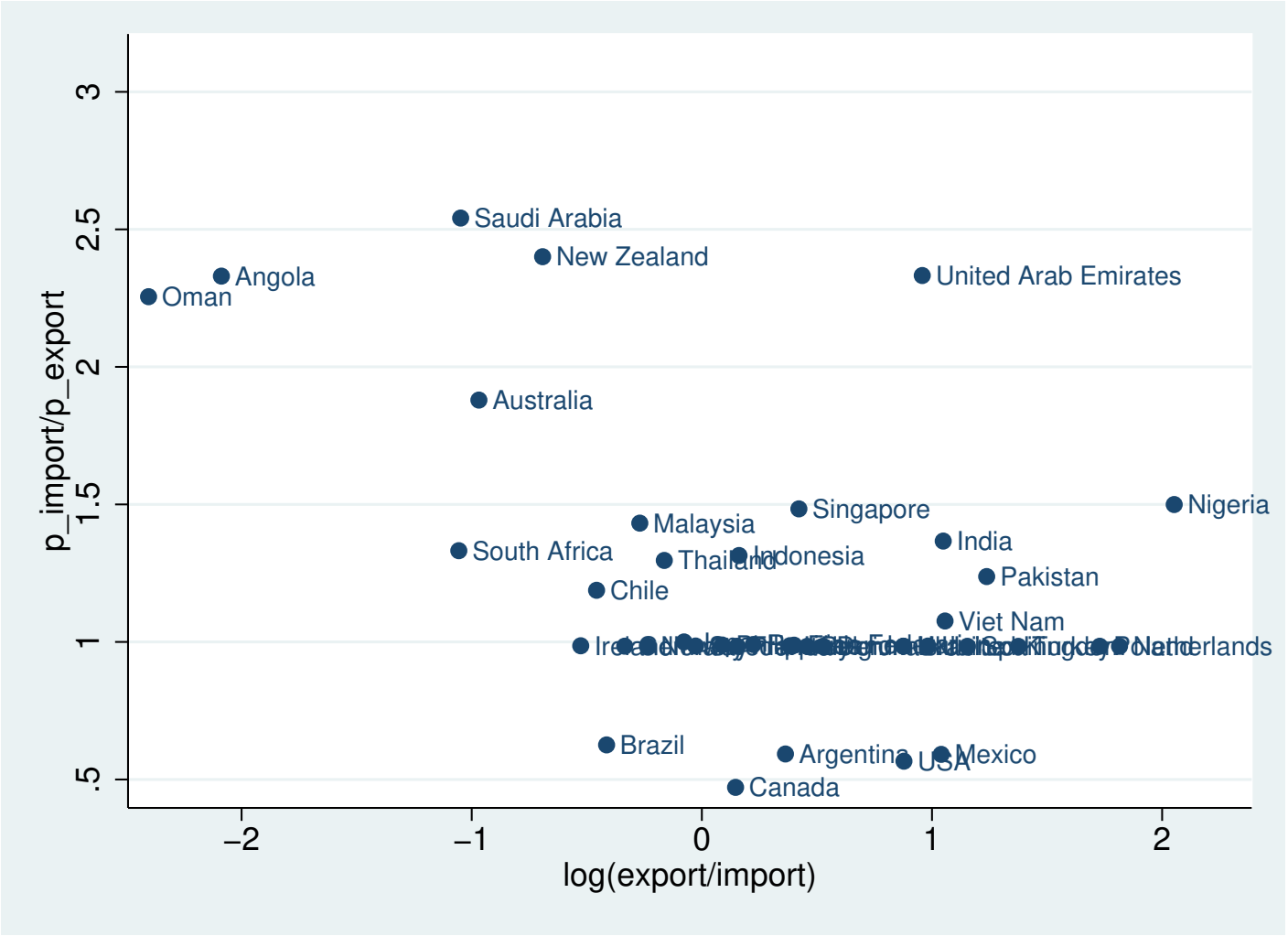
Notes: This table shows the estimation results of the Chinese port data. T-value is reported in the parenthesis. *** denotes the coefficient is significant at 1% level. Developed=1 if GDP per capita is above 12,000 USD.

Figure 1: The Imbalance and Wasted Goods Import Share in China



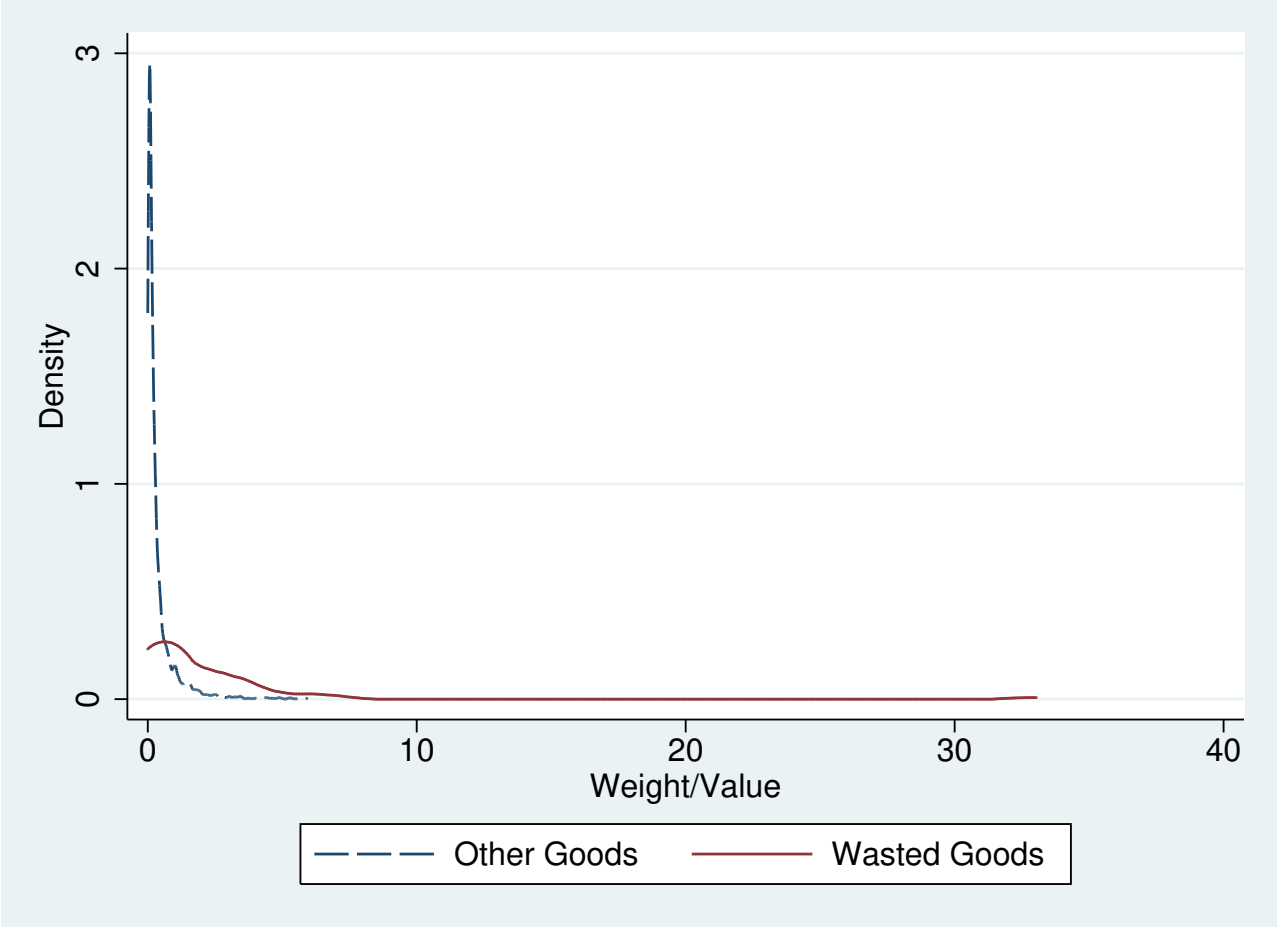
NOTE: This figure shows the trade imbalance and wasted goods import share of China. Trade imbalance is measured by (export-import)/(export+import).

Figure 2: Container Shipping Cost



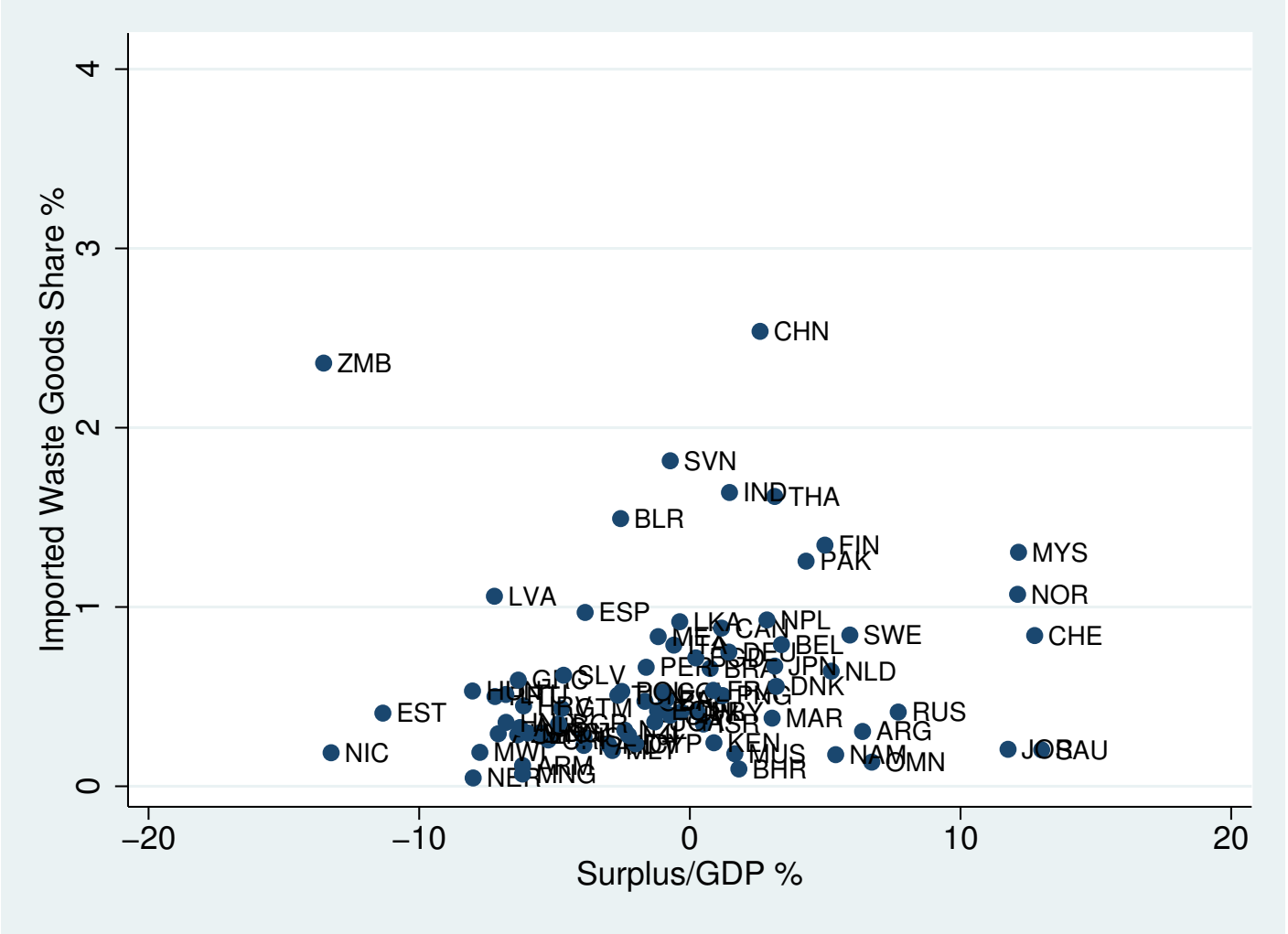
NOTE: This figure shows the ratio of container ship cost from other country to Shanghai and the cost of the opposite direction.

Figure 3: The Density of Weight to Value Ratio



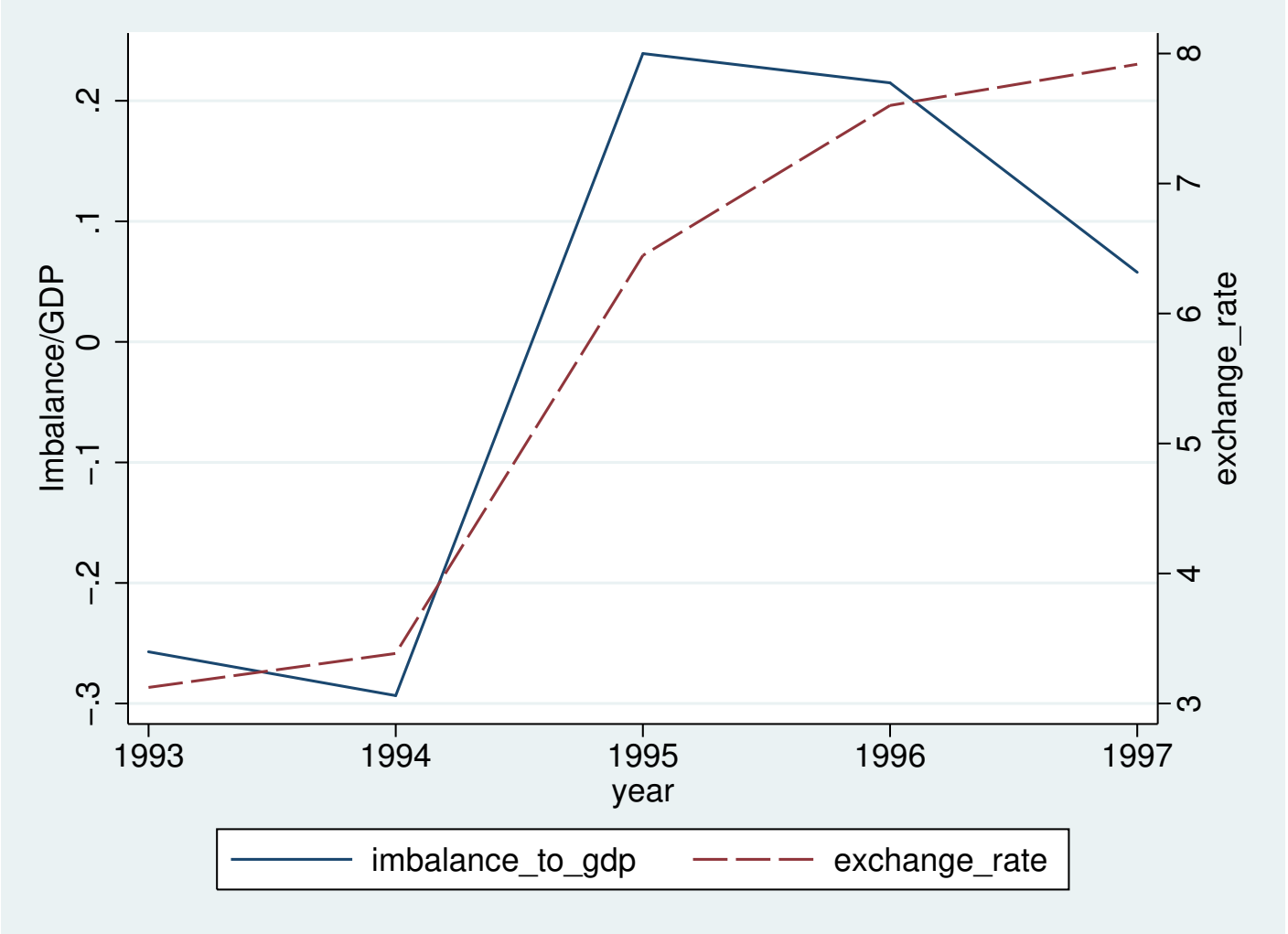
NOTE: This figure shows the density of the weight to value ratio.

Figure 4: The Imbalance and Wasted Goods Import Share in the world



NOTE: This figure shows the trade imbalance and wasted goods import share across countries.

Figure 5: The Imbalance and Exchange rate of Mexico



NOTE: This figure shows the trade imbalance and exchange rate change of Mexico.