# Tariff Pass-through in Wholesaling: Evidence from Firm-level Data in Japan

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***Abstract***: Tariff pass-through is a vital issue for considering who and to what extent the trade liberalization benefits. This paper empirically examines the tariff pass-through in wholesaling by employing the wholesale firm-level data in Japan. Our findings are summarized as follows. We started with the investigation of tariff pass-through for the import and consumer prices in Japan and found that a 1% reduction of tariffs raises import prices (export prices for exporters) by 0.49% and decreases consumer prices by 0.08%. Our investigation of the wholesalers indicates that importing wholesalers significantly raise their margin ratio against tariff reduction. On average, a 1% reduction of tariffs raises the margin ratio by around 0.15 percentage point. This rise is equivalent to the rise of sales prices to procurement prices by around 0.22%. In sum, wholesalers in importing country enjoy the smaller part of tariff rent than producers in exporting country but the larger part than consumers in importing country.
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## 1. Introduction

The impact of tariff reduction or elimination on prices, so-called "tariff pass-through," has long been studied in the international economics literature. Tariff pass-through is a vital issue for considering who and to what extent the trade liberalization benefits. In general, goods go from a producer to a household through wholesalers, retailers, and other local

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players (e.g., distribution services providers). In this flow, for example, if a producer captures all the rent from tariff reduction by raising its selling price by the same amount as the tariff reduction, consumers cannot enjoy any benefits from tariff reduction. Thus, to evaluate the benefits from trade liberalization, it is crucial to know how the rent from tariff reduction is distributed among players in the flow, i.e., producers, wholesalers, retailers, consumers, and other local players. To this end, the tariff pass-through rate, which indicates how prices are set by each player in response to a 1% change in tariffs, is a useful measure.

The academic literature has quantified the tariff pass-through for trade prices and consumer prices. An early empirical work on import prices is Feenstra (1989), which investigated the tariff pass-through for the US imports from Japan by using product-level import data. Similar analyses were conducted in Rezitis and Brown (1999), Chang and Winters (2002), and Mallick and Marques (2008). Also, by employing firm-level export data, Ludema and Yu (2016) and Görg et al. (2017) investigated the tariff pass-through in the cases of exporting from the U.S. and Hungary, respectively. Several studies examined the effects of tariff reduction through preferential/regional trade agreements (RTAs) (Cadot et al., 2005; Olarreaga and Ozden, 2005; Ozden and Sharma, 2006; Cirera, 2014). These studies noted above have found an incomplete tariff pass-through, i.e., a part of tariff reduction is passed onto trade prices, i.e., producers or exporters. On the other hand, Porto (2006), Nicita (2009), Han et al. (2016), and Ural Marchand (2012) investigated the pass-through for consumer prices by employing the household survey data. These studies found a decrease in consumer prices by tariff reduction. In sum, the literature has shown that both producers and consumers enjoy the benefits of tariff reduction.

This paper empirically examines the tariff pass-through for the case of wholesalers in Japan. To this end, we use the "Census of Commerce," which is conducted on all stores engaged in wholesale and retail trade. As introduced above, there are several studies that investigated the tariff pass-through for producers/exporters and consumers. However, no studies have ever empirically explored the case for wholesalers despite the fact that they are one of the key players in the flow of goods. We fill this gap by employing firm-level data on wholesalers in Japan. Specifically, we investigate the effects of tariffs on margin ratios of wholesalers. The margin ratio is defined at a firm-level as "sales minus procurements" over sales. This measure indicates the gross profit margin and has been often used in marketing.[1] We examine how much wholesalers raise their margin ratio against tariff reduction. Since our dataset on wholesalers does not allow us to identify detailed source countries in procurement (i.e., export countries), we focus on the effects of most favoured nation applied tariff rates (MFN tariff rates, hereafter) rather than applied tariff rates including preferential tariff rates. Therefore, we study for the period before Japan started to conclude RTAs actively. In short, we examine tariff pass-through in wholesaling for 1996, 2001, and 2006.

Our findings in this paper are summarized as follows. We start with the investigation

[1] The similar measure is examined in Anderson et al. (2018). In addition, the measure of markup may be more popular in economics, but these two measures are similar.

of tariff pass-through for the import and consumer prices because to the best of our knowledge there has been no evidence on these pass-throughs specific to Japan. We found that a 1% reduction of tariffs raises (tariff-exclusive) import prices by 0.49% and decreases consumer prices by 0.08%. Our investigation for wholesalers indicates that importing wholesalers significantly raise their margin ratio and thus sales prices relative to procurement prices against tariff reduction. On average, a 1% reduction of tariffs raises the margin ratio by around 0.15 percentage point. This magnitude is equivalent to the rise of relative sales prices by around 0.22%. In contrast, we found that tariff reduction lowers the margin ratio in wholesalers who procure from domestic producers. Although we should be careful with the comparison of the magnitude across players, our results may suggest at least that wholesalers in importing country enjoy the smaller portion of tariff rent than producers in exporting country but the larger portion than consumers in importing country.

In addition to the above-mentioned literature on tariff pass-through, this study is related to at least three strands of literature. The first includes the theoretical, rather than empirical, studies on the tariff pass-through in retailing (e.g., Richardson, 2004; Raff and Schmitt, 2009; 2012; 2016; Francois and Wooton, 2010; Cole and Eckel, 2018). In particular, Raff and Schmitt (2012) developed a model of international trade with heterogeneous retailers based on Melitz and Ottaviano (2008) and explored the effects of trade liberalization on the retail market structure. In their model, trade liberalization induces lower consumer prices not only by the standard pass-through effects but also by making competition tougher through the selection mechanism. As a result, it reduces the markups of retailers that source goods domestically but raises the markups of retailers that engage in direct imports. To our best knowledge, there are no theoretical studies that shed light on the tariff pass-through in wholesaling. However, these mechanisms in retailing would be useful when we consider the tariff pass-through in wholesaling.

The second is the literature on the exchange-rate pass-through for wholesalers or retailers. The example includes Hellerstein (2008), Nakamura and Zerom (2010), Antoniades and Zaniboni (2016), and Berner, Birg, and Boddin (2016). The results of these studies are mixed. Hellerstein (2008) showed that exporters (i.e., producers) obtain greater rent from the change of exchange rates than retailers and consumers. On the other hand, Nakamura and Zerom (2010) found that pass-through occurs almost entirely at the wholesale level. In sum, the significant recipients of the rent from exchange rate changes differs by studies (i.e., countries and products). Against this backdrop, we provide the first evidence from the tariff pass-through, which is known to be similar to the exchange rate pass-through as shown in Feenstra (1989). As mentioned above, we found the evidence on significant tariff pass-through in wholesaling in Japan.

The third is the literature that examines the firm-level performance of wholesalers and/or retailers in the context of international trade (e.g., Bernard et al., 2010; Meinen and Raff, 2018). For example, Meinen and Raff (2018) investigated the performance of retailers in Denmark for the period from 1999 to 2008 to examine how increased consumer goods

imports affect retail market performance and structure. They found that retailers that start to import have 8% greater sales, 6% greater profits, and 2% greater markups in the year of import initiation compared to non-importing retailers. In our study, we use the margin ratio as our dependent variable and therefore, we add some new evidence on the wholesalers' margin ratio. For example, we found that the ratio is significantly lower when the wholesalers' payment method is cash or credit cards than when it is charge sales. Also, it is found to be significantly higher in the sector where the import penetration from China is higher.[2]

The rest of this paper is organized as follows. The next section investigates the tariff pass-through in import and consumer prices. After presenting our empirical framework to examine the tariff pass-through in wholesaling in Section 3, we report our estimation results in Section 4. Last, Section 5 concludes in this study.

## 2. Tariff Pass-through in Import and Consumer Prices

Before examining the tariff pass-through in wholesaling, this section investigates the tariff pass-through in import prices and consumer prices. For the analysis of import prices, we focus on Japan's imports from 175 countries during 1988-2014 and then estimate the following equation.

$$\ln P_{cit}^{Import} = \alpha \ln(1 + Tariff_{cit}^{Applied}) + \mathbf{FE} + \epsilon_{cit}. \qquad (1)$$

$P_{cit}^{Import}$ is the (tariff-exclusive) unit import price (i.e., imports divided by import quantity) of product $i$ from country $c$ in year $t$. Product is defined at the harmonized system (HS) six-digit level. The data on the import value and quantity are obtained from the UN Comtrade. $Tariff_{cit}^{Applied}$ is Japan's applied tariff rate for product $i$ imported from country $c$ in year $t$. Its data are drawn from the World Integrated Trade Solution (WITS). In this analysis, since we have information on import source countries or exporting countries, we take into account not only MFN tariff rates but also preferential tariff rates including those for RTAs and generalized system of preferences (GSP). **FE** is various fixed effects, which are explained later.

The trend of the simple average of Japan's applied tariff rates on imports from 175 countries is depicted in Figure 1. Notice that we should not take the level seriously because it depends heavily on the number of non-preference partners (i.e., countries that applied relatively high rates) included in the computation of the simple average. We should examine its trend in this figure. The figure also shows the trend according to the average levels applied in 1988; positive, higher than 10%, and higher than 20%. Naturally, the more drastic change can be found for products with a higher average level in 1988. Overall, Japan's tariffs gradually declined. The reduction in the 1990s was mainly driven by the reduction of MFN rates, following the agreement made in the Uruguay Round negotiation. For Japan, MFN

[2] Other types of empirical studies on wholesalers include Basker and Van (2010) and Atkin et al. (2018).

tariffs had been already eliminated for 42% of total tariff lines by the latter half of the 2000s, and have been unchanged since then. The slight decrease in the average since the latter half of the 2000s is due to the proliferation of RTAs. The sharp decrease found in 2007 is because Japan eliminated GSP tariff rates of almost all products from the least developed countries, following the Hong Kong Ministerial Declaration in December 2005 (Ito and Aoyagi, 2019).

=== Figure 1 ===

The baseline estimation result is reported in column (I) in Table 1. In this specification, we include exporting country-product and exporting country-year fixed effects. For example, the former controls for the time-invariant parameters in sector-specific productivity distribution in exporting countries while the latter does for the factor prices such as wages in exporting countries and the total income in Japan. The coefficient for tariffs is estimated to be negatively significant, which is consistent with our expectation. In column (II), we add product-year fixed effects, which control for not only the product-level demand size but also the variation or change of MFN tariff rates in Japan. Namely, the coefficient for tariffs captures the effect of tariff changes, which result from application of the preferential tariff rates. The result again shows the negatively significant coefficient.

=== Table 1 ===

We further conduct additional estimation. In column (III), we restrict sample products to those used for the analysis of the tariff pass-through in wholesaling in a later section, in order to obtain the results, which may be compared with the tariff pass-through by different players.[3] The coefficient for tariffs is again estimated to be significantly negative. A 1% decrease in tariffs raises import prices by 0.49%. In columns (IV)-(VI), we use non-logged tariff rates as our main independent variable rather than logged tariff rates. The sign and statistical significance of the coefficients do not change compared with those in the logged version. These results are a bit different from those obtained in the previous studies. Rezitis and Brown (1999) found a positive, rather than negative, coefficient in the analysis on the exports of tobacco from Greece to the U.S. while Mallick and Marques (2008) found in India's imports that all tariff rent goes to exporting countries on average. In sum, the case of Japan shows that not only exporting countries but also importing countries enjoy some portion of the rent.

Next, we investigate the tariff pass-through in consumer prices. For this analysis, we examine the unit consumer prices of 127 commodities from 1996 to 2006 in Japan. Our estimation equation is specified as follows.

$$\ln P_{it}^{Consumer} = \beta \ln(1 + Tariff_{it}^{MFN}) + \mathrm{FE}_i + \mathrm{FE}_t + \epsilon_{it}. \qquad (2)$$

[3] The product list in the analysis for wholesaling is available in Appendix A.

$P_{it}^{Consumer}$ is the unit consumer price of product $i$ in year $t$. $Tariff_{it}^{MFN}$ is Japan's MFN tariff rates for product $i$ in year $t$. In this specification, we do not have a dimension of export countries because our data do not report prices by import sources. Thus, we examine the effect of MFN tariff rates rather than that of applied rates by focusing on the years before Japan's active conclusion of RTAs. By matching the HS codes with the commodity classification in the survey, we take a weighted average of MFN tariff rates by using import values at a tariff line-level in 1995 (i.e., pre-sample year) as a weight. In this computation, we employed the converter of HS codes over time developed by Ito and Aoyagi (2019). We control for product and year fixed effects. For example, these fixed effects will respectively control for the difference in the unit in the measurement of the prices across products and the total income in Japan.

Our main data source for this unit price is Japan's Family Income and Expenditure Survey compiled by the Ministry of Internal Affairs and Communications. The data include the yearly amount of expenditures and quantities per household. The unit price is computed by dividing total expenditure by total quantity. Namely, our measure of the consumer price is the one actually paid by households. The sample households are restricted to those with two or more persons. One important point is that the consumer price here mixes the prices of foreign goods and domestic goods. It is expected that tariff reduction decreases the price of foreign goods more greatly than that of domestic goods because the former decreases directly by the tariff reduction while the rate of decrease of the latter price depends on the level of competition induced by the tariff reduction in the market. Because of these reasons, the magnitude of the effect of tariffs becomes smaller in our analysis compared with the case where we focus only on the price of foreign goods. Since our interest lies in the tariff pass-through rate in foreign goods, the coefficient for tariffs in the above model will be smaller than its true level in foreign goods.

The baseline estimation result is shown in column (I) in Table 2. The coefficient is positive and significant, indicating that a 1% decrease of (one-plus) MFN rates reduces consumer prices by 0.1%. This magnitude is a bit smaller than that obtained in the previous studies, which is around 0.3% in Mexico (Nicita, 2009) and China (Han et al., 2016). In column (II), following the afore-mentioned literature on tariff pass-through in consumer prices, we introduce one additional variable, a log of Japan's unit import price of a product from the world, to control for its international price. The coefficient for this additional variable is significantly positive, indicating that the rise of international prices raises consumer prices as well. Also, the coefficient for tariffs is again estimated to be significantly positive. As in the analysis for import prices, in column (III), we restrict sample products only to those examined for wholesaling. The coefficient for tariffs slightly decreases but is still estimated to be significantly positive. A 1% decrease of tariffs raises consumer prices by 0.08%. In columns (IV)-(VI), we use non-logged tariffs, of which coefficients are significantly positive.

=== Table 2 ===

## 3. Empirical Framework

This section provides our empirical framework to investigate the tariff pass-through in wholesaling. As in the analyses conducted in the previous sections, our interest lies in the tariff pass-through of imported products in the wholesaling process. We first discuss theoretically the relationship of tariffs with a margin ratio, which is defined below. After specifying our estimation equation, we discuss some empirical issues.

### 3.1. Theoretical Consideration

To investigate the tariff pass-through in wholesaling, we examine the effect of tariffs on a margin ratio, which is a ratio of sales minus procurements to sales. If the quantity is the same between selling and procuring, the margin ratio indicates a ratio between a sales price and a procurement price. Thus, the relation of the margin ratio with tariffs indicates how much the change of tariffs passes onto the sales price relative to the procurement price. In particular, by focusing on the wholesalers who procure goods from foreign countries, we take this relation as a proxy for tariff pass-through of imported goods in wholesaling. Let $X$ be a ratio of the sales price to the procurement price. Quantitatively, the rise of margin ratios by one percentage point is equivalent to the rise of sales prices relative to procurement prices by $X$%. Since our interest lies in the effect of tariffs on importing wholesalers' sales prices, we use this magnitude relation later to convert the effect on margin ratios into that on the relative sales prices.

Before going on to the explanation on the estimation, we first discuss the effects on the margin ratio by using a theoretical model based on Raff and Schmitt (2012). Raff and Schmitt (2012) extended Melitz and Ottaviano (2008) to explore the effects of trade liberalization on the retailing sector. In the model, heterogeneous retailers source their goods from domestic or foreign producers. Their respective prices are denoted by $w$ and $t$. The procurement price of foreign goods includes trade costs or tariff. Since importing from a foreign producer is involved with fixed costs, only retailers with a unit labor requirement ($c$), less than a cut-off value choose importing. In addition, since retailers face a linear demand function of consumers, consumer demand goes to zero if the consumer prices are too high. Given that retailers with a high unit labor requirement impose high prices, only retailers with a unit labor requirement less than another cut-off value ($c_D$), will remain active. Since wage is normalized to one, the marginal cost of wholesaling is defined as $c + w$ domestic wholesalers and $c + t$ for importers.

We apply this model for retailing to wholesaling. For this application, the utility function of consumers in Raff and Schmitt (2012) should be interpreted as the production function of retailers. We also need to assume that retailers cannot undertake direct imports

and must procure their goods from wholesalers. Then, we can derive the margin ratio for domestic wholesalers (i.e., non-importing wholesalers) and importing wholesalers as follows:[4]

$$Margin = \begin{cases} 1 - \dfrac{2w}{c_D + 2w + c}, & \text{for Domestic Wholesalers} \\ 1 - \dfrac{2t}{c_D + w + c + t}, & \text{for Importing Wholesalers} \end{cases}.$$

The margin ratio can be considered as a combination of a sales price and a procurement price. The procurement prices ($w$ and $t$) have not only direct but also indirect influence on the margin ratio by changing the marginal cost and thus the sales price of wholesaling. Naturally, the unit labor requirement of the wholesaler ($c$) affects the marginal cost and the sales price. The same is true for the cut-off value for unit labor requirement ($c_D$) because lower cut-off value reduces the sales price through the decline in markups of wholesalers.[5] Since the cut-off value is a function of the average price across wholesalers and the mass of active wholesalers, it may be taken as indicating the degree of competition between wholesalers.

Total differentiation of the margin ratio shows[6]

$$dMargin = \begin{cases} \dfrac{2w}{(c_D + 2w + c)^2}\left[dc + \dfrac{dc_D}{dt}dt\right], & \text{for Domestic Wholesalers} \\ \dfrac{2}{(c_D + w + c + t)^2}\left[tdc - \left(c_D + w + c - t\dfrac{dc_D}{dt}\right)dt\right], & \text{for Importing Wholesalers} \end{cases}.$$

Notice $1 > dc_D/dt > 0$, suggesting that the reduction in trade costs induces a lower cut-off value for unit labor requirement though the change of cut-off value for the unit labor requirement is smaller than the change of trade costs.[7] The equation shows that the higher unit labor requirement of wholesalers is involved with the larger margin ratio for both domestic wholesalers and importers.

On the other hand, the effects of tariffs on margin ratios are qualitatively different between domestic wholesalers and importers. The lower tariff rate induces the smaller margin ratio for domestic wholesalers by the following mechanism. First, the reduction in tariff rates decreases the average prices through three channels; standard pass-through, the exit of the domestic wholesalers with the relatively high unit labor requirement, and an increase in the fraction of importers.[8] Such a reduction in the average price decreases

[4] See Appendix B for the derivations.

[5] Appendix B provides the expression for markups of wholesalers.

[6] Here we treat the price of domestic goods ($w$) as constant and the cut-off value for unit labor requirement ($c_D$) as an endogenous variable. Nevertheless, tariff reduction may force domestic producers to decrease their sales prices ($w$) due to the tougher competition with imported products. Our discussion does not change if this effect is not so relevant in terms of magnitude.

[7] See Appendix in Raff and Schmitt (2012) for the proofs and analytical expression of $dc_D/dt$.

[8] The first channel, standard pass-through, works on the average price via a decline in the marginal costs and thus that of the sales prices of importing wholesalers in response to the tariff reduction. Second, since

demand for each wholesaler and thus the cut-off value for unit labor requirement. As explained above, the lower cut-off value means smaller markups for wholesalers, resulting in a smaller margin ratio by decreasing the sales price. Although the same mechanism operates on the importers, the net effect of tariff reduction on the margin ratio becomes negative because the procurement price of foreign goods decreases. In Appendix B, it is shown that the effect of reduction in the procurement price always dominates the effects of tougher competition.

## 3.2. Empirical Specification

In our empirical analysis, there are three types of wholesalers in terms of procurement sources. The first type of wholesalers, which is called importers, procures from foreign countries. As demonstrated above, the tariff reduction will raise importers' margin ratios. On the other hand, the second and third types are non-importing wholesalers. The third type corresponds to the domestic wholesalers in the above discussion and includes the wholesalers that procure from domestic producers. Thus, as demonstrated above, the tariff reduction will lower the margin ratio in this type of wholesalers. The second type may be taken as a hybrid between the first and third types. It includes the wholesalers that procure from other domestic wholesalers. If those domestic wholesalers are importers, this type of wholesalers will enjoy a similar effect as the first type does. On the other hand, the procurement from non-importing domestic wholesalers will yield a similar effect as in the third type.

To differentiate the effects of tariff reduction across these three types of wholesalers, we specify our baseline equation for wholesale firm *f* in wholesale sector *i* in prefecture *r* at year *t* as follows.

$$Margin_{ft} = \gamma_1 Tariff_{it}^{MFN} + \gamma_2 Tariff_{it}^{MFN} \times Secondtier_{ft} + \gamma_3 Tariff_{it}^{MFN} \times Importer_{ft} + \mathbf{X}_{ft}\boldsymbol{\delta} + \mathbf{Z}_{it}\boldsymbol{\varphi} + \mathrm{FE}_f + \mathrm{FE}_{rt} + \epsilon_{ft}. \quad (3)$$

Our data, which are explained later, enable us to identify whether the procurement source is domestic or foreign countries but not a specific country in the case of foreign countries. Therefore, as in the analysis for consumer prices, we examine the effect of MFN tariff rates in Japan ($Tariff_{it}^{MFN}$). We introduce the interaction terms of tariffs with two dummy variables. $Secondtier_{ft}$ takes the value one if the main procurement source for wholesaler *f* is domestic wholesalers at year *t* and zero otherwise, while $Importer_{ft}$ takes the value one if the main procurement source for wholesaler *f* is foreign countries at year *t* and the value zero otherwise. We call wholesalers with one-valued $Secondtier$ "second-tier wholesalers."

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the wholesalers with higher unit labor requirement set higher sales prices, the exit of the domestic wholesalers with the higher unit labor requirement reduces the average price over surviving wholesalers. The exit of those wholesalers also induces the lower average price through the decline in markups. Finally, the average price is lower when the fraction of importing wholesalers is higher because the marginal costs and sales prices of importing wholesalers are lower than domestic wholesalers. Therefore, these three channels all lead to lower average prices.

In this specification, the coefficients $\gamma_1$, $\gamma_1 + \gamma_2$, and $\gamma_1 + \gamma_3$ correspond to the effects of tariffs on the margin ratio in the third, second, and first types of wholesalers, respectively. As discussed above, the effect of tariffs will be negative in the first type (i.e., importers) and positive in the third type (i.e., wholesalers procuring from domestic producers). Therefore, $\gamma_1$ and $\gamma_3$ are expected to be positive and negative, respectively. Furthermore, $\gamma_1 + \gamma_3$, which is our main interest, should be negative. On the other hand, as discussed above for the second-tier wholesalers, the sign of $\gamma_1 + \gamma_2$ is an empirical question since our data cannot differentiate between non-importers who procure from importing wholesalers and those who procure from non-importing wholesalers. Namely, the sum of $\gamma_1$ and $\gamma_2$ includes the effect of tariffs in both these types of non-importers. As a result, its magnitude is expected to lie between $\gamma_1$ and $\gamma_1 + \gamma_3$. Since we expect that $\gamma_1$ is positive, $\gamma_2$ should be estimated to be at least negative. In sum, the expected signs are the following.

$$\gamma_1 > 0, \qquad \gamma_2 < 0, \qquad \gamma_3 < 0, \qquad \gamma_1 + \gamma_3 < 0. \tag{4}$$

We further introduce some control variables. We control for non-interacted versions of the above two dummy variables (i.e., $Secondtier_{ft}$ and $Importer_{ft}$). Also, we introduce some other time-variant wholesale-firm characteristics ($\mathbf{X}_{ft}$), which includes a log of the number of employees (*Employee*), the dummy on payment method (*Cash/card dummy*), and a log of the number of establishments in firm *f* (ln *# of Units*). If the larger-sized wholesalers in terms of the numbers of employees and establishments have the stronger negotiation power, they may have the higher margin ratio. The dummy, *Cash/card dummy*, takes the value one if a wholesaler's main payment method is cash or credit cards and the value zero if it is charge sales. Since the method of cash or credit card tends to be used for a small amount of transaction, this variable is related to the transaction size.

The other control variables are as follows. As a time-variant sector characteristic ($\mathbf{Z}_{it}$), we introduce the Herfindahl index for wholesalers (*HHI*). If the competition of the wholesale market is tougher (i.e., *HHI* is smaller), the margin ratio will be lower. Last, we control for firm and prefecture-year fixed effects. The firm fixed effect includes wholesale firms' inherent characteristic, which may be related to the choice of the main procurement source. The inclusion of prefecture-year fixed effect is also important because the sales price must include not only the procurement price but also factor prices (e.g., wages) and transport costs. These elements are likely to depend on the location of wholesalers. Also, the demand size is obviously different by regions (prefectures). The prefecture-year fixed effect will control for these differences across regions.

## 3.3. Empirical Issues

Our main dataset is the Census of Commerce (the Census, hereafter), which is conducted on all stores engaged in wholesale and retail trade. The Census has been conducted every five years since 1997. To focus on the effect of MFN rates, we use the data

collected in 1997, 2002, and 2007.[9] The wholesale sectors are defined at a five-digit code. For example, "textile" at a four-digit level has five sectors, including raw silk and cocoons, chemical fiber materials, other fiber materials, yarn, and textile. To avoid matching tariffs in one sector with wholesalers dealing with many different products (e.g., general trading companies), we exclude those dealing with one two-digit code and more than two three-digit codes. Such firms account for around 10% in terms of total sales in wholesaling. The data source for tariffs is the same as in Section 2. We match the five-digit code in the Census with the tariff line-level code of the HS in Japan. Naturally, multiple HS codes are matched to each five-digit code in the Census. We take a weighted average in this aggregation by using import values in 1995 (i.e., pre-sample period). Since the figures in the Census are those for 1996, 2001, and 2006, we match tariffs in these years. The Herfindahl index is computed by using the firm-level sales in all wholesalers (including general trading companies) obtained from the Census.

There are three empirical and data issues. First, our firm-level analysis, rather than the firm-product-level analysis, is based on data availability. The Census reports the data on procurements only at a firm-level. Although we exclude the wholesalers that deal with many different products as mentioned above, our tariff variables may suffer from the measurement error problem if wholesalers deal with multiple products within a five-digit sector. As a result, the estimates by the ordinary least square (OLS) method are subject to attenuation bias toward zero. To deal with this measurement error, we perform an instrumental variable (IV) estimation. As an instrument, we use Japan's revealed comparative advantage (RCA) index defined at a five-digit sector code in wholesaling. RCA will be highly correlated with tariff rates because it is generally higher for competitive products, and the tariff rate is lower for those products (e.g., Rodrik, 1995). Furthermore, there are no reasons to think that the RCA is correlated with the measurement errors for tariff variables and the error term in the equation (3). In short, RCA will play a valid role as an instrument.

Second, we focus on the wholesalers in which the main sales destination is the domestic market, not the foreign market. In addition, we exclude the wholesalers who are mainly engaged in intra-firm transactions. As a result, the wholesalers included in the estimation sell mainly to either domestic wholesalers or retailers. Also, the sample wholesalers are restricted only to those whose main procurement source is foreign countries, domestic producers, or domestic wholesalers. The identification of the main sales partner and procurement source is possible because the Census reports the share (not level) of each partner and source in terms of transaction values. Third, margin ratios are computed by

[9] Although the Census originally includes the information on retailers, we focus on wholesalers in this paper. The main reason for not analyzing retailers is because consumers tend to purchase daily products in supermarkets or department stores rather than sector-specific retail shops. Furthermore, since we cannot compute the margin ratio at a firm-product-level, it is almost impossible to map tariff rates to supermarkets and department stores. As a result, the analysis on sector-specific retail shops will not show the whole picture on the allocation of tariff rent between retailers and consumers.

using the annual sales and purchases. It is natural that all procurements in a year are not necessarily sold within that year. However, since our dataset does not include figures on inventory, we do not adjust procurements for this issue.

Before moving to the next section, we take a brief overview of our dataset. Figure 2 depicts the distribution of margin ratios in 2006. It hits a peak at around 0.2, meaning that the sales price is around 25% (=100/(1−0.2) − 1) higher than the procurement price. The basic statistics are reported in Table 3. As found in Figure 2, the mean of the margin ratio shows 0.277. In the original data, the margin ratio can be either zero or one. The case of the value one arises when the procurements are recorded as zero. We exclude this case from the estimation. On the other hand, the margin ratio becomes the value zero when the same non-zero value is recorded for sales and procurements. Although we keep this case in the estimation sample, we later drop this for a robustness check.

=== Figure 2 & Table 3 ===

## 4. Empirical Results

This section reports our estimation results. Since our main variable, tariffs, changes in a sector-year dimension, we cluster the standard errors by wholesale sectors (Bertrand et al., 2004). We start with the estimation by the OLS. The baseline result is shown in column (I) in Table 4. All tariff-related variables including tariff variable and its interaction terms with importer dummy and second-tier dummy have insignificant coefficients. Among the variables, only the coefficients for *Cash/card dummy* and the number of establishments are significantly estimated. The former is negatively estimated, indicating economies of scale in the margin ratio. The positive coefficient in the number of establishments shows the larger-sized wholesalers have a significantly higher margin ratio. The coefficients for the importer and second-tier wholesaler dummy variables, employment size, and Herfindahl index are insignificantly estimated. These results are unchanged even if excluding observations with the zero-valued margin ratio as shown in column (II), although the coefficient for second-tier dummy turns out to be significantly positive.

=== Table 4 ===

We conduct two kinds of robustness checks on the above results. One is to estimate for two kinds of subsets of the wholesalers. First, we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% of total sales. This restriction is to improve the correspondence of the five-digit code between the margin ratio and tariffs. Second, we restrict only to those with the only single establishment in order to more precisely control for the fixed effect of location. In this estimation, a variable of the logged number of establishments is naturally dropped. The

results for these two kinds of estimation are reported in columns (III) and (IV) in Table 4. They are not that different than those in columns (I) and (II). All tariff-related variables have insignificant coefficients. In column (IV), the coefficient for second-tier wholesaler dummy is significantly positive, indicating that the second-tier wholesalers have higher margin ratios than the first-tier wholesalers.

The other robustness check is to estimate by the IV method. Table 5 reports the estimation results. The test statistics for under-identification and weak identification show reasonably high values. The results on the explanatory variables are drastically different. In particular, the coefficients for the tariff variable and its interaction term with importer dummy are significantly estimated. Compared with the OLS results, the absolute magnitude of these coefficients rises by addressing the attenuation bias due to the measurement error problem in our tariff variable. Their signs are consistent with our expectation. Furthermore, the sum of these two coefficients becomes negative. These results imply that the tariff reduction decreases and increases the margin ratio for the wholesalers who procure from domestic producers and foreign countries, respectively. The coefficient for the interaction term with the second-tier wholesaler dummy is negatively estimated as is consistent with the expectation, but insignificant.

=== Table 5 ===

Overall, this table shows that, for the importing wholesalers, a 1% decrease of tariffs raises the margin ratio by around 0.15 percentage point. As mentioned in Section 3, the rise of margin ratios by one percentage point is equivalent to the rise of sales prices relative to procurement prices ($X$) by $X$%. Therefore, evaluating $X$ at the average among importing wholesalers (i.e., 1.49), we can state that a 1% decrease of tariffs raises the relative sales prices by around 0.22%. In Section 2, we found for the common set of products that a 1% reduction of tariffs raises import prices by 0.49% and lowers consumer prices by 0.08%. Although we should be careful for the comparison of the magnitude across players, our results may suggest at least that wholesalers in importing country enjoy a smaller portion of tariff rent than producers in exporting country but a larger portion than consumers in importing country.

The IV results on other variables are as follows. The coefficients for the importer and second-tier wholesaler dummy variables are estimated to be significantly positive though the latter coefficient is insignificant in column (III). Since the absolute magnitude of the coefficients is larger for the importer dummy, the importing wholesalers have the highest margin ratio, followed by the second-tier wholesalers. On average, the wholesalers procuring from the domestic producers have the lowest margin ratio. The highest margin ratio in importing wholesalers is consistent with the result by Meinen and Raff (2018) that importing wholesalers have 2% greater markups as introduced in Section 1. On the other hand, the coefficients for employment size and Herfindahl index are again insignificantly

estimated. These results may indicate that, unlike the case of manufacturing, the employment size and extent of competition are not necessarily associated with performance for the wholesale firms. The coefficients for the number of establishments is estimated to be significantly positive, indicating that the larger-sized wholesalers in terms of the number of establishments have a significantly higher margin ratio. The coefficient for *Cash/card dummy* variable is again significantly negative.

Next, we conduct two robustness checks on our tariff variable. First, we use the non-logged version of tariff variable because our empirical model is not a structural one and there are no ex-ante reasons that we have to use logged tariffs. The results by the IV method are reported in Table 6 and show similar results to those in Table 5. For example, column (I) shows that, for the importing wholesalers, a one-percentage-point rise of tariffs decreases the margin ratio by 0.16 percentage point. Second, when we compute the weighted average of tariff rates, we exclude tariff line-level products with tariffs over 100%. Such products with extremely high tariff rates have non-ad-valorem types of tariffs. Namely, those high rates are based on the transformation of non-ad-valorem tariffs into ad-valorem equivalent rates. Since such rates are known to be unstable, we exclude the products with high tariff rates (i.e., 100%) in the computation of the weighted average. The results are shown in Table 7 and are similar to those in Table 5.

=== Tables 6 & 7 ===

We control for another element that may affect the margin ratio for the wholesalers. A growing number of studies have investigated the effect of import penetration from China on employment because many countries have experienced a dramatic increase of imports from China since her accession to the WTO in 2001 (e.g., Acemoglu et al., 2016). Since our sample period overlaps the period when Japan's imports from China increased remarkably, we add Japan's import penetration from China (*China penetration*) in the corresponding year as an additional control. Specifically, it is computed as a ratio of imports from China to the sum of those imports and domestic production value. The sector-level data on the production value are obtained from the Census of Manufacture. The results by the IV method are reported in Table 8 and show similar results for the variables taken up in the previous estimation. The new variable, China penetration, has significantly positive coefficients, which indicate that the margin ratio is higher in the sectors with the larger imports from China. This result seems to reflect an increase in cheap procurements from China.

=== Table 8 ===

Last, we further control for heterogeneous effects of tariffs on the margin ratio from

various dimensions. First, we introduce the interaction term of tariffs with a log of the number of employees to investigate if the magnitude of the tariff pass-through differs by the size of wholesalers. For example, the larger-sized wholesalers may enjoy the larger portion of the tariff rent because of the stronger bargaining power in the negotiation. Second, we introduce the interaction term of tariffs with the Herfindahl index to investigate if the extent of competition in the wholesale market affects the magnitude of tariff pass-through. For example, when tariffs decrease, the wholesalers may not be able to raise their margin ratio if the competition in the market is tough. The results for only tariff-related variables are shown in Table 9. Although the results for the variables included in the previous estimation are unchanged, the two new interaction terms have insignificant coefficients. Thus, these two elements (i.e., employment size and extent of competition) do not have a significant influence on not only the level of margin ratios but also the magnitude of tariff pass-through.

=== Table 9 ===

## 5. Concluding Remarks

This paper empirically examined the tariff pass-through in wholesaling by employing the wholesale firm-level data in Japan. Our findings are summarized as follows. We started with the investigation of tariff pass-through for the import and consumer prices and found that a 1% reduction of tariffs raises import prices by 0.49% and decreases consumer prices by 0.08%. Our investigation of the wholesalers indicates that importing wholesalers significantly raise their margin ratio against tariff reduction. On average, a 1% reduction of tariffs raises the margin ratio by around 0.15 percentage point. This magnitude is equivalent to the rise in sales prices relative to procurement prices by around 0.22%. Although we should be careful with the comparison of the magnitude across players, our results may suggest at least that wholesalers in importing country enjoy the smaller portion of tariff rent than producers in exporting country but the larger portion than consumers in importing country. However, it should be noted that our result for consumer prices includes the effects on those in domestic products. Therefore, the tariff pass-through in the consumer prices of imported products may be higher than our estimate.

We found that tariff reduction presents relatively small benefits to the consumers, while large benefits go to foreign producers and domestic distribution (wholesaling and retail) sector. Several policy implications for increasing benefits to consumers may be drawn. First, an improvement in efficiency coupled with increased competition in the distribution sector would result in greater benefits to consumers. The Japanese distribution sector has been argued to be inefficient because of their special characteristics including a large number of small establishments, many layers, exclusive (*Keiretsu*) distribution system, unique trading practices, sole representative importers, personal relationship, and long-

term contracts (Ito and Maruyama, 1991; Porter and Sakakibara, 2004). An improvement in efficiency may be realized if these problems are dealt with successfully. Furthermore, adoption of new technology such as information technology (IT) by the firms in distribution sector is likely to improve efficiency not only by overcoming these problems but also reducing the cost of communication. The government may provide an incentive for the firms to introduce such technology.

Second, although the disciplining effect of competition on distribution margin was not found in our analysis, competitive pressure would force the firms to adopt new technology to result in an improvement in efficiency. It is therefore important for the government to maintain and increase the level of competition in the distribution sector. Third, another possible way for the consumers to increase their benefits from tariff reduction is to import the products directly from foreign producers by bypassing the domestic distribution sector. Remarkable advancement in international e-commerce has enabled consumers to purchase products from foreign producers without difficulty. Direct importing by consumers puts pressure on the firms in the distribution sector and would make it difficult for them to survive unless they improve efficiency. The government is advised to establish an environment under which e-commerce may be conducted efficiently.

We found that the largest beneficiary from tariff reduction is foreign producers. One wonders if there is any way that consumers and distribution sector in Japan can do to increase their benefits at the cost of foreign producers. Naturally an increase in bargaining power would achieve this objective but how can this be done? One effective way may be to diversify the sources of imports. This can be realized by using IT as it facilitates the consumers and distribution sector to find new sources of imports. Recognizing these points, the government needs to create an environment, where IT technology is used effectively and efficiently at low cost. The government may also help the consumers and the distribution sector by introducing new import sources through public agencies such as the Japan External Trade Organization (JETRO) in the case of Japan.

These observations and policy implications may be applied to other countries. Indeed, there are studies that show similarities of the distribution sector in Japan and the US. Nishimura (1993) compared the U.S. and Japanese distribution, wholesaling and retailing sectors and found that gross margins in the two countries were quite similar. Similar findings were obtained in Nomura and Miyagawa (2017). Due to such similarity, our results obtained in this paper about Japan might be useful for the US as well.

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Table 1. Tariff Pass-through in Import Prices

| | (I) | (II) | (III) | (IV) | (V) | (VI) |
|---|---|---|---|---|---|---|
| ln (1 + Tariff) | -0.2416*** | -0.4554*** | -0.4925*** | | | |
| | [0.0789] | [0.1126] | [0.1225] | | | |
| Tariff | | | | -0.2115*** | -0.4059*** | -0.4380*** |
| | | | | [0.0679] | [0.1018] | [0.1111] |
| Exporter-HS6 FE | X | X | X | X | X | X |
| Exporter-Year FE | X | X | X | X | X | X |
| HS6-Year FE | | X | X | | X | X |
| Sample | All | All | Common | All | All | Common |
| R-squared | 0.8454 | 0.8516 | 0.8588 | 0.8454 | 0.8516 | 0.8588 |
| Number of obs | 1,523,325 | 1,517,612 | 1,077,420 | 1,523,325 | 1,517,612 | 1,077,420 |

*Notes*: The dependent variable is a log of import prices. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by exporting country-HS six-digit code. In column "Common," we restrict sample products only to those covered in our analysis for wholesaling.

Table 2. Tariff Pass-through in Consumer Prices

| | (I) | (II) | (III) | (IV) | (V) | (VI) |
|---|---|---|---|---|---|---|
| ln (1 + Tariff) | 0.1036* | 0.1085* | 0.0796* | | | |
| | [0.0606] | [0.0614] | [0.0436] | | | |
| Tariff * 100 | | | | 0.0385** | 0.0403*** | 0.0331*** |
| | | | | [0.0156] | [0.0155] | [0.0117] |
| ln Import price | | 0.0442 | 0.0517* | | 0.0439 | 0.0515* |
| | | [0.0318] | [0.0309] | | [0.0318] | [0.0308] |
| Sample | All | All | Common | All | All | Common |
| Number of obs. | 1,484 | 1,484 | 1,405 | 1,484 | 1,484 | 1,405 |
| Adj R-squared | 0.9928 | 0.9928 | 0.9955 | 0.9928 | 0.9928 | 0.9955 |

*Notes*: The dependent variable is a log of consumer prices. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by products. In all specifications, we control for product and year fixed effects. In column "Common," we restrict sample products only to those covered in our analysis for wholesaling.

Table 3. Baseline Statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Margin | 128,009 | 0.277 | 0.168 | 0 | 1.000 |
| ln (1 + Tariff) | 128,009 | 0.070 | 0.125 | 0 | 1.774 |
| ln (1 + Tariff) * Importer | 128,009 | 0.003 | 0.024 | 0 | 1.774 |
| ln (1 + Tariff) * Second-tier | 128,009 | 0.046 | 0.108 | 0 | 1.774 |
| Importer dummy | 128,009 | 0.035 | 0.185 | 0 | 1.000 |
| Second-tier | 128,009 | 0.682 | 0.466 | 0 | 1.000 |
| ln Employee | 128,009 | 1.972 | 1.004 | 0 | 8.689 |
| Cash/card dummy | 128,009 | 0.845 | 0.362 | 0 | 1 |
| HHI | 128,009 | 0.049 | 0.069 | 0.004 | 0.820 |
| ln # of Units | 128,009 | 0.205 | 0.533 | 0 | 6.111 |
| China penetration | 128,009 | 0.079 | 0.145 | 0 | 0.796 |
| RCA | 128,009 | -1.498 | 1.795 | -6.353 | 2.032 |

*Source*: Authors' computation.

Table 4. Baseline Results by OLS

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| ln (1 + Tariff) | -0.009 | -0.011 | -0.008 | -0.005 |
| | [0.007] | [0.007] | [0.007] | [0.008] |
| ln (1 + Tariff) * Importer | -0.002 | -0.004 | -0.004 | -0.018 |
| | [0.029] | [0.029] | [0.034] | [0.034] |
| ln (1 + Tariff) * Second-tier | 0.007 | 0.008 | 0.007 | 0.003 |
| | [0.008] | [0.008] | [0.009] | [0.009] |
| Importer dummy | 0.006 | 0.006 | 0.005 | 0.007 |
| | [0.005] | [0.005] | [0.005] | [0.006] |
| Second-tier | 0.003 | 0.003* | 0.002 | 0.004** |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| ln Employee | 0.002 | 0.001 | 0.002 | 0.001 |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| Cash/card dummy | -0.011*** | -0.012*** | -0.010*** | -0.011*** |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| HHI | -0.008 | -0.009 | -0.011 | -0.005 |
| | [0.013] | [0.013] | [0.014] | [0.015] |
| ln # of Units | 0.015*** | 0.014*** | 0.015*** | |
| | [0.002] | [0.002] | [0.002] | |
| Margin = 0 | Incl. | Excl. | Incl. | Incl. |
| Top share > 50% | | | X | |
| Single establishment | | | | X |
| Adjusted R-squared | 0.4626 | 0.4766 | 0.4691 | 0.4571 |
| Number of obs | 128,009 | 125,730 | 111,590 | 105,589 |

*Notes*: The dependent variable is a margin ratio. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by wholesale sectors. In all specifications, we control for firm and prefecture-year fixed effects. In "Top share > 50%," we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% in terms of sales. In "Single establishment," we restrict only to those with the only single establishment.

Table 5. IV Results

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| ln (1 + Tariff) | 0.101*** | 0.096*** | 0.096*** | 0.090*** |
| | [0.028] | [0.027] | [0.032] | [0.030] |
| ln (1 + Tariff) * Importer | -0.234** | -0.252*** | -0.238** | -0.272** |
| | [0.091] | [0.090] | [0.101] | [0.111] |
| ln (1 + Tariff) * Second-tier | -0.006 | -0.01 | 0.001 | -0.005 |
| | [0.022] | [0.022] | [0.025] | [0.025] |
| Importer dummy | 0.026*** | 0.027*** | 0.025*** | 0.028*** |
| | [0.009] | [0.009] | [0.009] | [0.010] |
| Second-tier | 0.004* | 0.005** | 0.003 | 0.005** |
| | [0.002] | [0.002] | [0.002] | [0.003] |
| ln Employee | 0.001 | 0.000 | 0.001 | 0.000 |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| Cash/card dummy | -0.011*** | -0.012*** | -0.011*** | -0.011*** |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| HHI | -0.013 | -0.013 | -0.016 | -0.008 |
| | [0.013] | [0.013] | [0.014] | [0.015] |
| ln # of Units | 0.016*** | 0.015*** | 0.016*** | |
| | [0.002] | [0.002] | [0.002] | |
| Margin = 0 | Incl. | Excl. | Incl. | Incl. |
| Top share > 50% | | | X | |
| Single establishment | | | | X |
| Underidentification test | 1588.5 | 1570.2 | 1418.6 | 1259.9 |
| Weak identification test | 568.8 | 561.9 | 506.4 | 453.0 |
| Centered R-squared | 0.6964 | 0.7047 | 0.7023 | 0.695 |
| Number of obs | 128,009 | 125,730 | 111,590 | 105,589 |

*Notes*: The dependent variable is a margin ratio. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by wholesale sectors. In all specifications, we control for firm and prefecture-year fixed effects. In "Top share > 50%," we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% in terms of sales. In "Single establishment," we restrict only to those with the only single establishment. In underidentification and weak identification tests, we report Kleibergen-Paap rk LM statistic and Kleibergen-Paap rk Wald F statistic, respectively.

Table 6. IV Results: Non-logged Tariffs

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| Tariff | 0.131*** | 0.125*** | 0.122*** | 0.117*** |
| | [0.036] | [0.036] | [0.041] | [0.039] |
| Tariff * Importer | -0.286** | -0.309*** | -0.289** | -0.334** |
| | [0.112] | [0.111] | [0.122] | [0.137] |
| Tariff * Second-tier | -0.01 | -0.015 | -0.002 | -0.01 |
| | [0.028] | [0.027] | [0.031] | [0.030] |
| Importer dummy | 0.028*** | 0.029*** | 0.026*** | 0.031*** |
| | [0.009] | [0.009] | [0.010] | [0.011] |
| Second-tier | 0.004* | 0.005** | 0.003 | 0.005** |
| | [0.002] | [0.002] | [0.003] | [0.003] |
| ln Employee | 0.001 | 0.000 | 0.001 | 0.000 |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| Cash/card dummy | -0.011*** | -0.012*** | -0.011*** | -0.011*** |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| HHI | -0.013 | -0.014 | -0.016 | -0.009 |
| | [0.013] | [0.013] | [0.014] | [0.015] |
| ln # of Units | 0.016*** | 0.015*** | 0.016*** | |
| | [0.002] | [0.002] | [0.002] | |
| Margin = 0 | Incl. | Excl. | Incl. | Incl. |
| Top share > 50% | | | X | |
| Single establishment | | | | X |
| Underidentification test | 2130.2 | 2106.8 | 1884.6 | 1677.2 |
| Weak identification test | 795.2 | 785.8 | 700.8 | 629.6 |
| Centered R-squared | 0.6968 | 0.7052 | 0.7027 | 0.6954 |
| Number of obs | 128,009 | 125,730 | 111,590 | 105,589 |

*Notes*: The dependent variable is a margin ratio. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by wholesale sectors. In all specifications, we control for firm and prefecture-year fixed effects. In "Top share > 50%," we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% in terms of sales. In "Single establishment," we restrict only to those with the only single establishment. In underidentification and weak identification tests, we report Kleibergen-Paap rk LM statistic and Kleibergen-Paap rk Wald F statistic, respectively.

Table 7. IV Results: Alternative Tariffs

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| ln (1 + Tariff) | 0.273*** | 0.260*** | 0.237*** | 0.247*** |
| | [0.078] | [0.078] | [0.084] | [0.088] |
| ln (1 + Tariff) * Importer | -0.457** | -0.495*** | -0.444** | -0.552** |
| | [0.186] | [0.184] | [0.190] | [0.229] |
| ln (1 + Tariff) * Second-tier | -0.059 | -0.065 | -0.037 | -0.065 |
| | [0.054] | [0.053] | [0.057] | [0.061] |
| Importer dummy | 0.037*** | 0.039*** | 0.035** | 0.043*** |
| | [0.013] | [0.013] | [0.013] | [0.016] |
| Second-tier | 0.007** | 0.008** | 0.005 | 0.008** |
| | [0.003] | [0.003] | [0.004] | [0.004] |
| ln Employee | 0.002 | 0.001 | 0.002 | 0.001 |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| Cash/card dummy | -0.010*** | -0.012*** | -0.010*** | -0.011*** |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| HHI | -0.013 | -0.014 | -0.016 | -0.01 |
| | [0.013] | [0.013] | [0.014] | [0.015] |
| ln # of Units | 0.015*** | 0.014*** | 0.015*** | |
| | [0.002] | [0.002] | [0.002] | |
| Margin = 0 | Incl. | Excl. | Incl. | Incl. |
| Top share > 50% | | | X | |
| Single establishment | | | | X |
| Underidentification test | 1594.8 | 1548.3 | 1605.7 | 954.7 |
| Weak identification test | 602.1 | 584.0 | 609.7 | 357.6 |
| Centered R-squared | 0.698 | 0.7062 | 0.7037 | 0.6963 |
| Number of obs | 128,009 | 125,730 | 111,590 | 105,589 |

*Notes*: The dependent variable is a margin ratio. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by wholesale sectors. In all specifications, we control for firm and prefecture-year fixed effects. In this table, we use the tariff variable that is constructed by excluding products with tariffs over 100%. In "Top share > 50%," we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% in terms of sales. In "Single establishment," we restrict only to those with the only single establishment. In underidentification and weak identification tests, we report Kleibergen-Paap rk LM statistic and Kleibergen-Paap rk Wald F statistic, respectively.

Table 8. IV Results: Additional Control

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| ln (1 + Tariff) | 0.054*** | 0.052*** | 0.046** | 0.053** |
| | [0.019] | [0.019] | [0.022] | [0.022] |
| ln (1 + Tariff) * Importer | -0.300*** | -0.315*** | -0.307*** | -0.334*** |
| | [0.092] | [0.091] | [0.101] | [0.111] |
| ln (1 + Tariff) * Second-tier | -0.009 | -0.012 | -0.003 | -0.008 |
| | [0.022] | [0.022] | [0.025] | [0.025] |
| China penetration | 0.035*** | 0.033*** | 0.033*** | 0.029*** |
| | [0.008] | [0.008] | [0.009] | [0.009] |
| Importer dummy | 0.029*** | 0.029*** | 0.027*** | 0.031*** |
| | [0.009] | [0.009] | [0.009] | [0.010] |
| Second-tier | 0.004* | 0.005** | 0.003 | 0.005* |
| | [0.002] | [0.002] | [0.002] | [0.003] |
| ln Employee | 0.002 | 0.001 | 0.002 | 0.001 |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| Cash/card dummy | -0.011*** | -0.012*** | -0.010*** | -0.011*** |
| | [0.002] | [0.002] | [0.002] | [0.002] |
| HHI | -0.014 | -0.014 | -0.017 | -0.009 |
| | [0.013] | [0.013] | [0.014] | [0.015] |
| ln # of Units | 0.015*** | 0.014*** | 0.015*** | |
| | [0.002] | [0.002] | [0.002] | |
| Margin = 0 | Incl. | Excl. | Incl. | Incl. |
| Top share > 50% | | | X | |
| Single establishment | | | | X |
| Underidentification test | 962.9 | 874.2 | 977.2 | 419.3 |
| Weak identification test | 380.0 | 344.2 | 390.1 | 160.5 |
| Centered R-squared | 0.6978 | 0.706 | 0.7036 | 0.696 |
| Number of obs | 128,009 | 125,730 | 111,590 | 105,589 |

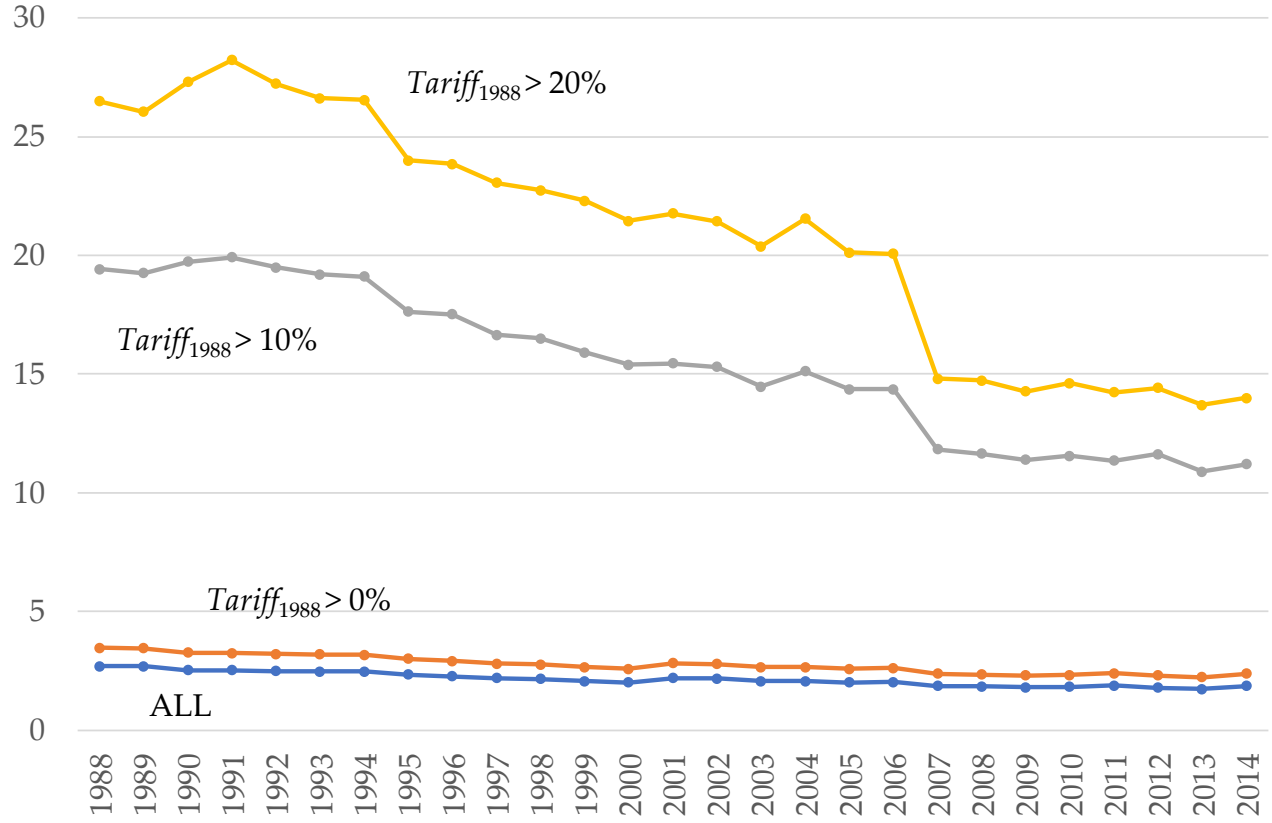
*Notes*: The dependent variable is a margin ratio. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by wholesale sectors. In all specifications, we control for firm and prefecture-year fixed effects. In "Top share > 50%," we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% in terms of sales. In "Single establishment," we restrict only to those with the only single establishment. In underidentification and weak identification tests, we report Kleibergen-Paap rk LM statistic and Kleibergen-Paap rk Wald F statistic, respectively.

Table 9. IV Results: Heterogenous Pass-through

| | (I) | (II) | (III) | (IV) |
|---|---|---|---|---|
| ln (1 + Tariff) | 0.001 | 0.019 | -0.003 | -0.050 |
| | [0.056] | [0.055] | [0.062] | [0.061] |
| ln (1 + Tariff) * Importer | -0.298*** | -0.312*** | -0.304*** | -0.328*** |
| | [0.091] | [0.091] | [0.101] | [0.111] |
| ln (1 + Tariff) * Second-tier | -0.008 | -0.011 | -0.002 | -0.008 |
| | [0.023] | [0.022] | [0.025] | [0.025] |
| ln (1 + Tariff) * ln Employee | 0.023 | 0.016 | 0.019 | 0.046* |
| | [0.020] | [0.020] | [0.023] | [0.026] |
| ln (1 + Tariff) * HHI | 0.148 | 0.016 | 0.303 | 0.545 |
| | [0.531] | [0.523] | [0.589] | [0.576] |
| Margin = 0 | Incl. | Excl. | Incl. | Incl. |
| Top share > 50% | | | X | |
| Single establishment | | | | X |
| Underidentification test | 691.5 | 691.5 | 632.1 | 731.3 |
| Weak identification test | 142.2 | 142.1 | 130.6 | 157.8 |
| Centered R-squared | 0.6977 | 0.706 | 0.7035 | 0.6956 |
| Number of obs | 128,009 | 125,730 | 111,590 | 105,589 |

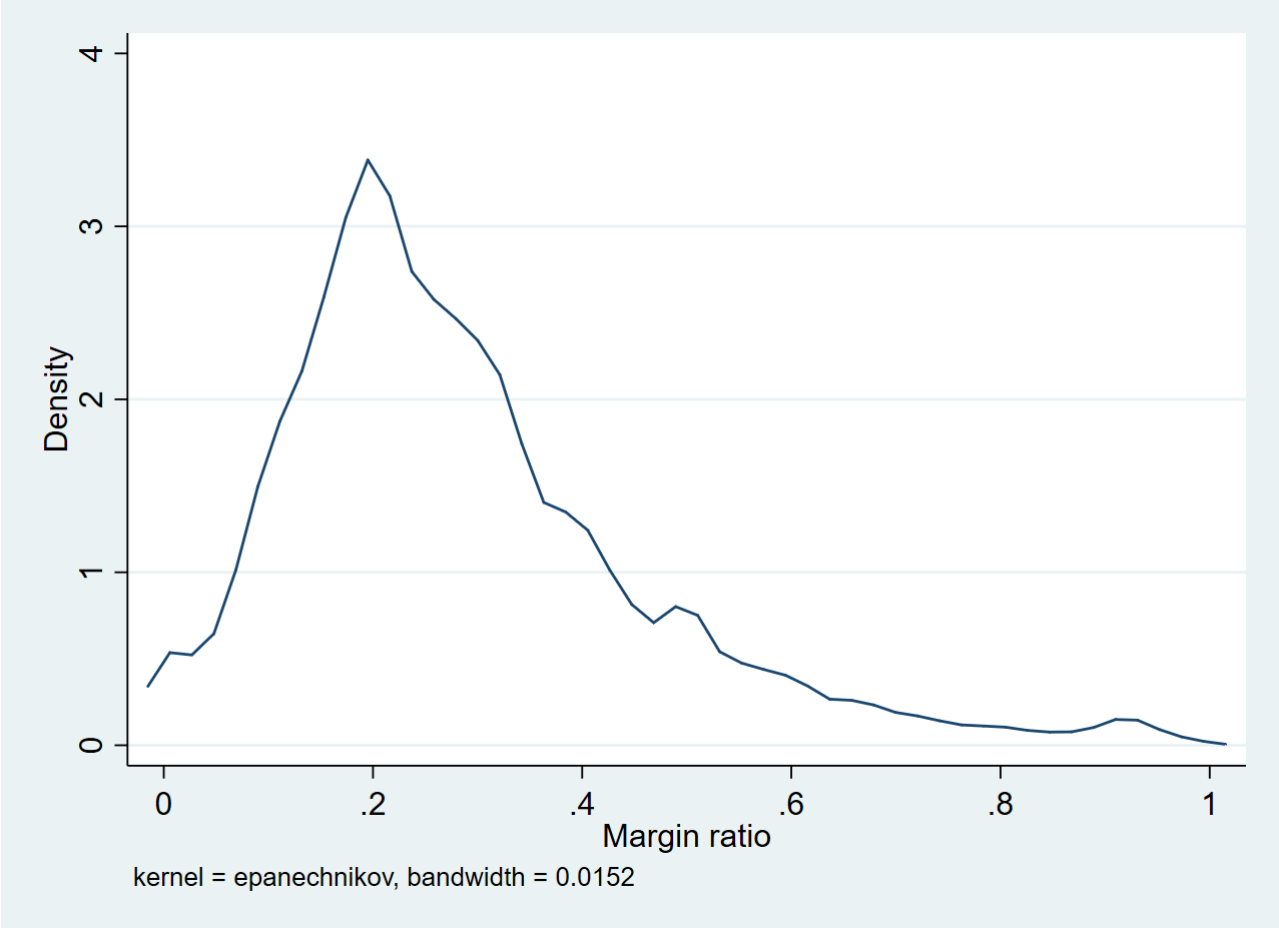
*Notes*: The dependent variable is a margin ratio. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In the parenthesis is the standard error clustered by wholesale sectors. In all specifications, we control for firm and prefecture-year fixed effects. In this table, we report the results in only tariff-related variables. In "Top share > 50%," we restrict sample wholesalers only to those in which the five-digit sector code with the largest sales accounts for more than 50% in terms of sales. In "Single establishment," we restrict only to those with the only single establishment. In underidentification and weak identification tests, we report Kleibergen-Paap rk LM statistic and Kleibergen-Paap rk Wald F statistic, respectively.

Figure 1. Trend of Simple Average of Applied Tariff Rates in Japan (%)




*Source*: Authors' compilation using the WITS.

Figure 2. Distribution of Margin Ratios in 2006




*Source*: Authors' compilation.

# Appendix A Tables

Table A1. Description of Wholesale Sectors: Two- and Three-digit Levels

| 2-digit | 3-digit | Description |
|---|---|---|
| 50 | | Textile and apparel |
| | 501 | Textile products (except apparel, apparel accessories and notions) |
| | 502 | Apparel, apparel accessories and notions |
| 51 | | Food and beverages |
| | 511 | Agricultural, animal and poultry farm and aquatic products |
| | 512 | Food and beverages |
| 52 | | Building materials, minerals and metals, etc. |
| | 521 | Building materials |
| | 522 | Chemicals and related products |
| | 523 | Minerals and metals |
| | 524 | Recovered material |
| 53 | | Machinery and equipment |
| | 531 | General machinery and equipment |
| | 532 | Motor vehicles |
| | 533 | Electrical machinery, equipment and supllies |
| | 539 | Miscellaneous machinery and equipment |
| 54 | | Miscellaneous wholesale trade |
| | 541 | Furniture, fixtures and house furnishings |
| | 542 | Drugs and toiletries |
| | 549 | Other products, n.e.c |

*Source*: Census of Commerce

# Appendix B. Derivative of a Margin Ratio with respect to Tariffs

In this appendix, we provide the derivation and proof. The margin ratio is defined as the ratio of sales minus procurements to sales. If the quantity is the same between selling and procuring, the margin ratio indicates a ratio between a sales price and a procurement price. Following Raff and Schmitt (2012), we can derive the sales prices as

$$p = \begin{cases} w + \frac{1}{2}(c_D + c) \ , & \text{for Domestic Wholesalers} \\ \frac{1}{2}(c_D + w + c + t), & \text{for Importers} \end{cases}.$$

Markup is defined as marginal costs subtracted from sales prices of wholesalers. Combining the above expression for sale prices with marginal costs in the main text, markups are derived as $(c_D - c)/2$ and $(c_D + w - c - t)/2$ for domestic wholesalers and for importing wholesalers, respectively.

Since the procurement prices are $w$ and $t$, for domestic wholesalers and importers, respectively, the margin ratio is

$$Margin = \begin{cases} 1 - \frac{2w}{c_D + 2w + c} \ , & \text{for Domestic Wholesalers} \\ 1 - \frac{2t}{c_D + w + c + t}, & \text{for Importers} \end{cases}.$$

From this equation, we calculate the derivatives of the margin ratio of domestic wholesalers as follows:

$$\frac{\partial Margin}{\partial c} = \frac{2w}{(c_D + 2w + c)^2} > 0$$
$$\frac{\partial Margin}{\partial t} = \frac{2w}{(c_D + 2w + c)^2}\frac{dc_D}{dt} > 0.$$

On the other hand, the derivatives of the margin ratio of importers with respect to a unit labor requirement, $c$, is

$$\frac{\partial Margin}{\partial c} = \frac{2t}{(c_D + w + c + t)^2} > 0.$$

Last, we show that $\partial Margin/\partial t < 0$. First, the derivative is derived as

$$\frac{\partial Margin}{\partial t} = -\frac{2}{(c_D + w + c + t)^2}\left[(c_D + w - c - t) + 2c + \left(1 - \frac{dc_D}{dt}\right)t\right].$$

The sign of $\partial Margin/\partial t$ is determined by the sign of $(c_D + w - c - t) + 2c + (1 - dc_D/dt)t$. As derived in Raff and Schmitt (2012), $c_D + w - c - t > 0$ since the quantity sold by an importing wholesaler is expressed as proportional to $c_D + w - c - t$ and must be positive for importers. Combined with $dc_D/dt < 1$, all terms are positive. Therefore, $(c_D + w - c - t) + 2c + (1 - dc_D/dt)t > 0$.