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The Effect of Tariffs on Imports: A Sector-Wise Analysis of Indonesia in 2001-2012

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Abstract

This paper examines the validity of the commonly accepted paradigm that tariffs discourage imports in Indonesia. Specifically, this paper investigates the effect of tariffs on imports by industry using six-digit sectoral trade data for the 2001-2012 period. We also measure the welfare cost of a marginal change in tariff rates in each industry using Harberger's approach. The results show that tariffs negatively affect only certain industries, such as chemical, stone/glass, and metals, but not other industries. The findings demonstrate that in these three industries, the welfare gain from a 1% decrease in the 2012 tariff rate amounts to approximately 3% of tariff revenue.

Keywords: Tariff, Indonesian import, Harberger's approach

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1 Introduction

The primary objective of this paper is to empirically test the validity of the commonly accepted paradigm that tariffs discourage import quantity in Indonesia. In 2011, the Ministry of Industry of Indonesia stated that tariff reduction increased Indonesian imports in the 2007-2010 period. However, to date, no existing research empirically examines this paradigm at the sector level for Indonesian imports. In this paper, we use panel data consisting of 3,392 six-digit sectors for the 2001-2012 period. By categorizing these six-digit sectors into 15 groups of sectors or industries, we estimate the effect of tariffs on imports for each industry separately. We then compute the welfare gain of a marginal decrease in tariff rates for each industry based on Harberger's approach.

The results show that tariffs discourage the importing of chemical products, stone/glass, and metals but do not have this effect on the other 12 industries. The results based on Harberger's approach reveal that the welfare gain from decreasing tariff rates by 1% is equal to 2.79% to 3.23% of tariff revenue in each of these three industries, with the highest gain in the metals industry at $9.9 million.

We also conduct a structural estimation of import demand functions for the 15 industries. The results revealed that, unlike their quantity, the import demand for foodstuffs and machinery/electrical is negatively influenced by the tariff; and that the price elasticity of import demand as well as its cross-price elasticity against the domestic price are insignificant for 10 out of 15 industries.

Some studies have discussed the effect of tariffs on imports in different parts of the world. Bertola and Faini (1991) estimated the behavior of imports in response to the elimination of tariff and non-tariff barriers to trade in Morocco. Thomakos (2002) empirically analyzed the effects of trade liberalization on import demand in Turkey by estimating the disaggregated import demand elasticities. Paulino (2004) employed country-level panel data to estimate the effect of trade liberalization on import growth in 22 developing countries, including Indonesia. Three of them researchers used import tariffs as an indicator of trade liberalization to investigate their impacts on import at the country level. Felbermayr, Jung, and Larch (2013) examined the effect of tariffs on welfare in the context of Melitz model, however, to the best of our knowledge, this paper is the first to investigate the effects of tariffs on sector-level imports as well as welfare in Indonesia.

The remainder of this paper is organized as follows. In Section 2, we discuss the methodology and data and in Section 3 we provide the estimation results of tariffs' impacts on import quantity. Section 4 conducts a structural estimation of the import demand functions. Finally, Section 5 concludes the paper.

2 Methodology and Data

We first estimate the effect of tariffs on imports by estimating the following equation for each of 15 industries:

$$q_{ijn} = \beta_{i0} + \beta_{i1}\tau_{ijn} + \beta_{in}y_n + \beta_{ij}D_j + \varepsilon_{ijn},$$

where subscript i represents industry i, $j \in J_i$ corresponds to the j^{th} six-digit sector, J_i is the set of six-digit sectors categorized in industry i, and n represents year n. The variables are defined as follows: q is the (natural) log of import quantity in tons; $\tau \equiv \ln(1+t)$, where t is the tariff rate; and y and D are year and sector dummies respectively.[1] Note that the year dummies capture the industry-specific endogeneities that influence both the import quantity and tariff rates simultaneously, such that our primary interest, β_{i1}, is consistent.

Welfare analysis via Harberger's approach We then measure the marginal social welfare cost of a change in the tariff rate via Harberger's approach.[2] This approach measures the social welfare cost resulting from a marginal increase in the tariff amount as follows:

$$\frac{\partial W}{\partial T_{ij}} = T_{ij}\left(\frac{dQ_{ij}}{dT_{ij}}\right),$$

where W is social welfare, T is amount of the tariff and Q is the import quantity.[3] Rearranging the above equation, we find that the marginal welfare cost of an incremental 1% increase in the tariff rates for all sectors in the i^{th} industry, denoted by $\triangle W_i$, becomes

$$\begin{aligned}\triangle W_i &= \sum_{j\in J_i}\frac{\partial W}{\partial t_{ij}} \\ &= \sum_{j\in J_i}\beta_{i1}\left(\frac{t_{ij}}{1+t_{ij}}\right)P_{ij}^{w}Q_{ij},\end{aligned}$$

where P^w is the world price.

Data This study employs annual data on Indonesian imports for 3,392 six-digit sectors from the 2001-2012 period.[4] We categorize these sectors into 15 groups of sectors (i.e., industries that are classified based on HS Nomenclature 2012 Edition by the World Customs Organization (WCO)).[5] As noted above, we use observations for six-digit HS sectors from each group to perform the above estimation. Table 1 presents the categorization of sectors into industries.

[1] The expression for the year dummy term is simplified by noting that $\sum_{\tilde{n}}\beta_{i\tilde{n}}y_{\tilde{n}} = \beta_{in}y_n$ as $y_{\tilde{n}} = 0$ for $\tilde{n} \neq n$.

[2] Harberger's approach was developed by Harberger (1964) to measure the effect of a marginal policy change on social welfare. Feldstein (1999) and Chetty (2009) applied this approach to measure the welfare cost resulting from a change in income tax.

[3] Subscript n is suppressed for notational ease hereafter.

[4] We measure all nominal variables in constant US dollars.

[5] In this study, we aim to identify the effect of tariffs on sectors with import data from 2001-2012 only. Each group or industry consists of several two-digit HS sectors. Due to data availability, there are several two-digit HS sectors that cannot be covered by this study. For example, the metals industry consists of two-digit HS sectors from 72-83. However, because there no import data exist for sectors under the two-digit HS of 77, we exclude this sector from the metals industry.

Table 1.
Two-digit sector classification

Industry	*HS Codes*	*Number of 6-Digit Sectors*	*Number of observations*
Animal	01-05	59	708
Vegetable	06-15	174	2,079
Foodstuffs	16-24	120	1,436
Mineral	25-27	83	996
Chemical and allied industries	28-38	575	6,900
Plastics/Rubbers	39-40	170	2,040
Raw hides, skins, leather, and furs	41-43	20	240
Wood and wood products	44-49	135	1,612
Textiles	50-63	398	4,776
Footwear/Headgear	64-67	35	420
Stone/Glass	68-71	119	1,428
Metals	72-83	471	5,646
Machinery/Electrical	84-85	665	7,977
Transportation	86-89	97	1,146
Miscellaneous	90-97	271	3,252

3 Estimation Results of Tariff's Impacts on Import Quantity

The results in Table 2 show the effect of tariffs on import quantity. The results reveal that tariffs discourage the importing of chemical, stone/glass, and metals but do not affect the other 12 industries.[6] Note that the percentage change in import quantity depends on the tariff rates in the following manner:

$$\frac{dq_{ij}}{dt_{ij}} = \frac{\beta_{i1}}{1 + t_{ij}}.$$

Among the chemical-related sectors, the highest tariff rate in 2012 was 10% and the lowest rate was zero, with β_{i1} at -3.386. These results imply that the importing of chemicals in 2012 would have declined by 3.08% to 3.39% as a result of a 1% increase in tariff rates depending on the sector. For the stone/glass industry, this rate of decline was between 2.45% and 3.08%, and for metals, the decline was between 2.95% and 3.40%, with the highest tariff rates at 30% and 15%, respectively, and the lowest at zero for both.

[6] Coefficients for foodstuffs and machinery/electrical are significantly positive, and we do not discuss these industries further. In fact, our back-of-the-envelope analysis via 2SLS reveals that the effects of tariffs on the demand in these industries is negative and statistically significant. See the appendix for details.

Table 2.
The effects of tariff on import quantity

Industry	*Coefficient*	*Robust S.E.*
Animal	2.0314	5.2765
Vegetable	0.1931	0.1778
Foodstuffs	0.6200 **	0.3114
Mineral	-93.1316	71.0667
Chemical and allied industries	-3.3861 ***	1.2905
Plastics/Rubbers	-0.6917	1.5139
Raw hides, skins, leather, and furs	-43.1392	38.3197
Wood and wood products	-5.4538	5.3141
Textiles	-0.0954	3.3456
Footwear/Headgear	-0.2318	2.8191
Stone/Glass	-3.1859 *	1.6893
Metals	-3.3974 **	1.4126
Machinery/Electrical	2.4937 **	1.1703
Transportation	-2.2348	2.1853
Miscellaneous	1.4479	2.8831

Note: ***: significant at 1%, **: significant at 5%; *: significant at 10%

The Effects of Tariffs on Social Welfare We now use Harberger's approach to measure the effect of an incremental change in tariff rates on social welfare. The results in Table 3 show that the metals industry experiences the highest marginal gain in social welfare at $9.9 million as a result of a 1% reduction in tariff rates. For all three industries, the marginal welfare gain is between 2.79% and 3.23% of their respective tariff revenue. We estimate that a 1% reduction in tariff rates, in turn, decreases the tariff revenue by $16,505, $6,536, and $67,886 for the chemical, stone/glass, and metals industries, respectively.

Table 3.
Welfare gain of 1% decrease in tariff rates in 2012

Industry	ΔWi *(thousand US$)*	*% to import value*	*% to tariff revenue*
Chemical and allied industries	2,291	0.117%	3.23%
Stone/Glass	2,336	0.241%	2.79%
Metals	9,896	0.121%	3.11%

4 Structural Estimation of Import Demand Functions

Here in this section we conduct a structural estimation of the import demand function described in the following simultaneous equation system. Let us specify the import supply as

$$q^s_{ijn} = \alpha_{i0} + \alpha_{i1} p^w_{ijn} + \alpha_{i2} c_{ijn} + \alpha_{in} y_n + \alpha_{ij} D_j + \upsilon_{ijn}, \tag{1}$$

and the import demand as

$$q^d_{ijn} = \gamma_{i0} + \gamma_{i1} p^w_{ijn} + \gamma_{i2} \tau_{ijn} + \gamma_{in} y_n + \gamma_{ij} D_j + \epsilon_{ijn}, \tag{2}$$

where superscripts d and s indicate import demand and supply respectively, and c in the supply equation (1) is a (natural) log of China's export to the world excluding Indonesia, while the definition of subscripts and other variables are the same as above. This variable c is used as an instrument of the world price when estimating the demand equation (2) by using 2SLS to examine the effect of tariff on import demand.[7]

Table 4.
The effects of tariff on import demand

Industry	*Coefficient*	*Robust S.E*
Animal	5.0896	12.7655
Vegetable	25.2945	82.6819
Foodstuffs	-3.9372 *	2.1496
Mineral	-5.8387	57.1550
Chemical and allied industries	-0.0735	10.1747
Plastics/Rubbers	-99.4074	1016.98
Raw hides, skins, leather, and furs	64.6941	63.0225
Wood and wood products	-27.1871	22.8807
Textiles	7.0412	6.3153
Footwear/Headgear	6.6735 ***	2.2201
Stone/Glass	-6.1793 ***	1.5968
Metals	-7.8417 ***	2.0552
Machinery/Electrical	-5.8788 ***	2.2407
Transportation	-2.1159	1.3716
Miscellaneous	18.3921	35.7976

Note: ***: significant at 1%, **: significant at 5%; *: significant at 10%

Table 4 presents the 2SLS estimates of γ_{i2} as discussed above. Unlike the import quantity, import demand of foodstuffs and machinery/electrical now became significantly negative. These indicate that the demand can be discouraged in these industries, however, raising the tariff does not suppress their import quantity.

With the fact that in equation (2) we have $\gamma_{i1} p^w_{ijn} + \gamma_{i2} \tau_{ijn} = \gamma_{i2} p_{ijn} + (\gamma_{i1} - \gamma_{i2}) p^w_{ijn}$ where $p_{ijn} = \tau_{ijn} p^w_{ijn}$ is the (natural log of) domestic price, γ_{i2} gives the cross-price elasticity of import demand against the price of domestic goods, and $(\gamma_{i1} - \gamma_{i2})$ gives the price elasticity of import demand itself. F-test results say that the null of $\gamma_{i1} = \gamma_{i2}$ is rejected for footwear/headgear,

[7] We excluded c from the estimation of import quantity as in equation (**??**) because it is unlikely for China's export excluding Indonesia to influence the tariff rates in Indonesia.

stone/glass, and metals with 1% significance, and as for machinery and transportation the null is rejected at 5% and 10% respectively. However, for other 10 industries the hypothesis that $\gamma_{i1} = \gamma_{i2}$ was not rejected, in other words, import demand is price inelastic in these industries.

5 Concluding Remarks

This study has examined the commonly accepted paradigm that tariffs discourage imports in Indonesia using panel data from 3,392 six-digit sectors from 2001 to 2012. The results show that tariffs discourage the import of only certain industries (namely, the chemical, stone/glass, and metals industries) but not other industries. The study finds that import quantity in these industries would decrease approximately 3% as a result of a 1% increase in tariff rates. However, the results based on Harberger's approach show that the welfare gain from a 1% reduction in tariff rates would be equivalent to approximately 3% of the tariff revenue in these industries.

The results from structural estimation revealed that, unlike their quantity, the import demand for foodstuffs and machinery/electrical is negatively influenced by the tariff; and that the price elasticity as well as cross-price elasticity against the domestic price are insignificant for 10 out of 15 industries. The observed insensitivity of import quantity and demand to tariff and prices is in large part due to the deepening of intra-Asian horizontal division of labor. Especially for those industries with a large amount of processing trade, the import quantity is known to be inelastic to price or exchange rates.[8] The implementation of tariff policy must therefore account for the variation in the effects of tariffs on different sectors and must consider that the welfare gain of reducing tariff rates is non-negligible in certain industries.

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