

Per-unit duties: foes of developing country exporters?¹

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ABSTRACT

Protectionist instruments such as tariffs can distort the prices of traded goods. This paper explores the impact of specific (per-unit) duties on patterns of agricultural trade. Specific duties may encourage countries to export higher priced products, leading to an “Alchian-Allen effect” on unit values. Their restrictive effect on trade values is smaller for developed compared to developing countries. It can be explained by the specialization of these countries on low-priced products and by the low level of quality differentiation among their exports. Our results highlight the discriminating nature of specific duties for low-income countries.

JEL Classification: F13 ; F14 ; F15

Key Words: Specific duties, agricultural trade, developing countries, trade unit values.

1. INTRODUCTION

“Shipping the good apples out” is a metaphor for the well-known Alchian-Allen effect (Alchian and Allen, 1964): countries tend to export higher priced goods to remote destinations. To explain this phenomenon the literature generally refers to per-unit transportation costs (Hummels and Skiba, 2004; Schott, 2004, 2008; Hummels and Klenow, 2005; Martin, 2012). However, additive trade costs are not confined exclusively to transportation: duties can also be applied per-unit (i.e. specific or *ad pesum* duties).

Like transportation costs, specific duties can shape international trade, with some being very restrictive. For example, in 2007, Japan applied a per-unit duty of USD 2,855 per ton on its paddy rice imports. Converted into *ad valorem* (percentage) terms, this corresponds to 905%!² Thus, products protected by such duties generally crystallize tensions among trade negotiators, particularly in the agricultural sector (Federal department of Finance, 2004). Moreover, specific duties are often seen as responsible for discriminating exports from low-income countries (Chowdhury, 2009) whose producers are specialized in low-priced goods and agricultural products, relatively more protected by specific tariffs than industrial goods.

Those considerations provoke two main questions. Firstly, to what extent are exporters affected when their agricultural products face specific duties? Secondly, by altering prices, do these duties disproportionately hamper poor countries’ exports? The aim of this paper is to explore the impact of specific duties on the patterns of agricultural trade.³ To address these questions we estimate the effect of per-unit duties on both trade prices and trade values, paying particular attention to developing country exporters.

² Using product unit value.

³ According to the WTO definition of agricultural products.

To our knowledge, few studies investigate the impact of specific duties on trade patterns, and particularly trade prices. Chowdhury (2008, 2009) are two papers that focus on specific duties. The author studies their impact on welfare for the Sub-Saharan African countries (SSA), using a general equilibrium model. She finds that they “wash away” more than half of the welfare benefits enjoyed by SSA countries as a result of the trade preferences granted by the European Union (EU).

Our paper also draws on two streams of the literature on international trade. The first refers to papers that investigate the consequences of trade policy instruments on trade patterns, including prices. Among them, Ramos et al. (2007) focus on MERCOSUR beef exports, which are subject to tariff rate quotas as well as specific or composite tariffs when entering the European market. The authors propose a partial equilibrium model to investigate the effects of a set of policy instruments on the composition of imports. Numerical simulations show that the structure of EU protection in the beef market leads to a significant positive impact on prices. Another line of investigation analyzes the determinants of trade prices (cf articles mentioned in the first paragraph), to test the Alchian-Allen conjecture of the effect induced by transportation costs on the unit values of exported goods.

Our paper confirms that specific duties encourage countries to export higher priced products. Hence, we can assume that specific duties play a similar role to Alchian-Allen transport costs. We show also that specific duties restrict trade, but with a smaller effect for developed than for developing countries. The contributions of our work are threefold. First, we address an area which, to our knowledge, has been ignored by the literature. Second, we use detailed (HS6 classification) data on trade and tariffs, distinguishing between their per-unit and *ad valorem* components with time variance (3 years). Third, we provide a discussion of the impact of specific duties on developing countries, using detailed indicators of export quality specialization.

The paper is organized as follows. Section 1 provides some descriptive evidence on specific duties. Section 2 quantifies their impact on trade unit values, looking for the Alchian-Allen effect. Section 3 empirically tests the impact of specific duties on the value of trade, distinguishing between developed and developing countries. Section 4 concludes by discussing the consequences of per-unit duties on the patterns of agricultural trade.

2. DESCRIPTIVE EVIDENCE

2.1. The use of per-unit duties

Our work uses MAcMap-HS6 protection data. This database provides information on customs duties at the HS6 level for 189 importing countries, applied to 220 exporting partners, for the years 2001, 2004 and 2007. Duties⁴ can comprise an *ad valorem* component (%) and/or a per-unit component, expressed in current dollars per ton. In our descriptive statistics, we consider compounded tariffs in which both the *ad valorem* and the specific components are positive as per-unit duties.

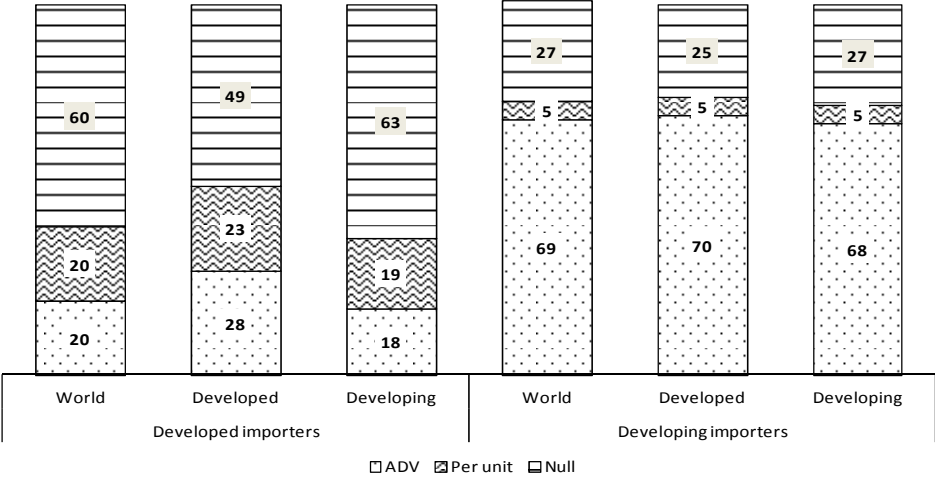
⁴ Tariff rate quotas (TRQ) are indicated by the presence of a filling rate used to compute the marginal rate of protection. In this section, for descriptive purposes, we retain this marginal applied rate. Thus, TRQs can belong to either category of duties.

According to our data, at world level in 2007, 1.3% of products⁵ were subject to specific duties. Agriculture is relatively more protected by this type of tariff (almost 4% of its HS6 lines) than industry (less than 1%, heterogeneously distributed across sectors). Seventy countries⁶ impose specific tariffs when importing agricultural goods⁷ (see the list in Annex 1). Although countries' profiles differ widely, it is remarkable that the rich countries (EU27, USA, Canada...) all use this instrument. The EFTA (European Free Trade Association) region is another particular case with most member countries exclusively protecting their agricultural markets with *ad pesum* rights. Insular countries (26) constitute another bulk of employers of per-unit duties. They include developed economies like Japan, Australia and New Zealand and also small developing economies like Vanuatu, the Seychelles and Mauritius.

The share of specific duties also differs between countries (see Annex 1). Some (Switzerland, Norway) use these instruments exclusively; for others (Australia, Panama), their application is limited.

Figure 1 shows the composition of tariffs in the agricultural sector applied by developed and developing economies.

Figure 1: Share of type of duties (%) in agriculture, by level of development (2007).



⁵ This ratio is computed as the number of lines at world level (HS6 – 6-digit level of Harmonized System classification) subject to specific tariffs in total number of lines (HS6) available, considering all existing bilateral relationships separately (thus this count refers to bilaterally applied protection at product level).

⁶ The EU is considered as a single entity. Considering all sectors, there are 74 countries that use specific tariffs. Ghana, Korea, Lebanon and Uzbekistan apply per unit tariffs exclusively to industry.

⁷ In this paper, we use the WTO definition of agricultural products.

Source: MAcMap-HS6 2007, Authors' calculations. Note: we consider the structure of protection separately for developed and developing importers, and protection applied to all exporters ("World"), to developed exporters ("Developed") and to developing exporters ("Developing").

In developed countries a large part of their agricultural products (60%) are subject to free trade compared to 27% for developing countries which use tariffs as a means of protection or as a means to collect revenue. The proportion of free-traded products in developed countries is less important for similar countries (49% of HS6 lines) than developing countries (63%), with preferential agreements explaining this difference (many developed countries grant preferences to developing economies, e.g. the EU Generalized System of Preferences or Everything But Arms initiative...).

Rich countries use more specific tariffs (20% of lines) than developing countries (5%). The latter countries prefer *ad valorem* (69%). Those duties are probably simpler for these countries to apply: they do not require "complex logistics" (to weight shipments at borders) and price estimations are relatively straightforward (invoices). On the export side, developing and developed countries face equivalent numbers of lines with specific duties. However, the level of protection varies widely. Figure 2 compares levels of *ad valorem* duties and *Ad Valorem* Equivalents (AVE) for specific rights.

This comparison involves two methodological issues: the choice of unit values to convert per-unit duties to percentages, and the weighting scheme to aggregate AVE across countries (Bouët et al., 2008). In the case of unit values, we refer to the MAcMap-HS6 methodology: the exporter's reference-group unit value, computed as the cross-country median of unit values within the group (to limit sensitivity to outliers), is used to convert specific duties to percentages.⁸ In the case of the weighting system, to reduce endogeneity bias,⁹ we follow Guimbard et al. (2012) which is based on (Bouët et al., 2008), and weight *ad valorem* equivalents by imports from the importer's reference group. When aggregation is across importers, these weights are scaled up to account for the importer's weight in the total imports of the reference group. Also, since we are interested in the heterogeneity among tariff instruments, we slightly modify the initial aggregation formula by adding the share of HS6 products of type of duty (*ad valorem*, per-unit, or null) over the total number of products of each importer. This aggregation procedure is summarized in the following weighting scheme for each type of duty d :

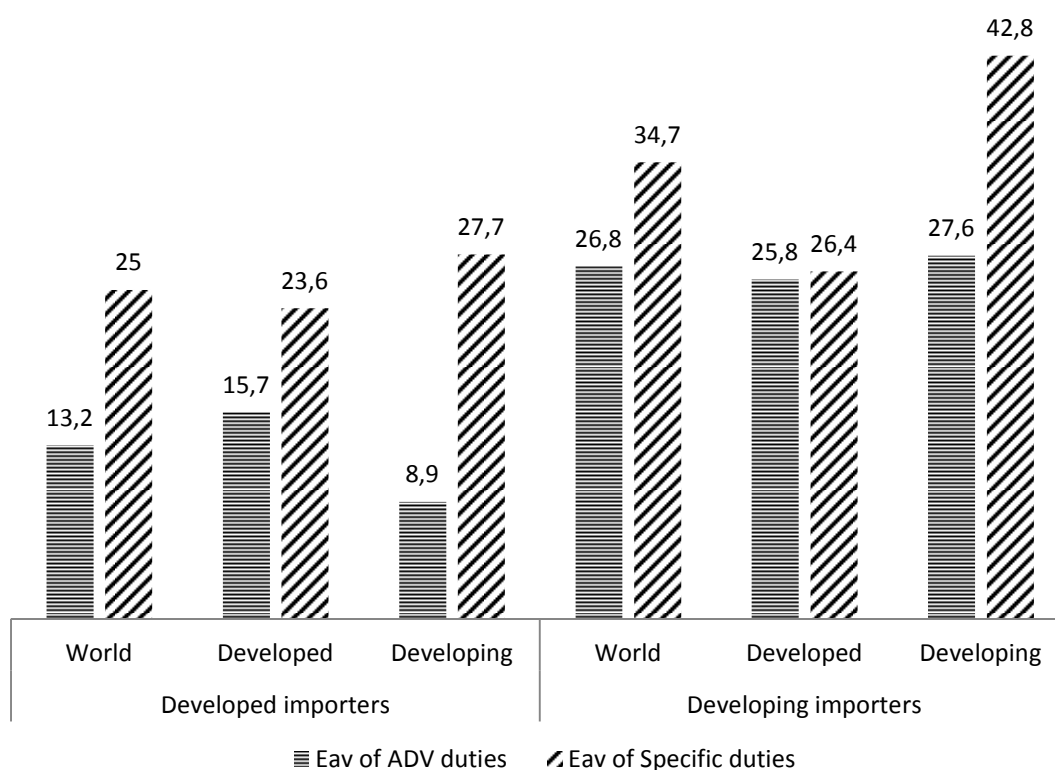
$$W_{d,i,j,k} = M_{i,R(j),k} \frac{M_{.,j,.}}{M_{.,R(j),.} - M_{j,R(j),.}} \frac{L_{d(k),.,j,.}}{L_{.,.,j,.}}$$

where $W_{d,i,j,k}$ is the weight applied in the aggregation process to product k sales from exporter i to importer j . M refers to imports, $R(j)$ to the importer's reference group, and subscript "." refers to the total over the category concerned. L refers to the number of HS6 products by tariff instruments ($d = \{ADV, Specific, Null\}$).

⁸ Formally: $AVE = ad\ valorem + \frac{Specific}{unit\ value}$, where the unit value is the exporter's reference group unit value. See Bouët et al. (2008) for a discussion about the choice of unit values to convert specific duty in percentage.

⁹ Trade is highly endogenous to the level of protection. Thus, a trade weighted average tend to minimize average protection as high tariff generally induce very low (or even zero) trade.

Figure 2: Applied protection (%) in agriculture, by level of development (2007)



Source: MAcMap-HS6 2007, Authors' calculations

Average AVE of per-unit duties faced by exporters (25% in developed markets; 34.7% in developing markets) is systematically higher than the average *ad valorem* for these markets (13.2% and 26.8%, respectively). The difference is more important for developing exporters (+18.8 percentage points for developed markets and +15.2 percentage points for developing markets) than for developed exporters (7.9 and 0.6 percentage points respectively for the same destinations).

For products protected by specific duties, developed exporters face lower levels of protection in other developed markets (23.6%) than in developing markets (26.4%), while developing country exporters face higher protection in other developing country markets (42.8%) than in developed ones (27.7%). More generally, developing country exporters suffer more from the higher protection induced by specific duties, probably due to the unit values of the goods traded (with trade agreements being another potential explanation), which confirms our intuition.

Regarding sectoral issues, Table 1 shows the share of per-unit tariffs in HS2 sectors containing agricultural lines in 2007, and the corresponding average protection as a percentage (computed only on HS6 lines with specific duties).

Table 1. Sectoral characteristics of specific duties in agriculture (2007)

HS2 code	Description	Share of HS6 lines (%)	AVE (%)
22	Beverages Spirits and Vinegar	35.7	18.1
04	Dairy products (including eggs and Honey)	25.3	38.4
17	Sugars and Sugar Confectionery	25.1	48.8
11	Products of the Milling Industry	21.2	24.5
24	Tobacco and Manufactured Tobacco Substitutes	20.9	34.7
10	Cereals	20.6	21.4
02	Meat and Edible Meat	20.1	48.2
16	Preparations of Meat, of Fish or of Crustaceans	19.7	24.7
19	Preparations of Cereals	18.4	20.8
01	Live Animals	14.8	33.8
20	Preparations of Vegetables	14.2	18.4
29	Organic Chemicals	12	22.3
35	Albuminoidal Substances. Modified Starches. Glues	11.4	9.7
21	Miscellaneous Edible Preparations	9.5	14.7
15	Animal or Vegetable Fats and Oils	9.2	16
07	Edible Vegetables	9	19.9
23	Residues and Waste from the Food Industries	9	19.2
08	Edible Fruit and Nuts	6.4	6.4
18	Cocoa and Cocoa Preparations	6.4	17.8
38	Miscellaneous Chemical Products	4.8	6.8
12	Oil Seeds and Oleaginous Fruits	4.7	9.4
06	Live Trees and othr Plants. Bulbs Roots.	2.3	13.3
52	Cotton	2.3	8.8
09	Coffee Tea Maté and Spices	2	4.3
14	Vegetable Plaiting Materials. Vegetable Products	2	1.2
51	Wool Fine or Coarse Animal Hair	1.4	1.2
33	Essential Oils and Resinoids. Perfumery Cosmetics	1.1	2.7
05	Products of Animal Origin (Not Elsewhere Specified)	1	9.3
13	Lac. Gums Resins and other Vegetable Saps	0.4	2.9
50	Silk	0.4	198.1
53	Other Vegetable Textile Fibres. Paper Yarn and Wove	0.1	0.1

Source: MAcMap-HS6 2007, Authors' calculations.

Specific duties occur in every agricultural sector but their shares vary widely. However, at the HS2 level, they are less frequent: only seven HS2 sectors have more than 20% of products protected by specific duties. The sector with the highest share of specific duties is beverages (35.7%), followed by dairy products (25.3%), sugar (25.1%), milling (21.2%), and tobacco and manufactured tobacco substitutes (20.9%). Tobacco and beverages are particular products that are generally subject to high taxes, both internally and at borders (health issues, low demand elasticities...).

In the case of average AVE (only on products subject to specific duties in each HS2 sector), silk is the most protected sector (almost 200% protection on average) but only for Japan as an importer. The sugar sector is distinguished by an AVE close to 49%, followed by meat (48.2%). Dairy products,

tobacco, and live animals are also heavily protected by specific duties, with average AVE greater than 30%.

Thus, on products subject to specific duties, developing country exporters face higher AVE applied protection compared to developed country exporters. Also, the impact of specific duties on trade can depend on the quality specialization of exporters, which differs with countries' levels of development (see next section).

2.2. Quality specialization in developing countries

Table 2 provides some descriptive statistics for quality specialization in developing countries. For each country and product, we compute the relative price index RP_{ikt} equal to the mean export unit value uv_{ikt} by exporter i , product k and year t , relative to the world mean export unit value uv_{kt} by product k and year t . A value greater than unity means that the country i exports the product k at a higher price than the world average price, i.e. it exports high quality products.¹⁰ An index lower than unity corresponds to specialization in low quality segments for the product k by country i . Table 2 reports the mean and median relative price index unit value for all products and all exporters, for each group of exporting countries, classified by decile of GDP per capita.

Table 2. Export trade prices according to GDP per capita

Decile of GDP per capita of exporting countries	$RP_{ikt} = \frac{uv_{ikt}}{uv_{kt}}$ relative price index		Price variation coefficient by product and year	
	Mean	Median	Mean	Median
1	0.76	0.58	54.2	47.7
2	0.79	0.62	64.9	57.6
3	0.84	0.67	62.9	54.9
4	0.82	0.69	69	59.6
5	0.95	0.79	68.6	59.8
6	1.04	0.92	83.1	71.4
7	1.11	0.93	83.8	73.6
8	1.27	1.10	95.3	84.2
9	1.13	1.02	100.8	89.2
10	1.23	1.07	96.5	84.7

Authors' calculation from the Trade Unit Value database, 2001, 2004, 2007

¹⁰ For a discussion of this index and its relation with product quality, see Berthou and Emlinger (2011).

These indicators confirm that developing countries, on average, tend to export at a lower price than the world price. They show also that the top exporters, ranked by income, specialize in high quality for each export product. Table 2 column 2 presents the average coefficient of variation of export unit values computed by exporter i , product k and year t . We observe that, on average, high income countries have higher coefficients of variation of the export price than developing countries. The latter therefore have lower quality ranges for each product, compared to developed countries.

This descriptive evidence suggests that per-unit tariffs have different impacts on exports depending on the exporting country's level of development. Firstly, per-unit duties are relatively important in agriculture, the sector in which developing countries tend to specialize. Secondly, given the specialization of developing countries in low priced products, and the relatively narrow price range of their exports, they might be more penalized by such barriers. In section 3 we empirically test this second statement.

3. THE SPECIFIC DUTIES AND THE ALCHIAN-ALLEN EFFECT

3.1. The Alchian-Allen conjecture

The well-known Alchian-Allen conjecture (Alchian and Allen, 1964), also known as the “shipping the good apples out” effect, corresponds to the fact that exporters charge higher prices for remote destination. The high cost of transportation leads firms to export higher priced/higher quality goods to distant partners, keeping lower quality goods for closer export or domestic markets.

This prediction has been tested in a number of studies, some of them theoretically grounding the positive impact of distance on prices. For instance, Hummels and Skiba (2004) extend the original model and prove that the relative strength of per-unit and *ad valorem* costs matters. Baldwin and Harrigan (2011) propose a Melitz-type model in which the heterogeneity of firms is linked not to productivity but to quality.

Several empirical studies look at the consequences of transportation costs on the unit values of exported goods through a quality upgrading effect. Schott (2004, 2008) and Hummels and Klenow (2005) examine the relationship between unit values and distance at country level. Martin (2012), Bastos and Silva (2010), and Manova and Zhang (2009), using data on French exporting firms, find that firms charge higher free on board (F.O.B.) unit values for exports to more remote countries.

In the literature, the Alchian-Allen effect is always linked to transportation costs, generally proxied by bilateral distance. Hummels and Skiba (2004) and Martin (2012) explore an alternative specification of transport costs by splitting them into an *ad valorem* (iceberg cost) part and an additive (per-unit cost) part. It is the latter that explains the Alchian-Allen effect. Indeed, when translated into percentages the transportation cost lowers with the value of the good, which produces an incentive for firms to export more expensive goods.

3.2. Empirical test of the Alchian-Allen effect of specific duties

Empirical specification

To test the Alchian-Allen effect of the imposition of specific duties by importing countries, we follow Hummels and Skiba (2004) and Martin (2012). We estimate an equation linking bilateral prices to exporter's and importer's incomes, importers' tariffs, and transport costs. Unlike Hummels and Skiba (2004), we do not have data on freight costs. The latter are approximated by the bilateral distance as is usual in the empirical literature. One of the main differences from the papers cited is that we consider separately the specific and the *ad valorem* parts of the tariff, defined at the bilateral and product levels.

$$\ln p_{ijkt} = \alpha \ln \frac{GDP}{cap}_{it} + \beta \ln \frac{GDP}{cap}_{jt} + \gamma \ln dist_{ij} + \mu \ln Tadv_{ijkt} + \delta \ln Tspe_{ijkt} + \sigma comp_{jkt} + \lambda_i + \lambda_j + \lambda_k + \lambda_t + \epsilon_{ijkt} \quad (1)$$

bilateral prices p_{ijkt} of imports of product k by country j from country i at time t are proxied by CIF import unit values, defined at the HS6 level, from CEPII's worldwide Trade Unit Value Database.¹¹ We use exporting and importing countries' GDP per capita from the World Bank World Development Indicators, and bilateral distances from CEPII. *Ad valorem* and specific duties are from the MAcMap-HS6 dataset.¹² The *comp* variable controls for the number of competitors on the market j for product k at time t . Products, exporters, importers and time fixed effects are included.

Equation (1) is estimated for years 2001, 2004, and 2007, for which data on tariffs are available. Since unit value data are noisy, we exclude extreme unit values, i.e. those above 50 times of the world median unit value for the product k and below 1/50 times for the same median.

Estimation of equation (1) is performed first using the ordinary least square (OLS) estimator. Bilateral unit values uv_{ijkt} and specific duties spe_{ijkt} can be determined using a number of common observed and non-observed factors, e.g. country's preference for high quality products. The simultaneous determination of these two variables is a potential source of endogeneity. Estimating equation (1) directly with OLS, therefore, may yield biased results. To handle these simultaneity and endogeneity biases, we use an Instrumental Variables (IV) approach. Three instruments are used for the specific duty. We first consider the mean export unit value of the importer j , by product k . We assume that the implementation of specific duties is aimed usually at protecting domestic production from competition from low-price products. According to this hypothesis, countries producing expensive goods (based on their quality specialization or production costs) tend to implement higher specific duties than other countries. As we do not have price data at production level, we use the export unit value of product k as a proxy for the price of the country's domestic products. As a second instrument we use a dummy variable for whether countries i and j are involved in the same trade agreement aimed at reducing the trade barriers between the partners. To take account of the bilateral dimension of our data, we consider the product of these two variables as a third instrument.

¹¹ See Berthou and Emlinger (2011) for a description of the dataset.

¹² See Guimbard et al. (2012) for a description of the dataset.

Results

Table 3 reports the estimations of equation (1). We find a significant and positive impact of specific duties on import unit values in all the estimations, confirming the Alchian-Allen effect. Exporters tend to export at higher prices if they face specific duties, *ceteris paribus*. The coefficient is higher when accounting for endogeneity with an IV estimator. The Sargan and Cragg-Donald statistic confirms that our IVs are adequate.

Table 3. Estimates of the determinants of bilateral export prices

	(1)	(2)
Distance	0.16*** (0.00)	0.12*** (0.01)
GDP/cap importer	0.20*** (0.02)	0.20*** (0.02)
GDP/cap exporter	0.15*** (0.01)	0.12*** (0.02)
No. of competitors	-0.001*** (0.00)	0 (0.00)
<i>Ad valorem</i> duties	-0.21*** (0.01)	-0.09*** (0.02)
Specific duties	0.01*** (0.00)	0.23*** (0.04)
No. of obs.	773462	773462
R2	0.603	0.56
IV	no	yes
Sargan p-value		0.693
Cragg Donald statistic		134.433

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All the variables are in log. Estimations in all columns include exporter, importer, product and time fixed effects

The other coefficients have the expected signs. We find the classic Alchian-Allen effect linked to transport costs through the positive coefficient of distance. Countries tend to export their most expensive products to distant partners. Table 3 column 1 shows that *ad valorem* duties have a negative impact on trade unit values, which is consistent with a possible reduction in exporters' markups to maintain competitiveness. Both per capita GDPs have significant and positive impacts. As shown in Schott (2004), prices increase with exporter's income and positively vary with importer's income.

In a second specification, we distinguish the impact of specific duties on unit values by exporter's level of income. We expect a higher impact for developed countries since they have more possibilities to upgrade their quality when faced with specific duties, than the poorest countries whose range of product quality is limited. The results of the specification are reported in Table 4. Columns 1 and 2 distinguish the impact of specific duties on developing¹³ and developed country exports. The cross variable is smaller for developing countries, that confirms the smaller (but still positive) impact of specific duties on trade unit values for the latter. This result is supported if we estimate the effect of specific duties on unit value by exporter per capita GDP quartiles: for the first quartile of GDP per capita the coefficient is not significant. Again, using an IV approach enhances the impact of specific duties on unit values. The Alchian-Allen effect of specific duties depends on the level of income of the exporting countries. The impact of imposing specific duties, on developing countries' export values is discussed further in section 4.

Robustness checks

To check the robustness of our estimates, we estimate equation (1) on different subsamples. First, we restrict the sample to the countries that represent 99% (104 countries), and 95% (67 countries) of agricultural trade (Annex 2 Table 2.1, columns 1 and 2 respectively). Second, we exclude products subject to TRQs¹⁴ and mixed tariffs¹⁵ (Annex 2, Table 2.1, columns 4 and 5 respectively). Since we have data only on TRQ and mixed tariffs for 2007, we estimate equation (1) for year 2007 as a benchmark (Annex 2, Table 2.1, column 3). For simplicity, we show only the IV estimations in Annex 2 table 2.1. The positive impact of specific duties on trade unit values is robust to sample modification.

Since equation (1) is estimated using exporter, importer, product, and time fixed effects, we use two alternative specifications following Hummels and Skiba (2004) as additional robustness checks. We first calculate the means of the variables relative to product k and time t and express all variables relative to this mean.

$$\ln uv_{ijkt} - \overline{\ln uv_{kt}} = \alpha(\ln GDP_{it} - \overline{\ln GDP_{kt}}) + \beta(\ln GDP_{jt} - \overline{\ln GDP_{kt}}) + \gamma(\ln dist_{ij} - \overline{\ln dist_{kt}}) + \mu(\ln Tadv_{ijkt} - \overline{\ln Tadv_{kt}}) + \delta(\ln Tspe_{ijkt} - \overline{\ln Tspe_{kt}}) + (\epsilon_{ijkt} - \overline{\epsilon_{kt}}) \quad (2)$$

This specification allows to remove commodity-time-specific variations in price that may be unrelated to the Alchian-Allen effect. In a second specification, we differentiate the variables with respect to their mean by importer j and product k .

¹³ The developing country group includes all those countries not classified as high income by the World Bank. The EU27 is considered to be developed.

¹⁴ TRQ is defined as an imported quantity associated with a low tariff which may be ad valorem or specific (or compounded) and to a high tariff (if the imported quantity exceeds the quota) which may also be ad valorem, specific, or both. We control for effects linked to TRQs by excluding them.

¹⁵ In MAcMap-HS6, for consistency, we retain only the ad valorem part of a mixed duty (e.g 15 USD + 30%, max 200% will become 200%). Thus, the ad valorem might contain a specific component. In this case, exporters and importers might behave differently compared to imposition of a pure ad valorem duty. Excluding those lines allows us to control for this effect.

Table 4. Estimation of bilateral prices according to exporter's level of development

	(1)	(2)	(3)	(4)
Distance	0.16*** (0.00)	0.14*** (0.00)	0.16*** (0.00)	0.15*** (0.00)
GDP/cap importer	0.20*** (0.01)	0.20*** (0.01)	0.20*** (0.01)	0.20*** (0.01)
GDP/cap exporter	0.15*** (0.01)	0.13*** (0.01)	0.15*** (0.01)	0.12*** (0.01)
No. of of competitors	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
<i>Ad valorem</i> duties	-0.20*** (0.01)	-0.14*** (0.02)	-0.20*** (0.01)	-0.18*** (0.02)
Specific duties*D(developed exporter)	0.02*** (0.00)	0.14*** (0.03)		
Specific duties*D(developing exporter)	0.01*** (0.00)	0.09*** (0.02)		
Specific duties*first quartile of exporter GDP/cap			0.01*** (0.00)	-0.01 (0.02)
Specific duties*second quartile of exporter GDP/cap			0.01*** (0.00)	0.06*** (0.02)
Specific duties*third quartile of exporter GDP/cap			0.01*** (0.00)	0.07*** (0.02)
Specific duties*fourth quartile of exporter GDP/cap			0.02*** (0.00)	0.08*** (0.03)
number obs.	773462	773462	773462	773462
R2	0.603	0.592	0.603	0.6
IV	no	yes	no	yes

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All the variables are in log. Estimations in all columns include exporter, importer, product and time fixed effects

$$\ln uv_{ijkt} - \overline{\ln(uv_{jk})} = \alpha(\ln GDP_{it} - \overline{\ln GDP_{jk}}) + \beta(\ln GDP_{jt} - \overline{\ln GDP_{jk}}) + \gamma(\ln dist_{ij} - \overline{\ln dist_{jk}}) + \mu(\ln Tadv_{ijkt} - \overline{\ln Tadv_{jt}}) + \delta(\ln Tspe_{ijkt} - \overline{\ln Tspe_{jk}}) + (\epsilon_{ijkt} - \overline{\epsilon_{jk}}) \quad (3)$$

The results of this alternative specification using mean differentiated variables, are identical to those from equation (1) (see Annex 2, tables 2.2 and 2.3).

4. THE EFFECT OF SPECIFIC DUTIES ON THE VALUE OF TRADE

In section 3, we examined the impact of specific duties on unit values, highlighting the well-known Alchian-Allen effect of these policy instruments on trade prices. However, as a protectionist tool, specific duties can reduce imported quantities. In this section, we investigate whether the positive impact of specific duties on trade prices compensates for their restrictive effect on traded quantities (i.e. positive impact on trade values).

Empirical specification

We estimate a classical gravity equation that explains bilateral trade at product level, by importer's and exporter's incomes, tariffs, and bilateral variables as proxies for transport costs (distance, colony,¹⁶ border,¹⁷ and language¹⁸). Country and product fixed effects are added to account for the multilateral resistance terms (Anderson and van Wincoop, 2004).

$$\ln v_{ijkt} = \alpha \ln GDP_{it} + \beta \ln GDP_{jt} + \gamma \ln dist_{ij} + \delta \ln Tspe_{ijkt} + \mu \ln Tadv_{ijkt} + colony_{ij} + border_{ij} + language_{ij} + \lambda_i + \lambda_j + \lambda_k + \lambda_t + \epsilon_{ijkt} \quad (4)$$

Trade data come from the BACI database¹⁹ and are defined at the HS 6-digits commodity level. Tariffs,²⁰ GDP and distance data are from the same datasets used previously. Bilateral dummies (colony, border, language) come from CEPII's geodist²¹ dataset.

We estimate the effect of the explanatory variables on the extensive and intensive margins of trade. Acknowledging the importance of zero trade flows, we run a probit model to evaluate the effect of our explanatory variables on the extensive margin of trade. Then we estimate equation (4) on the positive values of trade using OLS estimators, to assess the impact of specific tariffs on the intensive margin of trade. We also estimate equation (4), with exporter-time, importer-time and product fixed effects whose inclusion allows better appreciation of the multilateral resistance terms. Equation (4) is finally estimated with bilateral exporter-importer, time and product fixed effects to take into account all bilateral preferences.

¹⁶ A dummy equal to 1 if the trading partners have a common colonial history and zero otherwise.

¹⁷ Dummy equal to 1 if the two countries share a border, and zero otherwise.

¹⁸ Dummy equal to 1 if the two countries have a common official language, and zero otherwise.

¹⁹ See Gaulier and Zignago (2010).

²⁰ For the Tadv variable we use the power of the *ad valorem* part of the tariff, i.e. $\log(1+ad\ valorem)$ in equation (4).

²¹ See Mayer and Zignago (2011).

Results

Table 5 reports the regression results of equation (4). Table 5 column 1 presents the results of the probit estimation, column 2 reports the results of the OLS estimation. The negative impact of specific duties on trade values is clearly confirmed in both estimations. Despite their positive impact on trade unit values, specific duties still act as a trade barrier. They negatively affect both the probability of exporting (extensive margin) and the value of trade (intensive margin). The results are stable whatever our set of fixed effects. This result suggests that a 10% decrease in the value of the specific duty (USD/ton) of a given country for a given product would lead to a 0.7% increase in this country's imports of this product.

Other variables in equation (4) have significant coefficients, with the expected sign. Distance and *ad valorem* duties negatively impact on trade. Sharing a border or a language, and colonial links increase trade values as well as exporter's and importer's GDP.

We next investigate whether the impact of per-unit duties on trade differs with the level of development of the countries. We follow the same strategy as in the previous section and use cross variables with specific duties (see Table 6).²² Specific duties exhibit a higher impact on the trade values of developing countries than developed countries. Moreover, this impact decreases with the exporter's GDP per capita (Table 6 column 2). This result is consistent with the results for unit values. As exporters, developed countries are less constrained than developing countries by the use of specific duties by trade partners.

²² In the rest of the paper, we estimate equation (4) only on positive trade values, using the OLS estimator.

Table 5. Estimations on trade values

	(1)	(2)	(3)	(4)
	Probit	OLS	OLS	OLS
Importer's GDP	0.14*** (0.003)	0.27*** (0.01)		0.27*** (0.01)
Exporter's GDP	0.06*** (0.004)	0.17*** (0.01)		0.18*** (0.01)
Distance	-0.53*** (0.00)	-0.39*** (0.00)	-0.38*** (0.00)	
Common border	0.33*** (0.002)	0.49*** (0.01)	0.50*** (0.01)	
Common Official Language	0.33*** (0.001)	0.11*** (0.01)	0.11*** (0.01)	
Colony	0.37*** (0.002)	0.05*** (0.01)	0.05*** (0.01)	
<i>ad valorem</i> duties	-0.76 (0.006)	-1.13*** (0.02)	-1.15*** (0.02)	-1.00*** (0.02)
Specific duties	-0.05*** (0.00)	-0.07*** (0.00)	-0.07*** (0.00)	-0.05*** (0.00)
Fixed effects	Exporter, Importer, Product, Time	Exporter, Importer, Product, Time	Exporter*Time, Importer*Time, product	Exporter*importer, product, time
N	19667574	1501188	1501188	1501188
r2		0.233	0.235	0.28

Robust Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01, All the variable are in log

Table 6. Estimations on trade values by level of exporter's income

	(1)	(2)	(3)	(4)
Distance	-0.38*** (0.00)	-0.38*** (0.00)	-0.38*** (0.00)	-0.38*** (0.00)
Common border	0.50*** (0.01)	0.50*** (0.01)	0.50*** (0.01)	0.50*** (0.01)
Common Official Language	0.10*** (0.01)	0.11*** (0.01)	0.11*** (0.01)	0.10*** (0.01)
Colony	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
<i>ad valorem</i> duties	-1.15*** (0.02)	-1.15*** (0.02)	-1.15*** (0.02)	-1.15*** (0.02)
Specific duties*D(developed exporter)	-0.06*** (0.00)			
Specific duties*D(developing exporter)	-0.09*** (0.00)			
Specific duties*first quartile of exporter GDP/cap		-0.14*** (0.01)		
Specific duties*second quartile of exporter GDP/cap		-0.10*** (0.00)		
Specific duties*third quartile of exporter GDP/cap		-0.07*** (0.00)		
Specific duties*fourth quartile of exporter GDP/cap		-0.05*** (0.00)		
Specific duties			-0.09*** (0.00)	-0.11*** (0.00)
Specific duties*RPikt			0.02*** (0.00)	
Rpikt			-0.3 (16.35)	
Specific duties*Variation coefficient of price				0.06*** (0.00)
Variation coefficient of price				2.34 (2.54)
Number Obs.	1501188	1501188	1501185	1501188
r2	0.235	0.235	0.235	0.235

Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01, All the variable are in log; exporter*time, importer*time and product fixed effects included

The stronger effect of specific duties on developing countries' export prices may be explained by two factors: first, for each product these countries may have a relatively narrow range of prices, and consequently less flexibility in choosing their exported product according to destination market; second, developing countries usually export low priced products, and consequently are more sensitive to specific duties than developed countries. In order to check whether quality specialization explains the larger impact of specific duties on the exports of developing countries, we estimate the effect of those duties on trade values using the indicators defined in Table 2 (see section 2.2). In Table 6 column 3 we estimate the effect of specific duties according to the relative price index RP_{ikt} of the exporting country. The positive coefficient confirms that a higher relative price index reduces the effect of specific duties on trade. Furthermore, as expected, a higher relative price index induces a higher level of trade for the exporting country. Thus, the quality specialization of the exporter affects the sensitivity of exports to specific duties. Being specialized in a higher quality segment minimizes the effect of specific duties on trade.

In Table 6 column 4, we estimate the effect of specific duties on trade with respect to the coefficient of variation of the export price, computed by product. It appears that a larger range of prices reduces the effect of specific duties on trade. Quality differentiation within the same product category allows exporting countries to avoid the restrictive impact of specific duties on trade. In contrast, countries with a restricted quality range suffer more from the imposition of specific duties by destination countries. They find it difficult to discriminate by exporting high priced products to countries with specific duties and/or high transport costs, and lower quality products to more accessible markets. In other words, they cannot select the "good" or "bad" apples according to the export destination since, generally, they produce only one kind of apple.

5. CONCLUSION

Tariffs generally have two effects on trade patterns. On the one hand, they restrict import demand in relation to quantity. On the other hand, to preserve their trade revenues, exporters may reduce their export prices (Kreinin, 1961). The specific nature of per-unit duties leads to another behavior: as border protection decreases with the price of the goods, exporters tend to price-to-market, and consequently to ship more expensive products. We showed that this rise in price does not compensate for the reduction in trade quantities: specific duties still reduce trade values. Our results also confirm that developing country exporters suffer more than developed ones from specific duties. Indeed, specialization in high quality products allows developed exporters to overcome these barriers more easily. Furthermore, a wider range of quality permits these exporters to choose their destination market according to the type of protection imposed.

Thus, the conversion of specific duties into *ad valorem*, as discussed in the Doha proposal, might enhance trade for developing countries, but its magnitude would depend on the modalities of conversion into percentages (e.g. regarding choice of official unit values). The difficulties involved in concluding the Doha Development Agenda, and therefore the *status quo* on the use of specific duties may force some countries to increase the quality of their products. Although the presence of specific duties may be positive for exporters, it might reduce their trade (and thus their income and investment), locking them into specialization in low quality which is not welfare creating or good for development.

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APPENDIX

Annex 1. Share (%) of HS6 lines, for various types of duties, in agriculture 2007.²³

Importer	ADV	Per-unit	Null	Importer	ADV	Per-unit	Null
Armenia	61	3	36	Mauritius	31	0	68
Australia	18	1	81	Mexico	79	5	16
Azerbaijan	91	6	3	Moldova	77	3	20
Bahamas	83	0	17	Montenegro	66	9	25
Bangladesh	88	1	12	Namibia	47	8	45
Barbados	82	3	15	Nepal	98	2	0
Belarus	96	3	1	New Zealand	24	0	76
Belize	81	4	15	Norway	1	52	47
Bermuda	80	3	17	Pakistan	95	5	0
Bosnia and Herzegovina	41	21	37	Palestinian territory	46	3	51
Botswana	47	8	45	Panama	82	0	18
Brunei Darussalam	0	5	95	Papua New Guinea	48	5	47
Canada	28	5	67	Puerto rico	14	31	55
China	93	0	7	Russian federation	70	5	25
Comoros	100	0	0	Saint Kitts and Nevis	70	2	28
Cook islands	6	4	90	Saint Vincent and the Grenadines	85	1	14
Croatia	55	17	28	Seychelles	12	5	84
Egypt	85	1	14	Singapore	0	0	100
European Union	12	22	66	Solomon islands	96	4	0
Fiji	94	4	3	South Africa	44	7	48
Georgia	46	2	51	Sri Lanka	90	6	4
Haiti	60	0	39	Swaziland	47	8	45
Iceland	18	19	63	Switzerland	0	60	40
India	97	0	3	Taiwan	73	4	23
Indonesia	85	1	13	Tajikistan	73	3	24
Israel	46	3	51	Thailand	91	7	2
Japan	38	15	47	Former Yugoslav Republic	58	8	35
Jordan	71	1	29	Tonga	77	8	15
Kazakstan	96	2	2	Trinidad and Tobago	55	2	42
Kiribati	63	7	30	Turkey	75	0	25
Kyrgyzstan	62	0	38	Turkmenistan	33	3	65
Lesotho	47	8	45	Ukraine	59	24	16
Liechtenstein	0	61	39	USA	14	32	55
Malaysia	29	5	66	Vanuatu	66	9	26
Maldives	99	0	1	Zimbabwe	90	3	7

Source: MAcMap-HS6 2007, Authors' calculations.

²³ The table of Annex 1 includes all the countries that apply specific duties to at least one product. Thus, when their share is equal to 0, it is not absolute zero. It means that the share is inferior to unity, which is very close to zero (e.g., for Panama this share is 0.006%).

Annex 2. Robustness checks estimation on bilateral prices.

2.1 Estimates of the determinants of bilateral export prices on different subsamples

	(1)	(2)	(3)	(4)	(5)
	99% of trade	95% of trade	2007		
			All	TRQ excluded	Mixed tariffs excluded
Distance	0.140*** (0.00)	0.134*** (0.00)	0.134*** (0.01)	0.131*** (0.01)	0.136*** (0.01)
GDP/cap importer	0.182*** (0.00)	0.213*** (0.01)			
GDP/cap exporter	0.135*** (0.01)	0.153*** (0.01)			
Nber of competitors	-0.001*** (0.00)	-0.002*** (0.00)	-0.001*** (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
<i>Ad valorem</i> duties	-0.142*** (0.02)	-0.071*** (0.02)	-0.154*** (0.02)	-0.053 (0.07)	-0.203*** (0.02)
Specific duties	0.172*** (0.03)	0.222*** (0.03)	0.213*** (0.06)	0.273** (0.11)	0.200*** (0.06)
number obs.	676 845	516 758	421 921	407 226	411 617
R2	0.58	0.566	0.562	0.553	0.568
IV	yes	yes	yes	yes	yes

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All the variables are in log. Estimations in all columns include exporter, importer, product and time fixed effects

2.2 Estimation of bilateral prices, using commodity time differenced variables

	-1	-2
GDP/cap importer	0.17*** (0.00)	0.09*** (0.01)
GDP/cap exporter	0.16*** (0.00)	0.18*** (0.00)
Distance	0.15*** (0.00)	0.12*** (0.01)
<i>Ad valorem</i> duties	-0.18*** (0.01)	-0.03 (0.03)
Specific duties	0.01*** (0.00)	0.29*** (0.04)
number obs.	773462	773462
R2	0.181	0.041
IV	no	yes

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All the variables are in log.

2.3 Estimation of bilateral prices, using exporter commodity differenced variables

	(1)	(2)
GDP/cap importer	0.14*** (0.00)	0.13*** (0.00)
GDP/cap exporter	0.25*** (0.01)	0.26*** (0.01)
Distance	0.13*** (0.00)	0.13*** (0.00)
<i>Ad valorem</i> duties	0.05*** (0.01)	0.09*** (0.01)
Specific duties	0.03*** (0.00)	0.08*** (0.02)
number obs.	773462	773462
R2	0.091	0.083
IV	no	yes

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All the variables are in log.