



WTO accession and tariff evasion[☆]

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ARTICLE INFO

Keywords:

Tax evasion
Import tariffs
World Trade Organization
Customs Valuation Agreement

ABSTRACT

This study documents some unintended consequences of the World Trade Organization (WTO) membership by providing evidence on displacement of tariff evasion driven by the WTO accession process. The analysis focuses on the WTO Customs Valuation Agreement (CVA) which limits the discretion of customs officials when it comes to assessing the price of imports. While prior to the WTO accession customs officials are free to use their own judgment or apply minimum or reference prices, after their country joined the WTO they are mandated to accept the invoice price issued by the exporter. If customs officials enjoy discretion with respect to assessing the import price, they may assist importers with tariff evasion in exchange for bribes. Removing such discretion limits their ability to facilitate misrepresentation of import prices. Using data on 15 countries which joined the WTO between 1996 and 2008, we find a positive relationship between underreporting of import prices and the tariff rate, which is expected as the incentive to evade increases with the tariff rate. Importantly, this relationship disappears after a country joins the WTO. This result is consistent with the CVA closing one channel for corrupt behavior. However, we also find that changes to customs valuation procedures induce importers to seek alternative ways of tariff evasion, such as underreporting of quantities and product misclassification. The overall level of evasion remains unchanged.

1. Introduction

The World Trade Organization (WTO) with its 164 member countries is one of the most prominent international bodies.¹ Although it has formally existed for only two decades, there is a fast growing literature aiming to assess the benefits it brings to its members.² This literature (reviewed later in the text) has examined whether the WTO membership boosts international trade, raises incomes of its members, eliminates the terms-of-trade-driven restrictions in trade that arise when policies are set unilaterally, or can be used by governments as a commitment device vis-à-vis domestic lobbies.

This paper contributes to the literature by documenting an unin-

tended consequence of the WTO membership—displacement of tariff evasion to alternative channels. It argues that an institutional reform required as a condition of the WTO accession shuts down one channel through which import duties can be evaded. And indeed the evidence suggests virtual elimination of tax evasion through the affected channel. At the same time, the data also indicate greater evasion through alternative channels. The overall level of the evasion appears to be unchanged by the accession process.

The analysis focuses on the WTO Customs Valuation Agreement (Agreement on Implementation of Article VII of the GATT) which countries joining the WTO are expected to implement. Article VII sets the international rules on the methodology that countries must use to value imported goods in order to collect duty.³ Customs value should

[☆] The authors wish to thank Paul Baker, Richard Baldwin, Maarten Basker, Andrew Bernard, Tibor Besedes, Roberto Bonfatti, Thomas Cantens, Matt Cole, Anca Cristea, Luc De Wulf, Rui Esteves, Marion Jensen, Carol Newman, Nathan Nunn, Marcelo Olarreaga, Sebastian Sieglösch, Kjetil Storesletten, Pierre-Louis Vezina, four anonymous reviewers and seminar participants at the London School of Economics, Nottingham, Oxford, Oslo, Sussex, Tilburg, Warwick, WTO, Bilkent, the Empirical Investigations in International Trade conference in Santa Cruz, the CEPR conference on the Causal Analysis of International Trade in Villars, Empirical Investigations in International Trade and Investment conference in Bangkok, the Royal Economic Society Annual Conference 2014, the Irish Economic Association Annual Conference 2015 for their helpful comments and suggestions. We are grateful to Natasha Agarwal, Courtney Cullen, Benjamin Elsner and Julia Anna Matz for research assistance. Gaia Narciso acknowledges funding from the Arts and Social Sciences Benefactions Fund, while Beata Javorcik wishes to thank the University of Oslo for support.

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¹ For comparison, the United Nations has 193 member states.

² The WTO was preceded by the General Agreement on Tariffs and Trade (GATT), which was not a formal organization and which regulated international trade between 1948 and 1994.

³ Since a vast majority of import duties are *ad valorem* (i.e., expressed as a percentage of the value of imported merchandise) how this value is assessed matters a lot.

be based on “actual value”, which is the price of the imported merchandise, or like merchandise, in sales in the ordinary course of trade under fully competitive conditions. Customs value should not be based on value of merchandise of national origin, or arbitrary or fictitious values. Put differently, Article VII prohibits discretion in calculating a dutiable value or calculating a dutiable value on the basis of some external standard, such as a minimum price or a reference price, a practice that used to be widespread in developing countries. Instead the customs officials are obliged to accept the price stated on the invoice issued by the exporter.

By essentially mandating the use of invoices issued by the exporter as the basis for import valuation, Article VII limits the discretion of customs officials. If customs officials are free to use their own judgement when assessing the import price, they may assist importers with tariff evasion in exchange for bribes. Removing such discretion limits their ability to facilitate misrepresentation of import prices. The intended purpose of Article VII is to prevent member countries from eroding tariff concessions granted to other WTO members by overvaluing import flows.⁴

Our study focuses on misrepresentation of the import price and its sensitivity to the tariff rate before and after the WTO accession.⁵ To capture the misrepresentation of the import price, we follow [Javorcik and Narciso \(2008\)](#) and calculate the difference between the unit value of exports reported by the exporting country and the unit value of imports recorded by the importer (hereafter referred to as the unit value gap). Unit values are measured at the 6-digit level of the Harmonized System (HS) classification. We focus on differentiated products, as it is more difficult for honest customs officials to accurately assess the true price of differentiated products due to their intrinsic features and different qualities, which may give corrupt customs officials a plausible explanation for misrepresenting the true price.⁶ We focus on three major exporting countries, all of which are developed and relatively uncorrupt economies: Germany, US and France.⁷ We consider 15 importing countries which joined the WTO between 1996 and 2008. We use trade figures from the UN COMTRADE database and tariff data from the World Bank's WITS database.

Our empirical analysis proceeds in several steps. First, we show that there exists a positive and statistically significant relationship between the unit value gap and the tariff rate. When estimating this relationship we control for country pair, 6-digit HS product and year fixed effects (or alternatively for country-pair-2-digit-HS-code and year fixed effects). Our results are consistent with the underreporting of import prices being greater when the tariff rate is higher. This finding is intuitive as importers wanting to evade paying import duties will have a greater incentive to underreport the price of the imported product if the tariff rate is higher.

Then, we examine whether the relationship between the unit value gap and the tariff rate changes after the WTO accession. This appears to be the case. Our results suggest that the positive link between misrepresentation of the import price and the tariff level disappears

after the importing country joins the WTO. In our preferred specification, a ten-percentage-point increase in the tariff rate is associated with a 6.5% larger unit value gap prior to the WTO membership. In the post accession period, there is no statistically significant relationship between the tariff rate and the unit value gap. Thus our findings are consistent with the WTO Customs Valuation Agreement limiting the discretion of customs officials in terms of assessing the price of imported goods, which makes it much more difficult for corrupt officials to cooperate with dishonest importers to evade duty payments.

In a series of robustness checks, we show that our results hold when we restrict our sample to products whose tariff did not change around the accession time, products traded both before and after accession, or just large trade flows. We also show that our results are robust to controlling for unobservable importer-exporter-year or importer-exporter-product or exporter-product-year heterogeneity as well as to including non-WTO members in the control group. By conducting an event study analysis, we gain confidence that our results are not driven by confounding trends. We also argue that tariff evasion through underpricing is likely to take place only in differentiated products as it would be very easy to detect in homogenous products. We find no robust link between the unit value gap and the tariff rate in non-differentiated products either before or after the WTO accession.

Our smoking gun is the case of Ecuador which asked for a 5-year transition period to implement the Customs Valuation Agreement. We find that the positive relationship between underreporting of prices and the tariff rate is unaffected by the WTO membership during the transition period, but it disappears once the transition period is over.

So far our analysis suggests that the institutional change resulted in shutting down one of the tariff evasion channels. Next we examine whether changes to customs valuation procedures induce importers to seek alternative ways of tariff evasion. We do so by focusing on underreporting of quantities or smuggling. We find a positive and statistically significant relationship between underreporting of quantities and the tariff rate in the post-accession period. The magnitude of the estimated effect is quite large as it suggests that a 10 percentage point increase in the tariff rate is associated with an almost 11% increase in the quantity gap.

We also explore tariff evasion through misclassification of imports. We do so by controlling for tariffs on similar products. More specifically, we follow [Fisman and Wei \(2004\)](#) and include in our regression the average weighted tariff in the same 4-digit HS product category. We find a negative and statistically significant coefficient on the new variable, which suggest that lower tariffs on similar products are associated with a higher quantity gap. This is in line with the argument that lower tariffs on similar products make misclassification of products more attractive. There is also some indication that the relationship between the tariff on similar products and the quantity gap becomes stronger after the WTO accession. Again, this is suggestive of the importers switching to an alternative channel of tariff evasion.

What is the overall effect? To examine this question, the third part of our analysis focuses on the trade value gap, or discrepancy in total value of trade as reported by the exporting country and the importing country. We find no evidence of an impact of WTO accession on the trade value gap, indicating that the decrease in undervaluing is offset by the increase in underreporting quantities and product misclassification.

Our study documents two opposing effects of WTO accession. We argue that on the one hand taking away discretion of customs officials with respect to assessing prices of imported goods has resulted in lesser underreporting of prices (or more precisely, a lower semi-elasticity of the unit value gap with respect to the tariff rate). On the other hand, we find evidence consistent with greater evasion of import duties through underreporting quantities (or outright smuggling) and product misclassification following entry into the WTO. Our results suggest that the institutional reform mandated by WTO accession resulted in shutting

⁴ See [Section 2](#) for more details.

⁵ We build on the literature originating with the work of [Fisman and Wei \(2004\)](#) who show that the missing trade, defined as the discrepancy in the product-specific trade flow reported by the exporting country and the figures reported by the importer, is positively correlated with the tariff rate. While the finding of [Fisman and Wei](#) is based on trade flows between Hong Kong and China, subsequent studies have documented similar patterns in eight transition economies ([Javorcik and Narciso, 2008](#)), India ([Mishra et al., 2008](#)), Chinese imports from multiple exporters ([Rotunno and Vézina, 2012](#)) and Cameroon ([Raballand et al., 2013](#)).

⁶ [Javorcik and Narciso \(2008\)](#) find no evidence of underreporting of import prices being responsive to the tariff rate in general. However, they do find evidence suggesting that price misrepresentation is positively correlated with the tariff rate in the case of differentiated products.

⁷ These three countries were chosen as they are major global exporters, and they are in the top quantile of the least corrupt countries in the world according to the Transparency International Corruption Perception Index.

down one channel of tariff evasion, but at the same time has led to greater evasion through alternative channels. Thus our evidence is consistent with strong displacement of an illicit activity.^{8,9}

Our study is related to the literature assessing the implications of WTO membership. The potential gain in the form of increased trade has received the most attention from researchers. In a widely cited study, Rose (2004) failed to find a statistically significant relationship between the GATT/WTO membership status of a pair of countries and their bilateral trade. This finding was partially reversed by Tomz et al. (2007) who updated Rose's data to include both *de jure* and *de facto* WTO membership and then found a positive effect of the WTO on trade flows. Subramanian and Wei (2007) allowed for a differential effect on different country groupings and showed that a positive WTO trade effects exists for industrialized but not for developing nations. Eicher and Henn (2011) showed that after controlling for three sources of omitted variable bias, namely multilateral resistance, unobserved bilateral heterogeneity and trade effects of preferential trade agreements, there was no evidence of a positive WTO trade effect. This contrasts with the most recent results of Chang and Lee (2011) who used nonparametric methods and showed large GATT/WTO trade-promoting effects.

The literature also suggests that the WTO eliminates the terms-of-trade-driven restrictions in trade that arise when policies are set unilaterally (Broda et al. 2008, Bagwell and Staiger, 2011) or can be used by governments as a commitment device vis-à-vis domestic lobbies (Maggi and Rodriguez-Clare, 1998, 2007). There is also evidence consistent with WTO accession raising income, but only for those countries that were subject to rigorous accession procedures (Tang and Wei, 2009).¹⁰

Our work is also related to the tax literature. Tax evasion is by its very nature difficult to measure and reaction of tax evasion to policy changes even more so. Our analysis explores the impact of a policy shock on tax evasion. The results suggest that regulatory changes, which could potentially limit tax evasion, change the type of evasion but not its extent. They support the view of Slemrod and Kopczuk (2002) that the behavioral response to a tax rate change depends on the environment in which individuals operate and may be manipulated with instruments controlled by the government. Our study also add to the literature by pointing out the limited choice of possible tax collection mechanisms in developing countries where business environment tends to be less transparent (Gordon and Li, 2009).

Finally, our study contributes to the literature studying displacement of illegal activities (Chaiken et al. 1974; McPheters et al., 1984; Ayres and Levitt, 1998; Levitt, 1998; Di Tella and Schargrodsky, 2004).¹¹ This body of work concludes that displacement effects tend to be small in magnitude. Our study, together with the work by Yang

⁸ One can speculate that reforming one aspect of functioning of the customs administration was so effective precisely because officers retained flexibility in other areas. Cantens (2012, p. 10) argues that officers are very well aware of politician's objectives: "All Customs officers are familiar with the *Doing Business* reports, the *Logistics Performance Index* and the *Transparency International* classifications. Some Customs officers even know where their country is ranked directly from the cross-border trade indicator, one of the indicators summarized for the general classification in *Doing Business*. They describe what the minister wants following those classifications and the relative pressure that results."

⁹ The observed pattern is consistent with Yang (2008) who found that introduction of pre-shipment inspections in the Philippines led to increased usage of alternative methods of duty avoidance. Alternative methods included splitting shipments into smaller shipments with values below the threshold where pre-shipment inspection was required, as well as routing shipments through duty-exempt export-processing zones. It is also consistent with the findings of a working paper by Sequiera (2013) who showed that tariff liberalization was associated with a decline in bribe payments to customs officials. This decline was, however, partially offset by the displacement of corruption into more coercive forms of bribe extraction.

¹⁰ Article XXVI 5(c)-eligible countries were able to join the GATT by 1994 without making extensive reform commitments. These were former colonies whose former colonizers were GATT members by the time of their colonies' independence.

¹¹ See a literature review by Hesselting (1994).

(2008), leads to the opposite conclusion.

Our paper is structured as follows. The next section explains the link between adopting the Customs Valuation Agreement and evasion of import duties. Section 3 describes the data. Section 4 explores the relationship between underreporting of prices and the WTO membership. Section 5 focuses on underreporting quantities and product misclassification, while Section 6 examines the effect on the overall trade value. The last section presents the conclusions.

2. Why would adoption of the Customs Valuation Agreement affect evasion of import duties?

A country wishing to join the WTO needs to engage in parallel bilateral talks with individual member countries. In each bilateral talk, an agreement must be reached on tariff rates, specific market access commitments and other policies on goods and services of the acceding country. Following the most favored nation principle, the new member's commitments will then apply equally to all WTO members, even though they are negotiated bilaterally. These talks determine the benefits (in the form of export opportunities and guarantees) existing WTO members can expect when the new member joins.

Among other things, all countries joining the WTO are obliged to comply with the Customs Valuation Agreement (Agreement on Implementation of Article VII of the GATT, referred to as CVA hereafter).¹² Adopting the CVA means that customs officers in the joining country are no longer able to exercise discretion with respect to assessing the value of goods on the basis of which the import duty will be determined. Neither are they allowed to use some external standard, such as a minimum price or a reference price for this purpose. Instead customs officials are obliged to accept the price stated on the shipment invoice, though there are provisions for situations when customs administrations have reasons to doubt the accuracy of the declared value of imported goods.

The intended purpose of Article VII is to prevent new member countries from eroding tariff concessions granted to other WTO members by overvaluing import flows. According to *Development, Trade and the WTO. A Handbook*:

"The benefits that accrue to trade as a result of binding of tariffs would be considerably reduced if customs officials had significant discretion not to use the actual invoice price as the basis for determining dutiable value. The rules that are applied for valuation of goods are of crucial importance in ensuring that the incidence of duties levied is not higher than the bound tariff for the good concerned." (Rege 2002, p. 128)

For example, if the tariff rate on widgets is 10%, then a firm importing \$100 worth of widgets should pay \$10 in import duties. If, however, customs officials at the border valued the shipment at \$200, the resulting duty payment would increase to \$20 which would be equivalent to a 20% tariff rate. As many developing countries rely heavily on tariff revenue, customs officials are under pressure to meet revenue targets and hence may want to engage in this type of practices. Or new WTO members might wish to renege on some of the concessions they have made during the accession process. The CVA is designed to make it impossible.

The issue of customs valuation does come up during the accession process. For instance, the *Report of the Working Party on the Accession of China to the WTO* (1 October 2001, emphasis added) reads:

"Some members of the Working Party expressed concern regarding the methods used by China to determine the customs value of goods, in particular regarding the practice of using minimum or

¹² Though they may ask for a delay in implementing it (the so called transition period).

Table 1
Recent WTO members included in the analysis.

Accession countries	Date of WTO accession
Albania	8 September 2000
Armenia	5 February 2003
China	11 December 2001
Cape Verde	23 July 2008
Ecuador	21 January 1996
Georgia	14 June 2000
Lithuania	31 May 2001
Latvia	10 February 1999
Moldova	26 July 2001
Macedonia	4 April 2003
Nepal	23 April 2004
Oman	9 November 2000
Saudi Arabia	11 December 2005
Ukraine	16 May 2008
Vietnam	11 January 2007

reference prices for certain goods, which would be inconsistent with the Agreement on Implementation of Article VII of the GATT 1994 ("Customs Valuation Agreement")."

In response, "The representative of China confirmed that, upon accession, China would apply fully the Customs Valuation Agreement (...)". Similar statements can be found in other accession documents:

"The representative of Albania confirmed that, from the date of accession, Albania would comply with the WTO provisions concerning customs valuation (...)" (Report of the Working Party on the Accession of Albania to the WTO, 13 July 2000, emphasis added).

Countries joining the WTO are under pressure to comply with the agreement as failure to do so may result in a complaint against them being brought to the WTO Dispute Settlement Mechanism. For instance, in October 2000, the US brought up a complaint arguing that "Belgium's use of reference prices in the calculation of the applicable import duties would appear to be inconsistent with Article VII of the GATT 1994 and the Customs Valuation Agreement" and that "Belgium has failed to administer its customs valuation determinations and its assessment of tariffs in a transparent manner, thereby impeding trade ...".^{13,14}

By forcing customs officials to use invoices as the basis for assessing dutiable imports, Article VII takes away discretion they may have enjoyed previously. Customs officials, who are free to use their own judgement when assessing the import price, may be tempted to assist dishonest importers with tariff evasion through underreporting of prices in exchange for bribes. If questioned by authorities, they can always explain the artificially low price recorded with the lack of knowledge of the product. After all, it is the customs official's right and duty to determine the price as s/he saw appropriate, and s/he was under no obligation to take into account the price stated on the invoice. After adoption of the CVA, using a price that is lower than the invoice price could easily be spotted and thus corrupt behavior could be more easily detected. Thus removing discretion previously enjoyed by

customs officials limits their ability to facilitate misrepresentation of import prices.¹⁵

The new regime will not affect the difficulty associated with smuggling, underreporting of quantities and product misclassification, or the probability that such activities will be detected. It will, however, lower the cost of evasion through these channels *relative* to the cost of evasion through underreporting of prices. Therefore, underrecording weight will become easier to conceal *relative* to concealing price manipulation. All the importer will need to do is to combine two purchases of widgets into one shipment and show only one of the two invoices at the customs check point, since the customs official is not obliged to check quantities of every shipment.

A simple model following Yang (2008), presented in the Online Appendix (Section D), illustrates that an increase in the costs of evasion through one method will induce importers to switch to another method of evasion. It is also possible that corrupt customs officials who see their discretion taken away in one area (decisions about import prices) will find alternative means for corrupt activities.

3. Data

Our main data source is the World Bank's World Integrated Trade Solution (WITS) database that contains information on most favored nation and preferential tariff rates specific to pairs of countries and years, derived from the UNCTAD's Trade Analysis and Information System (TRAITS). The information is available at the 6-digit level in the HS classification. We consider 15 importing countries which joined the WTO between 1996 and 2008.¹⁶ These are: Albania, Armenia, China, Cape Verde, Ecuador, Georgia, Lithuania, Latvia, Moldova, Macedonia, Nepal, Oman, Saudi Arabia, Ukraine and Vietnam. Table 1 lists their accession dates. Due to data constraints, we exclude from the sample nine other WTO members that joined the organization during the same period.¹⁷ In our analysis, we consider the actual year of accession if the country became a WTO member between January

¹³ Source: https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds210_e.htm.

¹⁴ Similarly, "On 22 July 2003, Guatemala requested consultations with Mexico concerning certain Mexican customs rules, procedures and administrative practices which impose officially established prices for customs valuation and other purposes. Guatemala also contested the Mexican authorities' practice of requiring a deposit or bond to guarantee the observance of these officially established prices. In Guatemala's view, Mexican customs rules, procedures and administrative practices at issue are inconsistent with Mexico's obligations under the following WTO provisions: Articles I, II, VII and X of GATT 1994." (Source: https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds298_e.htm). In January 2008, the European Community (EC) requested consultations with Thailand with respect to the way the Thai customs authorities value alcoholic beverages and other products from the EC. The EC disputed the application by the Thai customs authorities of an "assessed value", which is considered to be arbitrary. (Source: http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds370_e.htm)

¹⁵ An anthropological study of the Cameroonian customs administration concludes that the recorded details of an import transaction are a result of negotiations between customs officials (who need to meet their revenue targets) and importers (who would like to limit their duty payments). "With 'large undertakings', often subsidiaries of international groups, officers do not negotiate; they apply the 'transactional value', the value shown on the invoice.... Negotiation is used for 'informals', 'central market traders'. It is even strongly recommended and organized for agreement on three points: quantity per unit of measurement (bundle, container), value of that unit of measurement and tax category (generally the highest of three or four categories).... Customs officers apply, or indeed set, 'administrative values', 'approved values' or 'reference values'. These differ from the invoice value, which is considered to be incorrect." Cantens (2012, p. 5)

¹⁶ We focus on countries which joined the WTO through working party negotiations. We exclude countries which were originally GATT members but formally joined the WTO after 1 January 1995 due to delayed ratification and other formalities.

¹⁷ Table 2 lists their names and the reasons why they have been excluded.

Table 2
List of recent WTO members not included in the analysis.

Countries not included	Year of WTO accession	Reason for exclusion
Bulgaria	1996	No tariff data available prior to accession
Cambodia	2004	No tariff data
Croatia	2000	No tariff data available prior to accession
Estonia	1999	Uniform tariff (no variation in tariff rates)*
Jordan	2000	No tariff data available prior to accession
Kyrgyz Republic	1998	Large gaps in tariff data
Mongolia	1997	No tariff data available prior to accession
Panama	1997	No tariff data available prior to accession
Tonga	2007	No trade figures available prior to accession

* Our methodology relies on variation in tariffs, thus we are unable to consider countries with a uniform tariff schedule.

and June, and the following year if the accession happened between July and December.¹⁸ We consider three exporters: Germany, US and France. We chose these particular exporters to cover the major source of exports in all regions of the world. We also decided to focus on developed and relatively uncorrupt countries in order to avoid confounding the effects of corruption in the exporting nation with the effects of corruption in the importing country.¹⁹

Our second data source is the United Nations' COMTRADE database which contains information on trade flows, also at the 6-digit HS level. The data on tariffs and trade flows are available for the period 1992–2009, though the coverage differs by country.

We consider only differentiated products because as argued by Javorcik and Narciso (2008) it may be easier to conceal the true value of such products, thus creating more opportunities for tariff evasion. We use Rauch's (1999) definition of differentiated products. He classified goods into three categories: (i) homogeneous which are products whose price is set on organized exchanges; (ii) reference priced, which are goods not traded on organized exchanges, but which possess a benchmark price; and (iii) differentiated which are products whose price is not set on organized exchanges and which lack a reference price because of their intrinsic features. Rauch suggested two definitions, a conservative and a liberal one, in order to account for the ambiguities arising in the classification. The conservative definition minimizes the number of commodities that are classified as homogeneous goods, while the liberal definition maximizes this number. We employ the conservative classification, but our results are robust to using the liberal definition.

4. Implementation of the WTO Customs Valuation Agreement

4.1. Summary statistics

Our variable of interest is the unit value gap defined as the difference in unit values of exports of product p at time t reported by the exporter k and by the importer c :

$$Unit\ value\ gap_{kcp_t} = \ln\left(\frac{Export\ value_{kcp_t}}{Export\ quantity_{kcp_t}}\right) - \ln\left(\frac{Import\ value_{kcp_t}}{Import\ quantity_{kcp_t}}\right) \quad (1)$$

The gap is calculated at the level of 6-digit HS product for each exporter-importer combination and each year.²⁰ A discrepancy between the value of exports recorded by the exporting country and the

¹⁸ In a robustness check, we will extend our sample to include also non-WTO members as the control group.

¹⁹ We decided against choosing just the cleanest countries, such as Denmark, Finland, New Zealand and Sweden as exporters, because on average they account for only 0.8% (Denmark), 1% (Finland), 0.2% (New Zealand) and 1.2% (Sweden) of imports of the accession countries considered.

²⁰ We drop from the sample the top and bottom 1% of observations for each country to avoid including possible coding mistakes in the data set.

Table 3
Summary statistics.

	Mean	Median	Min	Max	No. observations
Tariff	9.830	8	0	220	246,009
Unit Value Gap	0.108	0.061	-5.021	4.860	246,009
Quantity Gap	0.004	-0.040	-12.218	12.207	246,009
WTO	0.491	0	0	1	246,009

Table 4
Summary statistics by WTO accession. Unit value gap.

Sample	Before WTO accession (1)	After WTO accession (2)	Difference (1)-(2)
Mean Unit Value Gap			
All importers	0.218 (125,118 obs.)	-0.006 (120,891 obs.)	0.224***

Table 5
Summary statistics by tariff rate and WTO accession. Unit value gap.

Sample	Tariff above the median (1)	Tariff below the median (2)	Difference (1)-(2)
Mean Unit Value Gap			
Before WTO accession	0.304 (40,844 obs.)	0.176 (84,274 obs.)	0.128***
After WTO accession	-0.008 (38,836 obs.)	-0.005 (82,055)	-0.003

value of imports recorded by the importer is to be expected. The first reason is that export prices are expressed in f.o.b. (free on board) terms,²¹ while imports are recorded including the cost of insurance and freight (c.i.f.). The second reason is that countries tend to monitor imports more carefully than exports. In the absence of tariff evasion, one would expect the discrepancy to be negative. Yet, as illustrated in Table 3 presenting the summary statistics, both the average and the median gap in our sample are positive reaching 11.4% and 6.3%, respectively.^{22,23}

More interestingly from the perspective of our study, there is a

²¹ Free on board is a transportation term that indicates that the price for goods includes delivery at the seller's expense to a specified point and no further.

²² $\text{Exp}(.108) - 1 = .114$

²³ While unit values calculated based on national trade statistics may be imperfect proxies for product prices, they have been widely used in the literature and the analyses based on such data have produced meaningful and intuitive results (see e.g., Schott (2004) and Hallak (2006)). Moreover, in this study we are not interested in the value of the unit value gap *per se* but rather in its responsiveness to the tariff level which we view as consistent with tariff evasion.

sharp decline in the gap from the average value of 24.4% before the WTO accession to -0.6% after the accession. The difference between the two figures is statistically significant (see Table 4).

The existence of the unit value gap is suggestive of tariff evasion, but it does not constitute conclusive evidence. A systematic relationship between the tariff level and the gap would be much stronger evidence of improper customs practices. Thus in Table 5, we check whether there is a difference in the average unit value gap for the high and low tariff levels. Looking at the pre-accession period, we find a much higher gap for the above median tariffs than for the below median tariffs (35.5% vs 19.2%).²⁴ The difference between the two is statistically significant. In contrast, in the post-accession period, the average gaps are very small and negative, and the difference between them is not statistically significant. This pattern is in line with our hypothesis that the WTO accession is associated with limiting discretion of customs officials in terms of assessing the price of imported goods.

4.2. Econometric specification

To formally test the relationship between WTO accession and tariff evasion, we examine whether the semi-elasticity of the unit value gap with respect to the tariff rate changes around the accession time. More specifically, we estimate the following model:

$$\text{Unitvaluegap}_{kcp,t} = \beta_1 \text{tariff}_{kcp,t} + \beta_2 \text{WTO}_{ct} * \text{tariff}_{kcp,t} + \beta_3 \text{WTO}_{ct} + \alpha_{kc} + \alpha_p + \alpha_i + \alpha_{kcHS2} + \alpha_t + \varepsilon_{kcp,t} \quad (2)$$

where the unit value gap is defined as above, tariff is the applied tariff on imports of product p from country k to country c at time t , WTO is the dummy variable taking on the value of 1 if country c was a member of the organization at time t , and zero otherwise. The model also includes importer-exporter-pair fixed effects, product fixed effects and time fixed effects (or in an alternative specification importer-exporter-pair-2-digit-HS-code fixed effects and year fixed effect).²⁵ We implement two-way clustering of standard errors (by country-pair and by year), as suggested by Cameron et al. (2011).

Following the literature outlined earlier, we interpret a positive semi-elasticity of the unit value gap with respect to the tariff rate ($\beta_1 > 0$) as evidence of tariff evasion. The question of interest is whether this semi-elasticity changes after the WTO accession. If the WTO membership affects the functioning of the customs service, we would expect to observe a negative coefficient on the interaction term ($\beta_2 < 0$).

Before we proceed to testing the question of interest, we check for evidence of tariff evasion in our sample regardless of the WTO membership. In other words, we drop the terms involving the WTO from the estimation and show the results in the top panel of Table 6. We present five specifications with different combinations of fixed effects: (i) importer, exporter and year fixed effects; (ii) country-pair and year fixed effects; (iii) importer, exporter, product and year fixed effects; (iv) country-pair, product and year fixed effects; and (v) country-pair-2-digit-HS-code and year fixed effect.

In all five specifications, we find a positive and statistically significant (at the 1% level) relationship between the tariff rate and the unit value gap. In the first specification, a 10 percentage point increase in the tariff rate is associated with a 7.4% larger unit value gap,²⁶ i.e., the unit value reported by the importing country declines relative to the unit value reported by the exporter. In our preferred specification (column 4), the magnitude of the effect goes down to

about 5% but the coefficient remains statistically significant at the 1% level.

4.3. Baseline results

The results from our baseline specification, outlined in Eq. 2, support our hypothesis that institutional reforms mandated by the WTO accession affect tariff evasion through underreporting of prices. As evident from the middle panel of Table 6, we find a positive and statistically significant semi-elasticity of the unit value gap with respect to the tariff rate in the pre-accession period. In the post-accession period, this semi-elasticity ceases to be statistically significant. This is true in all specifications considered. Looking at column 1, a 10 percentage point increase in the tariff rate is associated with an 8.9% larger unit value gap prior to the WTO membership. There is no statistically significant relationship between the two variables in the post-accession period. These results are consistent with the WTO Customs Valuation Agreement limiting the discretion of customs officials with respect to assessing the price of imported products and thus the scope for underreporting of unit values of imports.

One may wonder why importers do not simply present shipment documents stating a lower price of imported products. The first reason is that exporters from well governed countries, such as those considered in our analysis, may be unwilling to produce fake documents or to falsify prices. The sales price has tax implications for the exporter, particularly in countries with value added taxes. Second, while Article VII means that the customs officers are expected to accept the invoice price, the burden of proof lies with the importer. In cases where customs authorities have reasonable doubts as to the truth or accuracy of the transaction value declared by the importer, they are allowed to ask importers to provide explanations, documents or other evidence to establish that “the declared value represents the total amount actually paid or payable for the imported goods” (Rege, 2002). It is not up to customs to prove that the invoice is inaccurate. If the customs authorities are not satisfied and have “reasonable doubts” about the truth or accuracy of the declared value, they may use alternative valuation methods specified in the agreement. The discretion available to customs in deciding on the dutiable value is, however, limited as they must follow five valuation methods applying them in a pre-specified order (see Rege (2002) for more details).

To gain more confidence that our results capture the impact of the CVA rather than a downward trend in evasion over time, in the bottom panel of Table 6, we test whether a weaker relationship between the unit value gap and the tariff rate was already present one year prior to the WTO accession. This is not the case. In none of the five specifications, is the interaction term between the tariff rate and the year prior to the WTO accession statistically significant. At the same time, our results of interest remain virtually unchanged.

4.4. Are all goods affected in the same way?

We do not expect all goods to be affected by adoption of Article VII. In our earlier work on eastern European countries (Javorcik and Narciso, 2008), we found that tariff evasion through underpricing took place only in differentiated products. This result is intuitive because these are products where prices may range widely depending on product quality, and it may be difficult for a non-specialist to detect underpricing. This reasoning led us to restrict our sample to differentiated products.

It is interesting nonetheless to check the effect of WTO accession on non-differentiated products. Underpricing of commodities, such as flour or sugar, can be easily spotted, therefore, we would not expect to find strong evidence of underpricing before accession and we would not expect to find that this relationship was affected by the accession. To examine this question, in Table A1 in the Online Appendix, we estimate the baseline regressions on a sample of non-differentiated products.

²⁴ The median tariff is calculated by the importing country and year.

²⁵ Examples of 2-digit HS codes include: Pharmaceutical products (HS30), Fertilizers (HS31), Photographic or cinematographic goods (HS37), Cork and articles of cork (HS45), Silk (HS50), Cotton (HS52), Furniture; bedding, mattress, mattress support, cushion, etc (HS94).

²⁶ $\exp(0.0071 * 10) - 1 = 0.074$.

Table 6
Unit value gap in WTO accession countries.

	(1)	(2)	(3)	(4)	(5)
Unit value gap during the whole period					
Tariff	0.0071*** [0.001]	0.0070*** [0.001]	0.0050*** [0.001]	0.0050*** [0.001]	0.0046*** [0.001]
Observations	246,009	246,009	245,969	245,969	245,770
Adjusted R-squared	0.030	0.033	0.108	0.111	0.085
Unit value gap pre and post WTO accession					
Tariff	0.0085*** [0.002]	0.0085*** [0.002]	0.0062*** [0.001]	0.0063*** [0.001]	0.0057*** [0.001]
Tariff×WTO	-0.0059** [0.002]	-0.0065*** [0.002]	-0.0077*** [0.002]	-0.0082*** [0.002]	-0.0069*** [0.002]
WTO	-0.0053 [0.038]	0.0008 [0.038]	0.0021 [0.037]	0.0071 [0.037]	0.0118 [0.038]
Test Tariff+Tariff×WTO=0					
F statistic	2.85	1.94	0.70	1.13	0.30
p-value	0.11	0.18	0.42	0.30	0.59
Observations	246,009	246,009	245,969	245,969	245,770
Adjusted R-squared	0.030	0.034	0.109	0.112	0.085
Unit value gap – 1 year before WTO accession					
Tariff	0.0088*** [0.002]	0.0088*** [0.002]	0.0065*** [0.001]	0.0066*** [0.001]	0.0059*** [0.001]
Tariff×WTO	-0.0063** [0.003]	-0.0069** [0.003]	-0.0083** [0.003]	-0.0087*** [0.003]	-0.0072** [0.003]
Tariff×1 year before WTO	-0.0032 [0.003]	-0.0034 [0.003]	-0.0040 [0.003]	-0.0041 [0.003]	-0.0027 [0.003]
1 year before WTO	-0.0089 [0.035]	-0.0011 [0.036]	0.0060 [0.030]	0.0126 [0.033]	-0.0083 [0.034]
WTO	-0.0180 [0.047]	-0.0090 [0.048]	-0.0055 [0.044]	0.0021 [0.047]	0.0009 [0.046]
Test Tariff+Tariff×WTO=0					
F statistic	2.26	1.54	0.72	1.18	0.35
p-value	0.15	0.23	0.41	0.29	0.56
Observations	246,009	246,009	245,969	245,969	245,770
Adjusted R-squared	0.031	0.034	0.109	0.112	0.086
Year FE	yes	yes	yes	yes	yes
Exporter FE	yes	no	yes	no	no
Importer FE	yes	no	yes	no	no
Country-pair FE	no	yes	no	yes	no
6-digit HS product FE	no	no	yes	yes	no
Importer*Exporter*2-digit HS product FE	no	no	no	no	yes

Notes: The dependent variable is the unit value gap as defined in Eq. 1 in the text. *1 year before WTO* takes on the value of one in the year before the *WTO* dummy equals one, and zero in all other years. The specifications in the top and middle panel mirror the bottom panel in terms of fixed effects (FE). Standard errors, clustered by year and importer-exporter pair, are listed in brackets. ***, **, * denotes significance at the 1%, 5% and 10% level, respectively.

Prior to the WTO entry, we find some weak evidence of tariff evasion through underpricing. The magnitude of the tariff coefficient goes down by two-thirds or a half when compared to differentiated products, and it is statistically significant only in the three of five specifications. Its interaction with the WTO membership does not appear to be statistically significant in any of the specifications. Finding distinct and intuitive patterns for differentiated and non-differentiated products gives us confidence that our analysis is picking up the effects it is

intended to capture.

As one may be concerned that Rauch's classification of products into three categories is quite crude, in our next exercise we exploit differences in dispersion of unit values across products. We do so by using information on US imports at the 10-digit HS level, disaggregated by exporting country and year. We focus on the US because the US is the largest importer in the world and because its trade statistics are available at a high level of disaggregation. For each exporting

Table 7
Products with high vs. low dispersion in unit values.

	(1)	(2)	(3)	(4)	(5)
Unit value gap during the whole period					
Tariff	0.0062*** [0.001]	0.0062*** [0.001]	0.0041** [0.002]	0.0043** [0.002]	0.0055*** [0.001]
Tariff×High dispersion	0.0032* [0.002]	0.0031* [0.002]	0.0036** [0.002]	0.0036** [0.002]	0.0025** [0.001]
High dispersion	0.0997** [0.044]	0.1032** [0.044]	-0.0536* [0.026]	-0.0546* [0.026]	0.0715** [0.033]
Observations	68,859	68,859	68,837	68,837	68,673
Adjusted R-squared	0.027	0.030	0.073	0.076	0.074
Unit value gap pre and post WTO accession					
Tariff	0.0073*** [0.001]	0.0074*** [0.001]	0.0051** [0.002]	0.0053** [0.002]	0.0065*** [0.001]
Tariff ×High dispersion	0.0028 [0.002]	0.0027 [0.002]	0.0030 [0.002]	0.0030 [0.002]	0.0019 [0.001]
Tariff ×WTO	-0.0046* [0.003]	-0.0051* [0.003]	-0.0055* [0.003]	-0.0059* [0.003]	-0.0058*** [0.002]
Tariff×WTO×High dispersion	-0.0039 [0.003]	-0.0039 [0.003]	-0.0049* [0.002]	-0.0048* [0.003]	-0.0052* [0.003]
WTO	0.0178 [0.035]	0.0176 [0.037]	0.0258 [0.041]	0.0250 [0.043]	0.0226 [0.038]
WTO×High dispersion	-0.0695 [0.049]	-0.0642 [0.049]	-0.0720 [0.049]	-0.0667 [0.049]	-0.0570* [0.029]
High dispersion	0.1419** [0.051]	0.1426** [0.052]	-0.0041 [0.037]	-0.0077 [0.038]	0.1172*** [0.033]
test Tariff+Tariff×WTO=0 F statistic	2.44	1.90	0.03	0.07	0.21
p-value	0.14	0.19	0.86	0.80	0.66
test Tariff+Tariff×WTO+Tariff×High dispersion+Tariff×WTO×High dispersion=0					
F statistic	0.54	0.31	0.52	0.56	0.71
p-value	0.48	0.58	0.48	0.47	0.41
Observations	68,859	68,859	68,837	68,837	68,673
Adjusted R-squared	0.028	0.031	0.075	0.078	0.075
Year FE	yes	yes	yes	yes	yes
Exporter FE	yes	no	yes	no	no
Importer FE	yes	no	yes	no	no
Country-pair FE	no	yes	no	yes	no
6-digit HS product FE	no	no	yes	yes	no
Importer*Exporter*2-digit HS product FE	no	no	no	no	yes

Notes: The dependent variable is the unit value gap as defined in Eq. 1 in the text. The specifications in the top panel mirror the lower panel in terms of fixed effects (FE). High dispersion 6-digit HS products are defined as those with the median dispersion above the median in a given year. Standard errors, clustered by year and importer-exporter pair, are listed in brackets. ***, **, * denotes significance at the 1%, 5% and 10% level, respectively.

country, 10-digit product and year combination we calculate the unit value of trade, keeping only products whose quantity is measured in kilograms. Then for each 6-digit HS product (which is the level of aggregation of our main dataset), we calculate the median average deviation using a well-known formula:

$$MAD_{pt} = \text{median}_{pt}(UV_{HS10,ct} - \text{median}UV_{pt})$$

In the final step, products with MAD above the median in a given year are classified as high dispersion products.

We expect tariff evasion to be more prevalent in products with high dispersion of unit values. First, we test whether this is true in general by ignoring the effect of the WTO accession. As evident from the top panel of Table 7, the data confirm our priors. The responsiveness of the unit value gap to the tariff rate is between 50 and 80 percent higher for

high dispersion products. The estimated effect is statistically significant in all specifications.

Second, we test whether the effect of WTO was felt more strongly in products with high dispersion of unit values. The estimates are presented in the lower panel of Table 7. We find a positive and statistically significant relationship between the tariff rate and under-reporting of unit values. While the coefficient on the tariff rate interacted with a high dispersion dummy is positive in all specifications, it is not precisely estimated. More interestingly, we find that the responsiveness of the unit value gap to the tariff rate goes down after the WTO accession and that this decline is larger for high dispersion products. In all five specifications, we cannot reject the hypothesis that there is no statistically significant relationship between the unit value gap and the tariff rate in the aftermath of the WTO accession. This is

Table 8
Ecuador.

	(1)	(2)	(3)	(4)
Unit value gap				
Tariff	0.0199*** [0.005]	0.0156*** [0.004]	0.0230*** [0.006]	0.0150** [0.005]
Tariff×WTO transition period	-0.0036 [0.005]	-0.0024 [0.004]	-0.0035 [0.007]	-0.0015 [0.005]
Tariff×WTO post-transition period	-0.0196*** [0.005]	-0.0167*** [0.004]	-0.0197*** [0.006]	-0.0147*** [0.004]
Intra-firm trade×tariff			-0.0771*** [0.025]	-0.0269 [0.032]
Intra-firm trade×tariff×WTO transition period		0.0183 [0.019]	0.0022 [0.017]	
Intra-firm trade×tariff×WTO post-transition period		0.0124	-0.0073 [0.018]	[0.016]
Intra-firm trade			0.1328 [0.229]	
test tariff×WTO transition period= tariff×WTO post-transition period				
F statistic	30.26	52.70	17.75	26.63
p-value	0.00	0.00	0.00	0.00
Observations	26,630	26,630	25,376	25,376
Adjusted R-squared	0.015	0.076	0.019	0.076
Year FE	yes	yes	yes	yes
Exporter FE	yes	yes	yes	yes
2-digit HS product FE	no	yes	no	yes

Notes: The dependent variable is the unit value gap as defined in Eq. 1 in the text. Standard errors, clustered by year, are listed in brackets. ***, **, * denotes significance at the 1%, 5% and 10% level, respectively. FE stands for fixed effects.

Table 9
Unit value gap pre- and post-WTO accession. Further robustness checks.

	(1)	(2)	(3)
Unit value gap pre and post WTO accession			
Tariff	0.0067*** [0.001]	0.0032** [0.001]	0.0083*** [0.002]
Tariff×WTO	-0.0046** [0.002]	-0.0058** [0.002]	-0.0101*** [0.003]
WTO	0.0140 [0.040]		-0.0058 [0.040]
test Tariff+Tariff×WTO=0	F statistic	0.97	1.87
	p-value	0.34	0.19
Observations		235,797	245,969
Adjusted R-squared		0.329	0.128
Importer*Exporter*6-digit HS product FE	yes	no	no
Importer*Exporter*year FE	no	yes	no
Exporter*6-digit HS product*year FE	no	no	yes
Year FE	yes	no	no
6-digit HS product FE	no	yes	no
Importer FE	no	no	yes

Notes: The dependent variable is the unit value gap as defined in Eq. 1 in the text. Standard errors, clustered by year and importer-exporter pair, are listed in brackets. ***, **, * denotes significance at the 1%, 5% and 10% level, respectively. FE stands for fixed effects.

Table 10
Summary statistics by WTO accession. Quantity gap.

Sample	Before WTO accession (1)	After WTO accession (2)	Difference (1)-(2)
Mean Quantity Gap			
All importers	-0.132 (125,118 obs.)	0.146 (120,891 obs.)	-0.278***

Table 11
Summary statistics by tariff rate and WTO accession. Quantity gap.

Sample	Tariff above the median (1)	Tariff below the median (2)	Difference (1)-(2)
Mean Quantity Gap			
Before WTO accession	0.043 (40,844 obs.)	-0.217 (842,74 obs.)	0.260***
After WTO accession	0.353 (38,836 obs.)	0.048 (82,055 obs.)	0.305***

true for all products as well as for high dispersion products.

4.5. The smoking gun

Ecuador, which is included in our sample, is an interesting case. The country joined the WTO in January 1996 and asked for a 5-year transition period for implementing the Customs Valuations Agreement. To take the transition period into account we estimate an augmented model for Ecuador, in which we allow for a different coefficient on the tariff rate in the 1996–2000 period (i.e., the time when Ecuador was already member of the WTO but was not obliged to implement Article VII) and in the 2001–2009 period (when Ecuador was a member obliged to have implemented Article VII). The results, presented in the first two columns of Table 8 show a positive and statistically significant coefficient on the tariff rate. As we would expect, the interaction term between the tariff rate and the 1996–2000 period dummy is not

Table 12
Summary statistics by tariff rate and tariff on similar products. Quantity gap.

Sample	Tariff on product <i>p</i> above the median (1)	Tariff on product <i>p</i> below the median (2)	Difference (1)-(2)
Mean Quantity Gap			
Tariff on product <i>p</i> below the average tariff on similar products (incentive to misclassify other products as product <i>p</i>) (A)	0.216 (19,213)	-0.104 (120,934)	0.320***
Tariff on product <i>p</i> above the average tariff on similar products (no incentive to misclassify other products as product <i>p</i>) (B)	0.187 (60,467)	-0.038 (45,395)	0.226***
	Difference (A) – (B) 0.028	-0.066***	

Similar products are defined as products in the same 4-digit HS category.

Table 13
Misclassification and underreporting of quantities.

	(1)	(2)	(3)	(4)	(5)
Underreporting of quantities					
Tariff	0.0047 [0.004]	0.0046 [0.004]	0.0012 [0.003]	0.0011 [0.003]	0.0002 [0.002]
Tariff × WTO	0.0170** [0.008]	0.0181** [0.008]	0.0090 [0.005]	0.0102* [0.005]	0.0126** [0.006]
WTO	-0.1149 [0.086]	-0.1434 [0.087]	-0.0655 [0.064]	-0.0955 [0.066]	-0.1496** [0.069]
test Tariff+Tariff × WTO=0 F statistic	12.58	14.38	7.08	8.74	4.46
p-value	0.00	0.00	0.02	0.01	0.05
Observations	246,009	246,009	245,969	245,969	245,770
Adjusted R-squared	0.020	0.023	0.104	0.108	0.082
Underreporting of quantities and misclassification					
Tariff	0.0067* [0.004]	0.0066* [0.004]	0.0040 [0.004]	0.0039 [0.003]	0.0045** [0.002]
Tariff×WTO	0.0166** [0.007]	0.0171** [0.007]	0.0131** [0.005]	0.0139** [0.005]	0.0148** [0.007]
Tariff on similar products	-0.0034** [0.001]	-0.0033** [0.001]	-0.0053* [0.003]	-0.0053* [0.003]	-0.0120*** [0.003]
WTO×Tariff on similar products	0.0003 [0.004]	0.0012 [0.004]	-0.0079** [0.003]	-0.0071* [0.004]	-0.0100 [0.007]
WTO	-0.1160 [0.090]	-0.1465 [0.092]	-0.0467 [0.065]	-0.0782 [0.067]	-0.1080 [0.076]
test Tariff+Tariff×WTO=0 F statistic	17.73	19.22	34.04	38.40	8.38
p-value	0.00	0.00	0.00	0.00	0.01
test Tariff on similar products+WTO×Tariff on similar products=0					
F statistic	0.98	0.44	35.30	27.34	10.82
p-value	0.34	0.51	0.00	0.00	0.00
Observations	246,009	246,009	245,969	245,969	245,770
Adjusted R-squared	0.020	0.023	0.105	0.108	0.082
Year FE	yes	yes	yes	yes	yes
Exporter FE	yes	no	yes	no	no
Importer FE	yes	no	yes	no	no
Country-pair FE	no	yes	no	yes	no
6-digit HS product FE	no	no	yes	yes	no
Importer*Exporter*2-digit HS product FE	no	no	no	no	yes

Notes: The dependent variable is the quantity gap. Tariff on similar products is defined as the weighted average tariff on all products within the same 4-digit HS code. The specifications in the top panel mirror the bottom panel in terms of fixed effects. Standard errors, clustered by year and importer-exporter pair, are listed in brackets. (FE)***, **, * denotes significance at the 1%, 5% and 10% level, respectively.

Table 14
Trade gap pre- and post-WTO accession.

Trade gap	(1)	(2)	(3)	(4)	(5)
Tariff	0.0131*** [0.004]	0.0131*** [0.004]	0.0074** [0.003]	0.0073** [0.003]	0.0060*** [0.002]
Tariff×WTO	0.0110 [0.007]	0.0116 [0.007]	0.0012 [0.005]	0.0020 [0.005]	0.0057 [0.005]
WTO	-0.1203* [0.061]	-0.1427** [0.067]	-0.0634 [0.038]	-0.0885* [0.045]	-0.1378*** [0.046]
test Tariff+Tariff×WTO=0 F statistic	24.34	24.69	6.94	7.47	6.19
p-value	0.00	0.00	0.02	0.01	0.02
Observations	246,009	246,009	246,009	246,009	245,770
Adjusted R-squared	0.018	0.023	0.109	0.114	0.084
Year FE	yes	yes	yes	yes	yes
Exporter FE	yes	no	yes	no	no
Importer FE	yes	no	yes	no	no
Country-pair FE	no	yes	no	yes	no
6-digit HS product FE	no	no	yes	yes	no
Importer*Exporter*2-digit HS product FE	no	no	no	no	yes

Notes: Standard errors, clustered by year and importer-exporter pair, are listed in brackets. ***, **, * denotes significance at the 1%, 5% and 10% level, respectively. FE stands for fixed effects.

statistically significant, while the interaction with the 2001–2009 period is negative and statistically significant. In other words, we find a positive relationship between underpricing of imports and the tariff rate in years prior to 2001. This relationship disappears in 2001, the year when Ecuador was expected to implement the Customs Valuation Agreement.²⁷

4.6. Intra-firm trade

Related-party trade accounts for a large fraction of global trade. Could its existence cloud our analysis? While multinationals may engage in transfer pricing or import duty avoidance through manipulation of intra-firm prices, such activities will not affect our analysis. It is true that by reporting an artificially low price a multinational can lower the duty paid by its importing affiliate. However, because under transfer pricing *the same price will be reported* in the exporting and the importing country, no gap in the unit value will be created. And few multinationals seem willing to engage in blatant tax evasion of the sort described in this study. Thus, if anything, the presence of intra-firm trade weakens the relationship between the unit value gap and the tariff rate in our analysis.

Ideally, we would like to exclude intra-firm trade from our analysis. Unfortunately, the UN COMTRADE statistics do not allow us to identify related party transactions. In fact, to the best of our knowledge, there is not even a comprehensive data source on FDI stocks disaggregated by destination country, industry and year. Therefore, we conduct a simple robustness check in the context of Ecuador.

The US Bureau of Economic Analysis (BEA) data allow us to observe imports by foreign affiliates of US multinationals from the US. While in theory, this information is available by destination country and industry, in practice very many data points are suppressed for confidentiality reasons. This is particularly true for small countries which do not get very large FDI inflows from the US (i.e., most countries in our sample). Even the data for China contain a few suppressed values. Interestingly, Ecuador is the only country for which we could obtain such figures for all the subsectors of manufacturing. Due to changes in the industry classification used by the BEA, more disaggregated figures for manufacturing are available only for 1997 and

1998. We thus consider figures for 1997. Using the COMTRADE statistics we calculate the share of each industry imports from the US going to affiliates of US multinationals operating in Ecuador. We use this share as a proxy for intra-firm trade intensity and assume it holds in all years as well as with respect to the other two trading partners of Ecuador (Germany and France).

The results, presented in columns 3 and 4 of Table 8, suggest that our main results are robust to allowing for a differential effect of intra-firm trade on tariff evasion in the pre- and post-WTO period. As for the intra-firm trade itself, as expected, it appears to weaken the link between the unit value gap and the tariff level, though this result is not very robust.

4.7. Unobservable heterogeneity

Next we demonstrate that our results are robust to controlling for other types of unobservable heterogeneity. In Table 9, we control for importer-exporter-product fixed effects (column 1), importer-exporter-year fixed effects (column 2), and exporter-product-year fixed effects (column 3) as well as some other fixed effects as specified in the table. Since our data vary at the importer-exporter-product-year level, column 1 presents the standard within estimates where the effects are identified off the variation over time.

In all specifications, we find a positive and statistically significant link between the unit value gap and the tariff rate. As before, this relationship disappears (i.e., ceases to be statistically significant) in the aftermath of the WTO accession.

4.8. Potential endogeneity

One may be concerned about potential reverse causality. Could it be the case that countries adjust their MFN tariffs in response to past evasion? We do not believe that this is a concern in our analysis for two reasons. First, all of our accession countries, with the exception of China, are small economies unlikely to wield much power in negotiations with large WTO members.²⁸ In the results, not reported to save space but available upon request, we find that our conclusions hold if we exclude China.

Second, the strict exogeneity test suggested by Wooldridge (2002, p.

²⁷ Given that we only have three exporting countries and one importer, we do not cluster standard errors at the country-pair level.

²⁸ See Section 2 for more information on how such negotiations are conducted.

285) does not reject our empirical strategy. The test results are presented in Table A2 in the Online Appendix. In the top panel, we augment our baseline specification by including the leads of all variables (i.e., the values of all variables at $t+1$). The estimates of the coefficients of interest are unaffected by this change, while the leads do not appear to be statistically significant in any of the specifications. This gives us confidence that the changes we capture indeed coincide with the WTO accession rather than being felt beforehand. In the lower panel, we estimate a specification with contemporaneous variables as well as their leads and lags. Again the leads are not statistically significant, which means that our modelling strategy is not rejected. We find the pattern of interest captured by the lags.

4.9. Other robustness checks

WTO accession is often associated with changes in trade policy and trade flows. To make sure that our results are driven by changes in tariff evasion rather than by other factors, we perform several checks. First, it could be the case that incentives to evade tariffs decline as the average tariff decreases. To take this into account we estimate our baseline specification on a subsample of products whose tariffs are the same in the year of the WTO accession (or any subsequent year) as in the previous year. While the sample size drops to about a third, the results are quite similar (see Table A3 in the Online Appendix, top panel).

Second, to address a potential concern that our results could be driven by a change in the composition of products, we restrict our sample to products traded by each country both before and after the accession. Again, our results are robust to this modification (see Table A3 in the Online Appendix, middle panel).

Third, we drop small product flows, i.e., flow with value below 50,000 dollars. Doing so does not affect our results (see Table A3 in the Online Appendix, bottom panel).

Fourth, we show that our results are robust to extending the comparison group. Rather than comparing tariff evasion in the pre- and post-accession period in WTO members alone, we also include non-member countries in our control group. The non-members include: Algeria, Azerbaijan, Belarus, Bhutan, Bosnia Herzegovina, Kazakhstan, Lebanon, Russian Federation, Serbia, Syria and Yemen. Changing the comparison group does not affect our findings (see Table A4 in the Online Appendix).

Fifth, we conduct an event study analysis to address the possibility of a confounding trend. We want to gain confidence that our findings on the impact of WTO accession on tariff evasion are not simply picking up a downward trajectory in the relationship between the unit value gap and the tariff rate happening for a completely unrelated reason. The results, presented in Section B in the Online Appendix, support the message of our paper. The relationship between the unit value gap and the tariff rate clearly changes at the point of the WTO accession. There is no indication of this relationship weakening in the pre-accession years.

Finally, as illustrated in the Online Appendix (Section C), the pattern we document cannot be explained by computerization of the customs procedures.

5. Is there evidence of displacement?

Closing one avenue of tariff evasion may lead to importers exploring alternative means of duty evasion. To explore this possibility we first examine the patterns of underreporting quantities pre- and post-WTO accession. We define quantity gap as difference between quantities of exports of product p reported at time t by the exporting country k and quantities of imports reported by the importing country c :

$$\text{Quantity gap}_{kcpt} = \ln(\text{Export quantity}_{kcpt}) - \ln(\text{Import quantity}_{kcpt}) \quad (4)$$

Unlike the unit value gap, the quantity gap will not be affected by exports being reported on f.o.b. basis and imports including the costs of insurance and freight. However, a mismatch in statistics may arise due to transit time (e.g., exporting country may report goods as being shipped in December of year t , while goods may arrive at their destination only in January of year $t+1$) or to countries recording their imports more carefully than their exports. As indicated by the summary statistics, presented in Table 10, the average quantity gap prior to the WTO accession was equal to -12.4% (i.e., on average importing countries reported larger quantities of goods arriving relative to the exporting countries' records). This sign pattern reversed after the WTO accession with the average quantity gap reaching positive 15.7% , which is consistent with underreporting of quantities by importing countries. The difference between the two means is statistically significant.

Table 11 breaks down these averages by the tariff level. After the WTO accession, a large positive quantity gap is observed in products with the above median tariff rate and a small positive quantity gap in products where tariffs are below the median. The difference between the two figures is statistically significant. Before the WTO accession, the gap is positive only in high tariff products. The summary statistics presented so far are quite suggestive of tariff evasion through underreporting of quantities (or outright smuggling) intensifying after the WTO accession.

We argued that the negative quantity gap reported before the accession may be due to importers tracking imports very carefully in order to collect duties, an incentive that is absent in the case of exporters tracking their exports. But there is another possible explanation for the negative quantity gap—product misclassification. Importers may misrepresent the product code in order to benefit from a lower tariff rate that applies to a different, but similar, product. To see whether the data support this possibility we present summary statistics for the quantity gap disaggregated in two ways: (i) by own tariff being above or below the median tariff for the country-year combination; and (ii) by own tariff being above the average tariff on similar products (where similar products are defined as products within the same 4-digit HS code). If the tariff on product p is lower than the tariff on similar products, importers have an incentive to misclassify other products by pretending that they are importing product p . This would skew the data towards imports of product p being overreported and the quantity gap being smaller or negative.

The results, presented in Table 12, are consistent with both underreporting of quantities and product misclassification. The quantity gap is always larger for products with a high own tariff than for products with a low own tariff (column 1 versus column 2), and the difference between the figures is statistically significant. This pattern is in line with underreporting of quantities or outright smuggling. The figures reported in column 2 suggest that the quantity gap is negative (i.e., imports are overreported) if the own tariff rate is low. This is especially true if the tariff on similar products is high and thus the incentive to misclassify is large. The difference between the two figures in the first column is statistically significant.²⁹

Now we turn to the econometric evidence. We estimate a specification analogous to Eq. (2) with the quantity gap as the dependent variable and present results in the top panel of Table 13. In none of the specifications do we find a statistically significant relationship between the quantity gap and the tariff rate in the pre-WTO period. The most intriguing is, however, the finding of a positive and statistically significant relationship between underreporting of quantities and the tariff rate in the post-accession period in four of five specifications. The magnitude of the estimated effect is quite large as it suggests that a 10 percentage point increase in the tariff rate is associated with a 10.7%

²⁹ In our exercise we assumed that it is easier to misclassify products within the same 4-digit product group. This does not need to be the case and could explain the existence of a negative quantity gap in cases where the tariff on product p is higher than the average tariff on similar products.

larger quantity gap (based on the estimates from column 4).

Next we look for evidence of evasion through misclassification of goods. We do so by adding an additional variable, tariff on similar products, to our model. More specifically, we control for the average weighted tariff in the same 4-digit HS category. The rationale for this exercise is that lower tariffs on similar products make it more attractive for dishonest importers to misclassify their products into a lower tariff category. We allow for the effect of the new variable to vary with the WTO accession. As can be seen in the lower panel of Table 13, we find the expected sign on the variable of interest. The estimated coefficient is statistically significant in all regressions in the pre-accession period and in the two of five specifications in the post-accession period. Strikingly, the magnitude of the effect more than doubles with the WTO accession.

The results presented in this section are consistent with tariff evasion through underreporting of quantities (or outright smuggling) and product misclassification worsening after the WTO accession. These findings are in line with a simple model, presented in Section D of the Online Appendix, which predicts that an increase in the costs of evasion through one method may induce importers to switch to another method of evasion.

6. The overall effect

So far our study has documented two opposing effects of WTO accession. We have argued that on the one hand taking away discretion of customs officials with respect to assessing prices of imported goods has resulted in lesser underreporting of prices. On the other hand, we have found evidence consistent with greater evasion of import duties following entry into the WTO through underreporting of quantities (or outright smuggling) and product misclassification. But what is the overall effect?

To examine this question, we focus on the trade value gap, or discrepancy in total value of trade (i.e. price \times quantity), as reported by the exporting country c and the importing country k pertaining to product p at time t . In other words, we ask whether “more trade goes missing” in higher tariff categories in the aftermath of the WTO accession.

We estimate our baseline specification from Eq. (2), but we replace the dependent variable with the trade value gap. The results, presented in Table 14, confirm the offsetting power of the two channels of tariff evasion. While the estimated coefficient on the tariff rate is positive and statistically significant at the one percent level, the coefficient on the interaction term is not statistically significant in any specification. Thus we conclude that WTO accession does not seem to have an impact on the overall level of tariff evasion. This is to be expected, as reducing corruption or combating evasion is not a condition for membership. Neither is it included in any obligations imposed on WTO members.

7. Conclusions

Our study documents an unintended consequence of the WTO accession process. We argue that implementation of Article VII resulted in limiting discretion of customs officials in terms of assessing unit values of goods. While prior to the WTO accession, they were free to use their judgement or to apply minimum or reference prices, after their country joined the WTO they were mandated to accept the invoice issued by the exporter. This limited the scope for negotiation between importers and customs officials and their ability to misrepresent import prices. This institutional reform has thus effectively shut down one channel of import duty evasion. Dishonest importers have responded by more heavily relying on alternative evasion channels, such as undercounting quantities and product misclassification.

To test our hypotheses we use data on 15 countries which joined the WTO between 1996 and 2008. We find a positive relationship between underreporting of prices in the importing country and its tariff rate

prior to the accession. This relationship disappears after the country joins the WTO. However, at the same time we find that removing the opportunity to underreport prices has induced importers to underreport quantities. More specifically, we find that in the post-accession period there is a positive and statistically significant relationship between underreporting of import quantities and the tariff rates. Further, the data suggest that the relationship between tariff on similar products and underreporting quantities becomes stronger after the accession suggesting greater extent of product misclassification. Thus our evidence is consistent with closing one avenue for tariff evasion leading importers to find alternative ways of avoiding duty payments.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jdeveco.2016.11.001.

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