Centre International pour la Fiscalité et le Développement
International Centre for Tax and Development
ICTD

Working Paper 62

Using Internal and External Sources of Information to Reduce Customs Evasion

Cyril Chalendard

January 2017

www.ictd.ac

UKaid from the British people

Norad

ICTD Working Paper 62

Using Internal and External Sources of Information to Reduce Customs Evasion

Cyril Chalendard

January 2017

Using internal and external sources of information to reduce customs evasion
Cyril Chalendard
ICTD Working Paper 62
First published by the Institute of Development Studies in January 2017

ISBN: 978-1-78118-347-2

Available from:
The International Centre for Tax and Development at the Institute of Development Studies, Brighton BN1 9RE, UK
Tel: +44 (0) 1273 606261
Email: info@ictd.ac.uk
Web: www.ictd/en/publications

Using internal and external sources of information to reduce customs evasion

Cyril Chalendard

Summary

This paper aims to identify some factors that reduce evasion of customs duties in developing countries. Following the recent literature on customs evasion, we proxy customs fraud by discrepancies in bilateral trade statistics. Estimates first show that the more frequently a product is imported, the more customs fraud reduces. We argue that this result is indicative of the fact that customs officers use what they have learned from similar import declarations – use customs' internal information – to better assess the compliance of declarations. Then, we show that relying on an information provider – a pre-shipment inspection company in our case – seems to increase tax enforcement. Results indicate that pre-shipment inspections significantly reduce observed discrepancies in trade statistics. In line with previous studies, we find that the semi-elasticity of evasion increases with the tax rate. Finally, estimates confirm that enforcement is product-varying. Results are robust to various robustness checks.

Keywords: use of internal information; external information acquisition; customs enforcement; tax evasion; pre-shipment inspections.

Cyril Chalendard holds a PhD in Development Economics from CERDI, France. He has worked for several international organisations, including the World Bank and World Trade Organization. He has been a visiting scholar in customs authorities in West Africa, Central Africa and Latin America. His research areas include customs risk management, tax evasion, trade facilitation and profit shifting.

Contents

Figures

Acknowledgements

Support from the International Centre for Tax and Development (ICTD) and the French government's *Programme d'Investissements d'Avenir* (ANR-10-LABX-14-01) is gratefully acknowledged. I also wish to thank two anonymous referees, Emmanuel Brunet-Jailly, Thomas Cantens, Céline Carrère, Vianney Dequiedt, Marcellin Djeuwo, Anne-Marie Geourjon, Hubert Kempf, Bertand Laporte, Luc Leruth, Marcelo Olarreaga, Patrick Plane and Martha Tesfaye Woldemichael (in alphabetical order) for their useful comments/discussions. Finally, I would like to thank participants at the 10th Annual World Customs Organization Picard conference, and the 4th Annual TARC Workshop. The responsibility for all interpretations and conclusions expressed in this article lies solely with the author.

Acronyms

2SLS	Two stage least squares
ACV	Agreement on customs valuation
IV	Instrumental variable
OLS	Ordinary least squares
PSI	Pre-shipment inspection
RDI	Request for detailed information
ROF	Report of findings
VAT	Value added tax
WTO	World Trade Organization

Introduction

Kleven et al. (2016) stress that tax enforcement is excellent when there is third party reporting. Conversely, they indicate that tax enforcement is weak when there is no reporting of information. The taxpayer has a strong informational advantage in this situation. This is, for instance, the case with taxation of international trade transactions, notably the taxation of imports, as the customs authority does not know what export declaration was made by the exporting company at the country of embarkation.[1]

Customs authorities are continually seeking quality information to offset the informational advantage of the importer. In practice paper trails do not help the customs officer, as supporting documents are often forged.[2] Yet, the authority can rely on other information sources (internal or external) to estimate accurately the transaction value. Customs may infer the value from previous import declarations – using their internal information to assess the compliance of the declaration. Alternatively, customs can acquire information through the implementation of a pre-shipment inspection (PSI) programme. For this, the government enters into a contract with a private information provider, a PSI company.

Since trade taxes – tariffs, excises and import value added tax (VAT) – continue to account in sub-Saharan African countries for a significant part of their tax revenue (see Chalendard 2016), reducing the information asymmetry between the importer and the customs authority is of vital importance in these economies. Using a customs database from a representative sub-Saharan African country (named Country A[3]), with unusually detailed information on import transactions (see Section 3), this paper aims to discuss to what extent the use of internal information and the implementation of PSI programmes may support customs in their fight against fraud.

Following Bhagwati (1964)'s approach, we proxy mis-reporting by discrepancies in mirror trade statistics – the difference between the export value and import value. Each observation is at the HS-6 product-trade partner level. Our key variables of interest are (i) the number of import declarations, and (ii) the pre-shipment inspection frequency. While the first aims to proxy the internal information available, the latter aims to quantify the acquired external information. Estimates indicate that 1 per cent increase in the number of import declarations leads to a reduction of approximately 0.4 per cent in discrepancies in trade statistics. The more a product is imported, the more customs fraud is reduced. As the customs risk analysis system does not exploit historical data – the information contained in previous import declarations – we argue that this negative correlation is indicative of the fact that in the field customs officers infer the transaction value of a specific product from the declared value of similar products previously imported. As in Javorcik and Narciso (2008), we find that enforcement is product-varying. Estimates also confirm that higher taxes trigger more customs evasion.

---

1 To improve communication between customs, the World Customs Organization has recently launched the Customs Enforcement Network digital platform. For more details on this, see Han and McGauran (2014).

2 On the relationship between information trails and enforcement, see Pomeranz (2015); Almunia and Lopez Rodriguez (2015); Bachas and Jensen (2014).

3 The country's name is kept confidential as the study provides useful information for tax evasion purposes on the risk management system of local customs. Country A has direct access to the sea (most imports pass through seaports), and, as in many African countries, Country A government's budget continues to rely heavily on revenue from border collection. The assessment of the customs value remains problematic, as in other African countries - see e.g Zake (2011); Montagnat-Rentier and Parent (2012). This is why the government (of country A) considers relying on the PSI services of a private company is still useful.

Regarding the external information source, the analysis indicates that PSIs significantly reduce evasion. Results show that 1 per cent increase in the frequency of PSIs results in a 0.7 per cent decline in discrepancies in trade statistics. Given that PSI services are not free, only a cost-benefit analysis (not carried out in this paper)[4] would allow us to draw any conclusions concerning the effectiveness of PSI.

The interaction variable between our proxy quantifying the internal information available (the number of import declarations) and the quantity of external information acquired (the PSI frequency) is not significant. This lack of significance supports the hypothesis that the importer adjusts their declaration to the value estimated by the PSI company (legal practice).

To address the potential endogeneity issue of PSIs, we use instrumental variable (IV) techniques. Given our unit of analysis (HS6 product-partner level) and the fact that we rely on administrative data, it is hard to find a valid instrumental variable. Nevertheless, we argue that the rate of import operations handled by a specific customs clearance office – called Office #1– seems to be a fairly good instrument. Office #1 is the main customs clearance office of the main seaport of Country A.[5] Its activity does not rely on any risk analysis. Interestingly, the customs office is fully specialised in the clearance of containerised imports for home use. As a consequence, Office #1 clears goods (i) for which there is an incentive to cheat – contrary to other customs procedures (temporary admission, inward processing, outward processing, etc.) taxes are charged for imports for home use, and (ii) for which there exists an ability to cheat – compared to bulk imports, cheating is easier when imports are containerised. Thanks to a recent customs reform, different customs offices now perform at a similar level. Enforcement, therefore, does not vary between customs offices.[6] This implies that importers that try to cheat have no incentive to strategically import through a specific customs office in order to escape taxes and duties. Put differently, this means it is unlikely that the fact that imported goods are released by Customs Office #1 has a specific effect on non-compliance. Our instrument is highly significant in the first stage regression. Although IV estimates confirm the bias (the coefficient is double), other results remain largely unchanged. Results also hold to the inclusion of trade partner dummies, HS-2 industry dummies or HS-2 industry-trade partner dummies. Finally, note that findings are robust to a series of additional robustness checks, such as using an alternative measure of underreporting, using an alternative measure of the quantity of internal information available, and numerous changes in the sample size.

The paper refers to the tax compliance literature.[7] The benchmark economic approach of modelling tax non-compliance has been pioneered by Allingham and Sandmo (1972). Basically, the rational taxpayer evades if the benefits of non-compliance exceed the expected costs (the tax adjustment and fine). Compliance arises because of the fear of detection and punishment. Since evasion depends on the level of tax enforcement, a number of studies endogenise the probability of detection. Fack and Landais (2016) empirically and theoretically find that the elasticity of non-compliance is highly sensitive to the level of enforcement. Regarding corporate tax compliance, Almunia and Lopez Rodriguez (2015) highlight that firms react positively to stricter tax enforcement. As stressed by Kleven et al. (2011), enforcement also depends on the type of income. They notably find that third party reporting is an effective way to reduce evasion. Yet, Carrillo et al. (forthcoming) underline that firms, especially in developing countries, may find some alternative tax evasion methods

[4] A justification is available upon request.

[5] A large part of imports arrive through the main seaport.

[6] Except for land border offices. A robustness check addresses the concern related to the (informal) trade across land borders.

[7] For a review, see e.g. Andreoni et al. (1998); Slemrod and Yitzhaki (2002); Sandmo (2005); Saez et al. (2012); Hashimzade et al. (2013).

in response to their inability to cheat on third party reported income. In particular, they show that under a weak enforcement environment relying on third party information may ultimately have no (positive) impact on corporate tax revenue because of adjustments on less verifiable costs.

Our work contributes to the emerging empirical literature on customs compliance. Customs evasion is typically proxied by discrepancies in mirror trade statistics.[8] Evasion appears to be greater in countries where the rule of law is limited (see Jean and Mitaritonna 2010), and the level of corruption is high (see Fisman and Wei 2009). Fisman and Wei (2004)'s results are consistent with the conjecture that enforcement is invariant to the tax rate. The role of entrepot trade in facilitating evasion has been empirically studied (Fisman et al. 2008). In sub-Saharan Africa, the role of Benin, Togo and the Gambia for unofficial transit trade has been stressed (Golub 2012). Customs evasion is facilitated by international networks (Rotunno and Vézina 2012). Supporting the argument that efficient border management highly depends on border point characteristics (e.g. the existence of suitable secure infrastructure and advanced computerisation), Mishra et al. (2008) find that the elasticity of evasion varies by the mode of entry of goods (airport, seaport or land port). Finally, it has been largely stressed that enforcement depends on intrinsic characteristics of products (see e.g. Javorcik and Narciso 2008).

The remainder of the article is structured as follows. Section 1 presents information sources. Section 2 describes our measure of underreporting and the empirical approach. Section 3 describes the data and provides some descriptive statistics. Section 4 presents and discusses the results and includes several robustness checks. Concluding remarks are given in Section 5.

1 Presentation of information sources

While firms have private information on the import value, the customs authority does not have information on the true value. In order to determine the truthfulness of the declaration, customs therefore seek reliable information. In addition to the information provided by the mandatory documentation (commercial invoice, bill of lading, etc.), in developing countries customs can rely on two additional information sources – one internal and one external.

1.1 Use of historical data: an internal information source

Examining the efficiency of alternative audit rules (relative vs. fixed), Bayer and Cowell (2009) theoretically show that a response to the problem of hidden information can be using the free information provided by tax returns of competing firms.[9] This finding simply states that, when a firm makes an extremely low (corporate tax) report compared with reports of competing firms, the tax authority should have serious doubts about the truthfulness of the tax return. Further investigations should then be conducted. Adapted to our specific context,

8 The existing empirical literature on customs compliance has mainly tried to estimate how customs compliance responds to taxes. Higher taxes are associated with more evasion. In the seminal work of Fisman and Wei (2004), estimates show that the semi-elasticity of evasion increases with the tax rate for China. Specifically, they find that 1% increase in tariffs increases evasion by about 3%. Customs evasion has also been empirically studied for India (Mishra et al. 2008); North America (Stoyanov 2012); Eastern Europe (Javorcik and Narciso 2008); sub-Saharan Africa (Van Dunem and Arndt 2009; Bouet and Roy 2012; Levin and Widell 2014; Worku et al. 2016); and Tunisia (Rijkers et al. 2015). Finally, note that underreporting of exports may also occur. For instance, Ferrantino et al. (2012) find evidence for underreporting of exports at the Chinese border to avoid paying VAT.

9 Bayer and Cowell (2009) find that the tax authority has a clear advantage in setting up an audit rule to compare competing firms' tax returns – introducing a (relative) rule with an audit probability depending on competing firms' reports, instead of using a fixed rule – using an audit rule specifying a fixed probability of inspection.

their contribution suggests that exploiting the information contained in 'competing' import declarations – previously registered import declarations – may be helpful in assessing the transaction value of an import. If historical data has an informational component, then exploiting this internal source of information would facilitate tax enforcement in customs. The informational advantage of the importer would then be partially offset.[10] Since declarations are secret, the importer has no information on reports made by other importers. Therefore, importers are not able to internalise these (potential) informational externalities unless they collude at the declaration stage.[11]

In sub-Saharan Africa, to the best of our knowledge, no customs authority currently exploits its internal information – historical data – in a systematic and formal way. In particular, no risk analysis system compares new import declarations to previous ones. Nevertheless, as argued below, customs officers in the field may make efficient use of the information provided by previous import declarations.

Customs officers have to determine import compliance. To carry out this difficult task, they may, in addition to analysing supporting documents, draw on their knowledge/prior experience to issue an opinion on compliance. In such a situation, the customs officer uses information that he has learned from similar import declarations to better assess the tax and duties payable. This implies that the more frequently a product is imported, the more difficult it is to underreport. The empirical analysis tries to address this specific question.

1.2 Pre-shipment inspection services: an external information source

1.2.1 Background on PSI programmes

Over fifty countries have experienced PSI programmes since the mid-twentieth century. PSI mainly consists of a set of verification services to assist customs authorities in combating fraud. These services, performed by a private company operating in the exporting country,[12] aim to provide an opinion on the main characteristics (value, quantity, classification, etc.) of the shipment after completing an inspection. For carrying out this activity, the surveillance company usually charges between 0.5 per cent and 1.05 per cent of the free-on-board (f.o.b) value of inspected merchandise, with a minimum amount. Fees are paid either by the contracting government or the importer. Finally, note that PSI contracts and PSI activities are regulated by the World Trade Organization (WTO) agreement on PSI, and by the code of practice of the International Federation of Inspection Agencies.

Given that there are several stages, we provide below an overview of a standard import operation. In our case study (Country A), the administrative burden is separated into two distinct (but complementary) procedures: (1) the PSI procedure, and (2) the import customs clearance procedure. The timing of a classic import operation is given below:

PSI process. The PSI process takes place in the country of embarkation. A non-binding completed form – the request for detailed information (RDI) – is sent to the PSI firm's local office. Analysing the supporting documentation and the overall coherence of the RDI, the private company performs preliminary price verification. Then, based on a risk analysis, a proportion of shipments are subjected to a physical inspection.[13] A report of findings (ROF)

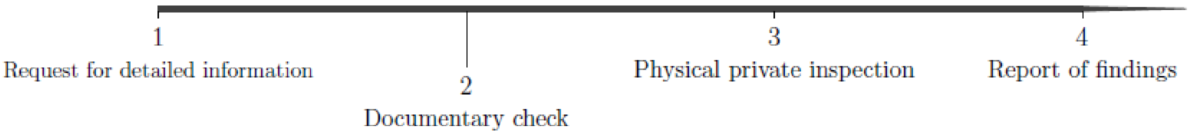
10 Obviously, exploiting the internal information is beneficial if and only if the main characteristics of the product (the value-to-quantity ratio, the unit value and bulkiness) are strongly correlated among import transactions.

11 On this, see Bayer and Cowell (2016).

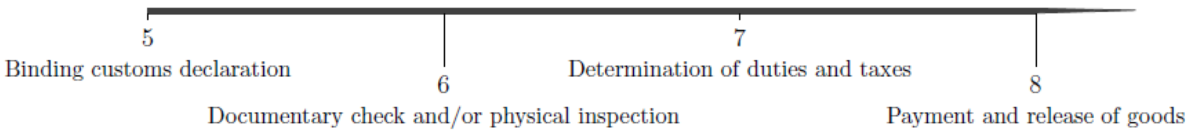
12 The market structure is oligopolistic. Dequiedt et al. (2012) outline that SGS-BIVAC, INTERTEK and COTECNA account for more than 90% of the market.

13 In some countries, goods are always physically inspected (e.g. Ghana and Togo).

stating the estimated customs value, quantities and tariff classification is issued.[14] Notice that the WTO agreement on customs valuation (ACV)[15] stipulates that the ROF can only be used by customs as an advisory document. The PSI process is summarised in the following diagram.



Import customs clearance procedures. When the shipment is at the seaport/airport/land port of destination, the economic operator makes the customs declaration (themselves or by a representative, namely the customs broker).[16] The necessary documents (the bill of lading, the commercial invoice, the ROF, etc.) are filed with customs. Obviously, the PSI-supplied information acts as an incentive for the economic operator to make an import declaration in accordance with the report of findings. Differences may arise in cases of dispute between the importer and the surveillance company, or collusion between the importer and the customs officer.[17] From the results of risk analysis,[18] a documentary check and/or a physical inspection may be carried out. Using the ACV methodology and the customs code, the key objectives of honest customs officers are then: (i) to correctly assess the customs value (unit price and quantities), and (ii) to verify the classification of goods. Based on the inspector's report, customs announce the amount of taxes and duties, and eventually penalties, to be paid.[19] Once payment is complete, goods are released. The following diagram summarises the main steps in customs clearance.



1.2.2 The efficiency of PSI services: an open question

Existing research on the evaluation of PSI programmes does not provide a clear response (see De Wulf and Sokol 2005; McLinden et al. 2011). Anson et al. (2006) studied four PSI programmes. The results are mixed. Their empirical results suggest that PSI may have no impact (Indonesia), reduce fraud (Philippines) or increase fraud (Argentina). Jean and Mitaritonna (2010) also find a heterogeneous effect. In particular, their results indicate that PSI programmes seem to be less efficient in least developed countries. Low (1995) argues that success depends on the details of the PSI contract. Yang (2008a) stresses that PSI programmes may create new forms of fraud, rather than curbing it. Studying the Philippines' PSI programme, he shows that importers adapted their behaviour and found alternative ways to evade duty following the introduction of PSIs. By splitting up shipments to get a shipment's value below the minimum value threshold, or by importing via a duty-exempt export processing zone, bad practices continued. Nonetheless, switching to alternative methods became much more complex as corrective measures were set up. Finally, Yang (2008b)

---

[14] The classification of goods is usually determined according to the harmonised system of classification issued by the World Customs Organization. For the sake of brevity, complaints and appeals procedures are not detailed in this paper.

[15] Available at <https://www.wto.org/english/docs_e/legal_e/20-val_01_e.htm>.

[16] For further details on the declaration processing, see e.g. Keen (2003); Martincus et al. (2015); Fernandes et al. (2015).

[17] See Dequiedt et al. (2012).

[18] For more details on modern risk analysis techniques, see e.g. Geourjon and Laporte (2005, 2012).

[19] The customs inspection may fail to detect fraud - see e.g. Cariolle et al. (2016). Note also that, due to corruption, inspectors' reports are sometimes incorrect - see e.g. Sequeira and Djankov (2014); Sequeira (2016).

outlines that, on average across countries, PSI programmes are associated with a decrease in underreporting, but these improvements do not appear to persist over time. Thus, PSI programmes may only have a short-term performance-enhancing effect.

2 Empirical strategy

2.1 Measure of underreporting

Our measure of underreporting is the $Trade\ gap$.[20] We define the $Trade\ gap$ as the difference between the value of exports from each trade partner to Country A as reported by each trade partner, and the value of imports by Country A from each trade partner as reported by Country A. The logarithmic form aims to reduce the problem of non-normality of the distribution. Formally, we have:

$$Trade\ gap_{pe} = \ln(Export\ value)_{pe} - \ln(Import\ value)_{pe} \qquad (1)$$

where *Export value*$_{pe}$ is the value of exports of the HS 6-digit product *p* reported by Partner Country *e* to Country A and *Import value*$_{pe}$ is the value of imports by Country A from the Partner Country *e* of the HS 6-digit product *p*. As indicated by Bhagwati (1964), a positive gap reveals an underreporting of imports.[21]

2.2 Baseline specification

2.2.1 Econometric specification

We draw on Fisman and Wei (2004)'s specification. We augment their model by mainly adding (i) our key variables of interest, and (ii) some fixed effects (HS-2 industry - trade partner dummies). The following model is then obtained,

$$Trade\ gap_{pe} = \alpha + \gamma \ln(\#\ imports)_{pe} + \kappa PSI\ frequency_{pe} + \sigma\ Taxes_{pe} + \zeta\ Differenciated\ product_p + D_{ie} + \varepsilon_{pe} \qquad (2)$$

where γ and κ are our key parameters of interest, $Trade\ gap_{pe}$ is the measure of underreporting (as defined in eq.1) and ε_{pe} is the error term. In order to remove potentially omitted variable bias, we include pairwise HS-2 industry-trade partner dummies D_{ie}. These dummies control for all factors – whether observable or unobservable – that are constant over HS-6 products belonging to the same HS-2 industry *i* and coming from the same trade partner *e*. Following Fisman and Wei (2004), we cluster standard errors at the HS-4 digit level to account for potential heteroskedasticity.

2.2.2 Variable quantifying the internal information available: $\boldsymbol{ln}(\#\ \boldsymbol{imports})$

Following Section 1.1, we want to estimate the effect of the number of import declarations (in logarithm) – $\ln(\#\ imports)$ – on evasion.[22] If a negative relationship exists between our product-trade partner varying variable and evasion, it would suggest that the more frequently

[20] See Fisman and Wei, (2004); Javorcik and Narciso (2008); Mishra et al. (2008); Jean and Mitaritonna (2010); Bouet and Roy (2012); Ferrantino et al. (2012); Rijkers et al. (2015); Worku et al. (2016), among others.

[21] The literature typically assumes that export declarations are compliant, since there are no longer taxes on exports.

[22] Notice that one import transaction tallies with one import declaration in our final dataset.

a product is imported, the more difficult it is for an importer to underreport the value of the good. Such an effect would probably not be attributable to the product's intrinsic characteristics because the latter is captured (to a large extent) by HS-2 industry-trade partner dummies and the *Differentiated product* variable (Section 2.2.4). Since the customs risk analysis conducted by the automated clearance system does not exploit historical data, we therefore argue that a negative correlation would suggest that customs officers use information contained in previous import declarations to determine the compliance of declarations. As any import declaration may be inspected in Country A, the informational component of previous import declarations is potentially systematically used.[23] Due to potential large differences in countries' product quality (see e.g. Hallak and Schott 2011), it may be useless to compare the declared value of a product that has to be assessed with the declared value of a similar product coming from another trade partner. For instance, it is likely that obtaining information on the value of Chinese dresses does not really help to assess the value of a French dress. Therefore, our preferred proxy quantifying the available internal information only counts the number of import operations from the exporting country for each HS-6 product (and not from the world). We consider the number of import operations from the world in Appendix A. The information quality associated with this latter variable being probably lower, we expect a smaller negative coefficient.

2.2.3 Variable quantifying the external information acquired: *PSI frequency*

As mentioned in the Introduction, Country A uses the services of an information provider – a PSI company. Bear in mind that, at the point of embarkation, a company's employees have to (i) assess the transaction value, (ii) verify the quantity, and (iii) share their opinion through establishing a report of findings. Additional details of the local contract may be provided upon request. Exploiting the fact that PSIs are not systematic (see Section 2.2), we aim to estimate the relationship between the frequency of PSI and our evasion measure.[24] If the PSI company provides useful information to customs, we expect that undervaluation will be mitigated for observations with high PSI rates. The potential endogeneity issue is discussed later.

2.2.4 Control variables

In our regressions, we control for the import taxation rate and the degree of differentiation of the product.

Import taxation rate. Following Pritchett and Sethi (1994), we use collected taxes – the sum of duties, excises and VAT effectively paid – as our measure of revenue. Divided by the import value, we get the de facto tax rate (variable *Taxes*). De facto means that the rate is calculated from taxes effectively paid, and thus may differ from those mentioned in the customs code. Differences are due to granting preferential treatment. Some minor taxes – the statistical tax[25] and a regional integration tax – are not included, since reliable data is regretfully not available at the HS-6 product level. Note that σ is the semi-elasticity of evasion with respect to taxes. Fisman and Wei (2004) argue that tax differentials may create an incentive to misreport the classification of goods.[26] The misreporting hypothesis is tested by including the average tariff on similar products in the econometric specification.

---

23 Since customs officers are allowed to re-route a declaration from a facilitation channel to an inspection channel in case of suspicion, any declaration may be physically inspected. However, such requests must be duly reasoned in order to prevent malpractice.

24 Note that our final database indicates the fraction of imports submitted to a PSI for each HS6 product-trade partner. For further details, see Appendix C.

25 The statistical tax is a tax imposed to raise customs' administration revenues - see Doe (2006).

26 Chalendard et al. (2016) describe some misclassification techniques.

Degree of differentiation. Mishra et al. (2008) outline that the level of enforcement is product-varying. To capture the degree of differentiation of product, we use the classification of Rauch (1999). Rauch (1999) defines a differentiated product as a good not having a reference price, or not quoted on an organised exchange.[27] We conjecture that, due to the lack of a reference price, assessing the transaction value of differentiated products is much more difficult, which in turn makes deception easier. A higher evasion is thus expected for differentiated products.

2.2.5 Endogeneity issue and potential bias

Evasion may be estimated with measurement errors. Indeed, some discrepancies in trade statistics are due to factors other than tax evasion, such as statistical reasons – difference in (c.i.f - f.o.b) valuation (see Nitsch 2012), exchange rate conversion issues (see Carrère and Grigoriou 2014), unintentional misclassifications (see Jean and Mitaritonna 2010), or weak export control laws (see Stoyanov 2012). However, to the extent that measurement errors in the evasion measure are not related to the error term, the estimator remains unbiased (but less efficient, see Jean and Mitaritonna 2010). In the case of export subsidies granted by the trade partner, over-reporting of exports may arise. Nevertheless, under the reasonable assumption that export misreporting is not related to our independent variables, estimations are not biased.

Country A is a member of a regional integration zone, so a common external tariff rate applies to Country A. The government is thus not able to modify tariffs according to tax evasion. For VAT, the general tax code sets out only two distinct VAT rates –a general rate and a zero rate for basic necessities. Therefore, it is very unlikely that the government determines the VAT rate on the basis of customs evasion.

As regard the PSI variable, the fact that shipments below a minimum value are exempted from private inspection may create an incentive to underreport. Yang (2008a) shows that this exemption was exploited by tax evaders at the beginning of the Philippine PSI programme. The usual strategy consists of declaring a value below the threshold to avoid a PSI. Graphical representations of cumulative distribution function of shipments with a value around the PSI threshold (see Figure 1) suggest that these fraudulent activities are not common. One remaining concern is that an effective PSI risk analysis implies that the riskiest import declarations are inspected more frequently. The *PSI frequency* variable may therefore be affected by the *Trade gap*. In such a situation, the error term ε is correlated with the PSI variable, meaning that the independent and identically distributed (i.i.d.) assumption is violated. Even if descriptive statistics suggest that, prima facie*,* endogeneity seems not to be an actual problem – PSIs are not more frequent for products with a larger gap – we choose to use an instrumental variable approach to deal with this potential reverse causation. Given our unit of analysis (HS6 product-partner level), and the fact that we rely on administrative data, it is hard to find a valid instrumental variable. However, we argue that the fraction/rate of import declarations handled by a specific customs office –Office #1– seems to be a fairly good instrumental variable. This variable varies by HS6-product and trade partner. Office #1 is the main customs clearance office of the main seaport of country A. It is worth mentioning that, according to the shipment's characteristics (notably the type of shipment and the container size), shipments (and so import declarations) are transmitted to the most appropriate customs local office. Guidance criteria are thus exclusively based on technical criteria. This means that Office #1's activity does not rely on any risk analysis. The customs office is fully specialised in the clearance of containerised imports for home use. Office #1 therefore clears goods for which: (i) there is an incentive to cheat – contrary to other customs

[27] Non-differentiated goods are reference priced goods or homogeneous goods - goods traded on an organised exchange. A typical example of a homogenous product is sugar.

procedures (temporary admission, inward processing, outward processing, etc.), taxes are charged for imports for home use; and (ii) there exists an ability to cheat –compared to bulk imports, cheating is easier when imports are containerised. Due to the introduction of performance measurement contracts,[28] performance of the main customs offices is now similar. This implies that cheating importers have no incentive to strategically import through a specific customs office in order to escape taxes and duties. In other words, it is unlikely that the fact that imported goods are released by Customs Office #1 has a specific effect on undervaluation. As a consequence, we argue that enforcement does not vary between customs offices.[29] We therefore conjecture that the proposed instrument seems not to be correlated to fraud.

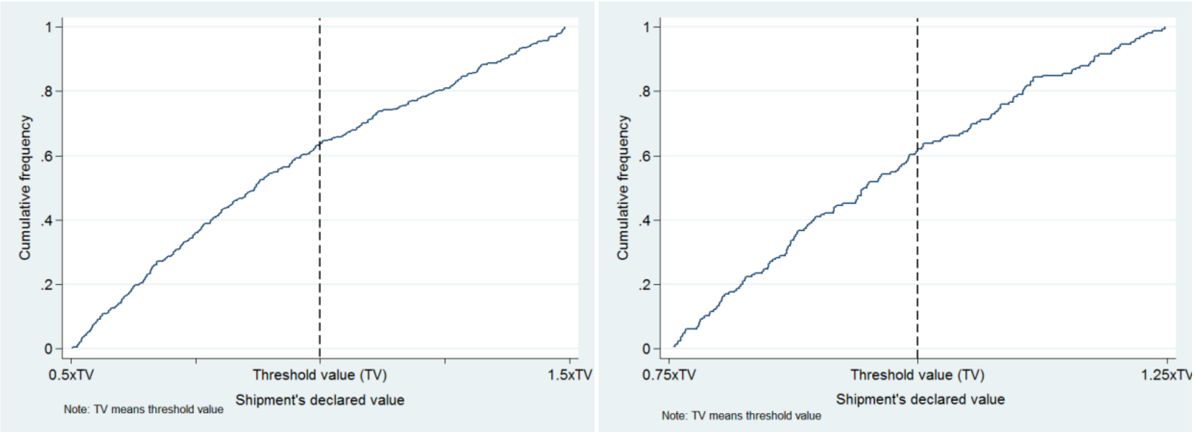


Figure 1 Statistical distribution of shipments with a value close to the PSI minimum value, bandwidths: 0.5 x the minimum value (left) or 0.25 x the minimum value (right)
Observation: Displayed graphical representations are quite linear and distributions have no real peak, suggesting that declaring shipment values below the threshold to avoid PSI is not a common practice.

3 Data and descriptive overview

3.1 Dataset

The dataset is drawn from an export database and an import database. Country-disaggregated export data is provided on an annual basis, and comes from the well-known UN COMTRADE database. Local customs have provided transaction-level import data. Interestingly, each customs declaration provides in-depth information including the HS-11 digit product code, the customs office of entry, the presence of any attached administrative document (the report of findings), the date of registration, the exporting country, the declared value, the declared quantity and the declared weight. The import database is only formed by imports for home use – we have removed from the original dataset (i) transit operations to (landlocked) neighbouring countries, and (ii) temporary admissions. Since export data cannot be disaggregated beyond the 6-digit level, import data has been aggregated on a 6-digit basis. Import values are expressed in the local monetary unit. A conversion into US dollars has been performed using the exchange rate at the date of registration of the declaration. Exchange rate miscalculations are thus reduced. Since we consider the European Union as a single trade partner, the 'Rotterdam effect' – differences in import and export reports due to the transit trade, see Herrigan et al. (2005) – is reduced. Trade partners that do not report

28 For more details on performance measurement contracts, see Cantens et al. (2014).

29 Except for land border offices. Although land border customs offices are less efficient, it is worth mentioning that only 3% of declarations are cleared by a land border customs office. A robustness check addresses the concern related to the trade across land borders.

their exports to UN COMTRADE (e.g. Egypt, Morocco, Nigeria, United Arab Emirates and neighbouring countries) are excluded from the sample. Due to important variations in the local nomenclature used in recent years, our study covers only one year (2013). Main explanatory variables have been obtained from the Information Technology department, local customs. Appendix C provides a full list of variables, definitions and sources.

In order to assess the quality of our database, we rely, as Mishra et al. (2008), on the match rate between imports and exports. This ratio is defined as the number of observations for which a non-zero export and a non-zero import are registered, divided by the total number of observations (unit of analysis: HS6 product-trade partner level). The average match rate is quite large (66 per cent) indicating that data seems to be reliable.[30] The rate is slightly higher than in Van Dunem and Arndt (2009) (55 per cent) and Mishra et al. (2008) (65 per cent). Table 1 presents the corresponding match rate for the top ten partners. It is noteworthy that the coverage is particularly strong for the European Union (91 per cent). Non-matched observations are removed from our final dataset. The sample then contains 52 trade partners and 3,085 products. The number of exported HS6 products per country is displayed in Table 6, Appendix A.

Table 1 Match rates across main trade partners

Country name	Share of HS6 products that are in both databases (%)
European Union	91
China	86
United States	87
India	57
South Africa	58
Turkey	52
Japan	81
Taiwan	56
Switzerland	61
Republic of Korea	62

3.2 Descriptive statistics

Table 2 displays the summary statistics of the data used, in which each observation is at the HS-6 product-trade partner level. For dummy variables, the mean is those observations for which the variable is equal to one. Our sample has 8,749 observations. With no evasion, we expect a negative gap due to the c.i.f-f.o.b margin. However, observe that both mean and median of *Trade gap* are positive. This feature supports the hypothesis that tax evasion is quite widespread. Note that these discrepancies are larger than in Tanzania (mean: 0.004, see Levin and Widell 2014) but lower than in Mozambique (mean: 0.290, see Van Dunem and Arndt 2009) and Kenya (mean: 0.724, see Levin and Widell 2014). Finally, observe that over 25 per cent of the discrepancies are negative (p25<0, row 4), suggesting that some factors reduce the ability to cheat.

30 As in Mishra et al. (2008), the average match rate is weighted by the number of traded products.

Table 2 Summary statistics

	Mean	Median	Min	Max	SD	p5	p25	p75	p95	Observation
Ln(Export value)	10.13	10.29	0.00	18.94	2.84	5.08	8.29	12.13	14.50	8,749
Ln(Import value)	9.94	10.06	-1.87	18.81	2.78	5.26	8.08	11.89	14.36	8,749
Trade gap	0.19	0.07	-11.24	11.81	2.24	-3.51	-0.88	1.26	4.05	8,749
PSI frequency	0.64	0.72	0.00	1.00	0.35	0.00	0.36	1.00	1.00	8,749
Ln(# imports)	1.98	1.79	0.00	9.29	1.60	0.00	0.69	3.06	4.96	8,749
Ln(# imports from the world)	4.40	4.43	0.00	9.57	1.78	1.39	3.14	5.75	7.19	8,749
Taxes	0.31	0.29	0.00	6.56	0.23	0.00	0.11	0.49	0.58	8,749
Differentiated product	0.83	1.00	0.00	1.00	0.38	0.00	1.00	1.00	1.00	7,073

Summary statistics for the dependent variable $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$ and for the independent variables. Please refer to Appendix C for a detailed definition of these variables. SD is standard deviation, p stands for percentile in this table. Observations are at the HS 6 product-trade partner level. Such high maximal taxation rate is explained by the presence of products subject to compound tariffs (a combination of ad valorem and specific tariffs). In a robustness check, we exclude from the sample products subject to an administrative value.

The distribution of our measure of underreporting is fairly normally distributed (see Figure 2). Therefore, we can perform a Pearson's correlation to assess the relationship between our dependent variable (*Trade gap*) and our regressors,[31] see Table 3. Prima facie, the number of import operations appears to mitigate underreporting. The correlation coefficient between the proxy for customs fraud and PSIs is not significant. Nevertheless, notice that correlation is not causality, since correlation only quantifies the extent to which two variables go together. The positive and significant linear correlation between *Taxes* and the *Trade gap* supports the hypothesis of tax evasion. Large rates are associated with large gaps. Evasion seems to be more prevalent for differentiated products. Furthermore, Table 3 shows that none of the pairwise correlation coefficients between two explanatory variables are in absolute value greater than 0.8 (the high correlation threshold usually recognised),[32] indicating that there is no multicolinearity between any two explanatory variables. Finally, note that our instrument is strongly and positively correlated with PSI frequency – the Pearson's correlation coefficient is positive (0.701) and significant at 1 per cent, but uncorrelated with the dependent variable – the coefficient (0.015) is not significant at 1 per cent. Thus, the fraction of import declarations handled by the main customs clearance office (Office #1) appears to be a plausible instrument (relevant and exogenous).

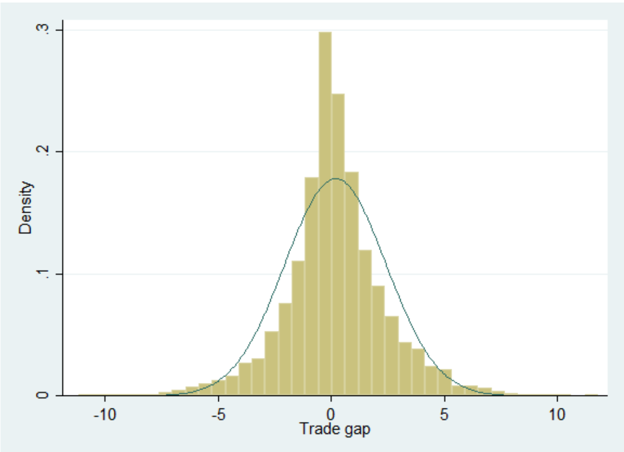


Figure 2 Density distribution of the *Trade gap*

[31] Note that the Pearson's correlation coefficient is a measure of linear relationship. Therefore, a not significant value does not imply that there is no relationship between the variables.

[32] It is usually acknowledged that when the Pearson correlation (in absolute value) is greater than 0.8, the issue of multicolinearity arises.

Table 3 Pearson's correlations

Variable	Trade gap	Taxes	PSI frequency	Ln(# imports)	Differentiated product
Taxes	0.137***	1.000			
PSI frequency	0.007	0.346***	1.000		
Ln(# imports)	-0.224***	0.000	-0.037***	1.000	
Differentiated product	0.040***	0.040***	-0.144***	0.067***	1.000

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$.
(iii) Coefficient is statistically different from zero at the ***1% , **5%, and *10% level. For further details, please see the text.

4 Results and robustness

4.1 Basic results

We estimate Equation 2. The regression results are displayed in Table 4. We use a number of dummy variables to ensure a robust econometric identification. Column (2) includes trade partner dummies. The inclusion of trade partner dummies captures any individual partner characteristic, such as the geographical distance or differences in the quality of export monitoring. Column (3) adds HS-2 industry dummies. Industry dummies D_i take into account the unobserved heterogeneity across industries – determinants of gaps not industry-varying. Column (4) replaces trade partner and HS-2 industry dummies with couple dummies – HS-2 industry-trade partner dummies. Regression 4 is more refined relative to other regressions as it controls for industry-trade partner characteristics.

Effect of our key variables of interest. The negative coefficient on *PSI frequency* suggests that PSIs reduce evasion. The coefficient is quite stable across specifications. Quantitatively, Column (4) indicates that a 1 per cent increase in PSIs leads to a reduction of approximately 0.36 per cent of discrepancies in trade statistics. Notice that this estimated ordinary least squares (OLS) coefficient may be biased due to endogeneity. Two stage least squares (2SLS) estimates highlight that the downward bias is substantial. Although these results per se do not justify contracting with a PSI firm,[33] they show that relying on an information provider seems to reduce the importer's incentive to cheat.

As for the l*n(# imports)* variable, Column (4) outlines that every 1 per cent increase in the number of import declarations results in 0.41 per cent decline in evasion. This estimate is consistent with the hypothesis that customs officers use information they have learned from similar import declarations to better assess the import value. Notice that the magnitude of the coefficient of the (natural logarithm of the) number of import declarations from the world –*Ln(# imports from the world)*– is half (-0.2, see results in Table 9, Appendix A). This result suggests that the informational component of historical data (previous import declarations) seems to increase with the relevance of data used.

Effect of other explanatory variables. Control variables are significant with the expected sign. Clearly, the estimated semi-elasticity of underreporting with respect to taxes is positive and significant. Our estimates outline that 1 per cent increase in taxes (tariff, excise and VAT) leads to about 1.55 per cent increase in evasion, see Column (4).[34] The estimate is

---

33 A cost-benefit analysis would be necessary to draw any conclusions concerning the PSI effectiveness.

34 From eq.2, we get:

$$\frac{\partial Trade\ gap}{\partial Taxes} = \sigma$$

slightly larger than that found for Mozambique (1.38 per cent, see Van Dunem and Arndt 2009) but lower than the estimate of Tanzania (2.36 per cent, see Levin and Widell 2014). The coefficient associated to the *Differentiated product* dummy is significant and positive, indicating that the quality of enforcement is product-varying. This result confirms that cheating is easier when the price is not well known. Enforcement is thus weaker for differentiated products.[35]

Endogeneity issues: IV approach. To address the potential endogeneity of *PSI frequency*, we use the instrumental variable approach. First-stage regression results support the instrument relevance (see Table 7, Appendix A). The coefficient of the instrument is positive and statistically significant at the 1 per cent level. It is noteworthy that *Office #1 frequency* explains about 50 per cent of the variance of the PSI variable. To test the instrument exogeneity, we conduct a statistical test. Precisely, we regress the *Trade gap* on the *Office #1 frequency*. The coefficient is not significant, indicating that it is unlikely that the exclusion restriction is violated.[36]

The results of the IV estimation – second stage regressions – are displayed in Columns (5)-(8), Table 4.[37] The qualitative nature of our results is unaffected. Instrumenting for the potential endogeneity of *PSI frequency*, the magnitude of the PSI coefficient is, as expected and in absolute terms, larger than in the OLS estimations. Specifically, instrumental variable estimations outline that 1 per cent increase in PSIs reduce trade statistics discrepancies by 0.69 per cent, see Column (8), Table 4.

Factors reducing customs fraud: independent, substitute or complementary? To test whether the combination of our two variables of interest is associated with a lower gap, we introduce the multiplicative variable *PSI frequency x Ln(#imports)*. The associated coefficient is not significant. We interpret this result as evidence that the economic operator fully adjusts their import declaration to the report of findings (see timing in Section 1.2). This behaviour explains why PSI-supplied information seems not to be useful for the customs officer. This importer's response is in line with Carrillo et al. (forthcoming)'s findings. Empirical results are omitted due to space, but are available from the authors upon request.

Using eq.1, it yields:

$$\frac{\frac{\partial Import\ value}{\partial Taxes}}{Import\ value} = \frac{\frac{\partial Export\ value}{\partial Taxes}}{Export\ value} - \sigma$$

Observe that, as in Fisman and Wei (2004), this reduced form highlights that increasing taxes may induce a negative value effect – a decline of exports to Country A, see the first term, and a negative compliance effect – the fraction of true imports reported to local customs is reduced, see the second term ($-\sigma$).

Misclassification of imported goods – mislabelling a higher-taxed product as a lower-taxed similar product – may be a useful strategy to evade taxes. To test for misreporting, we follow Fisman and Wei (2004), and we add the average tax rate of the HS-4 digit category as an additional regressor. As in Levin and Widell (2014) for Tanzania, we find no hard evidence of evasion by misclassification within 4-digit classifications (results are not reported but they are available upon request). It suggests that understating import value at customs clearance seems to be the main channel of evasion. Notice that, due to our specific targets, products that illegally enter the territory are systematically excluded from the final sample. Smuggling is therefore not considered in this paper.

35 Contrary to Mishra et al. (2008), the effect of this 'ease-of-enforcement' measure seems to be linear; results are available upon request.

36 For the sake of brevity, results are not reported. They are obviously available upon request.

37 Note that first-stage F statistics – Kleibergen-Paap Wald statistics – indicate that the instrument is not weak. Kleibergen-Paap Wald statistics are much greater than the Stock-Yogo weak ID test critical values of 16.38, suggesting that the assumption of weak identification is rejected. Notice that, in this study of a single endogenous regressor, the Kleibergen-Paap Wald statistics are the heteroskedasticity-robust first-stage F statistics.

Table 4 Basic results: OLS and IV

Variables	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PSI frequency	-0.209**	-0.287***	-0.324***	-0.356***	-0.304*	-0.502***	-0.611***	-0.694***
	(0.106)	(0.101)	(0.114)	(0.134)	(0.163)	(0.170)	(0.190)	(0.206)
Ln(# imports)	-0.316***	-0.419***	-0.417***	-0.414***	-0.316***	-0.420***	-0.417***	-0.414***
	(0.017)	(0.018)	(0.018)	(0.020)	(0.017)	(0.018)	(0.018)	(0.019)
Taxes	1.404***	1.549***	1.486***	1.553***	1.454***	1.653***	1.616***	1.710***
	(0.197)	(0.209)	(0.265)	(0.297)	(0.220)	(0.235)	(0.293)	(0.314)
Differentiated product	0.265***	0.370***	0.149	0.210*	0.251***	0.338***	0.130	0.189
	(0.070)	(0.074)	(0.114)	(0.124)	(0.073)	(0.077)	(0.112)	(0.115)
Constant	0.290***	0.368	0.239	0.578***	0.348***	0.569*	0.0717	1.514***
	(0.103)	(0.315)	(0.315)	(0.148)	(0.124)	(0.338)	(0.420)	(0.197)
Trade partner dummies		Yes	Yes			Yes	Yes	
HS-2 industry dummies			Yes				Yes	
Couple dummies				Yes				Yes
Estimator	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Observations	7,073	7,073	7,073	7,073	7,073	7,073	7,073	7,073
R-squared	0.071	0.119	0.135	0.266	0.071	0.119	0.134	0.264
Adjusted R-squared	0.071	0.113	0.117	0.158	0.071	0.112	0.116	0.156

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) Couple dummies: HS-2 industry-trade partner dummies.
(vi) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

4.2 Robustness tests

4.2.1 Preliminary sensitivity analysis

As discrepancies in bilateral trade data may be due to measurement errors rather than customs fraud, we run regressions including only observations with large gaps – observations for which the discrepancy accounts for, in absolute value, more than 5 per cent, 10 per cent, 15 per cent, 20 per cent, or 25 per cent of the export value. Estimated coefficients remain essentially unchanged. Regression results are given in Table 8, Appendix A.

4.2.2 Robustness checks using alternative proxies quantifying the internal information available

Use of a proxy independent of the cif-fob ratio. Since exports are expressed f.o.b and imports are expressed c.i.f, interpretations so far have been based on the assumption that the number of import operations does not impact the $\frac{cif}{fob}$ *factor i.e,* $\frac{\partial \frac{cif}{fob} factor}{\partial Ln(\#\ imports)} = 0$. Yet, it cannot be ruled out that the number of import operations affect transport costs. In particular, in a situation where importers voluntarily choose to split purchases into many transactions/shipments – due to liquidity constraints, for instance – transport costs are then (probably) larger. This, in turn, would imply a smaller *Trade gap*.

Equation 3 outlines that the derivative of the *Trade gap* is the sum of derivatives of (i) the *Quantity gap*, (ii) the *Unit value gap* and (iii) the $\frac{cif}{fob}$ *factor*; with $Quantity\ gap = \ln(\frac{Exported\ quantity}{Imported\ quantity})$ and $Unit\ value\ gap = \ln\left(\frac{\text{Exported unit value}_{fob}}{\text{Imported unit value}_{fob}}\right)$.[38]

$$\frac{\partial Trade\ gap}{\partial Ln(\#\ imports)} = \frac{\partial Quantity\ gap}{\partial Ln(\#\ imports)} + \underbrace{\frac{\partial Unit\ value\ gap}{\partial Ln(\#\ imports)} + \frac{\partial \frac{cif}{fob}\ factor}{\partial Ln(\#\ imports)}}_{\frac{\partial Ln(\frac{Exported\ unit\ value_{fob}}{Imported\ unit\ value_{cif}})}{\partial Ln(\#\ imports)}} \quad (3)$$

As stressed above, if a relationship between *Ln(# imports)* and the $\frac{cif}{fob}$ *factor* exists, then the estimated marginal effect differs from the specific impact of the number of import declarations on underreporting. To overcome this potential problem, we wish to use a not $\frac{cif}{fob}$ *factor*-varying dependent variable. To this end, we focus on discrepancies in volume.[39] Given that the unit of measurement for the supplementary quantity is product-varying (item, litre, meter, etc.), we use the net weight – always expressed in kilograms – as our quantity variable. Following the *Trade gap*, we define the *Weight gap* as follows: $Weight\ gap = \ln(Exported\ weight) - \ln(Imported\ weight)$.

Based on Equation 2, the following equation is then estimated:

$$Weight\ gap_{pe} = \alpha_w + \gamma_w \ln(\#\ imports)_{pe} + \kappa_w PSI\ frequency_{pe} + \sigma_w\ Taxes_{pe} + \zeta_w\ Differenciated\ product_p + D_{ie+}\ u_{pe} \quad (4)$$

where u_{pe} is the error term and subscript *w* stands for the *Weight gap* specification.

Assessing accurately the quantity may be a difficult task, especially when goods are containerised and/or in case of large shipments. Accumulating information, knowledge about the usual weight and the usual bulkiness may therefore help the customs officer in determining quantities imported. Thus, we expect that γ_w<0. Given that PSI companies have to produce a detailed assessment of quantities shipped, a negative relationship between the *PSI frequency* and underreporting of quantities is also expected.

Table 5 displays the results. The coefficient on the *Ln(#imports)* variable slightly changes. Results also reiterate the role played by PSIs in reducing underreporting. Furthermore, estimates highlight that quantity-based evasion increases with taxes. As observed in previous estimations (see Table 4), when we include HS-2 industry dummies, the coefficient associated with the product differentiation variable is not significant due to a lack of intra-industry variability.

---

38 The proof is available upon request.

39 Bear in mind that, by definition, cheating on the total value implies cheating on the volume (quantity) and/or on the unit value (as *total value=quantities x unit value*).

Table 5 *Weight gap* as an alternative dependent variable

Variables	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PSI frequency	-0.491***	-0.509***	-0.615***	-0.661***	-0.702***	-0.750***	-1.081***	-1.218***
	(0.107)	(0.112)	(0.122)	(0.146)	(0.178)	(0.186)	(0.202)	(0.230)
Ln(# imports)	-0.337***	-0.420***	-0.418***	-0.414***	-0.338***	-0.421***	-0.417***	-0.414***
	(0.019)	(0.022)	(0.022)	(0.024)	(0.019)	(0.022)	(0.022)	(0.022)
Taxes	0.536***	0.680***	0.429**	0.418**	0.645***	0.795***	0.638***	0.673***
	(0.154)	(0.161)	(0.183)	(0.202)	(0.175)	(0.184)	(0.216)	(0.231)
Differentiated product	-0.306***	-0.189**	-0.074	0.023	-0.337***	-0.225***	-0.104	-0.013
	(0.083)	(0.084)	(0.127)	(0.139)	(0.086)	(0.087)	(0.125)	(0.130)
Constant	0.767***	1.062***	0.608**	2.505***	0.899***	0.606***	-1.752	-1.215
	(0.116)	(0.278)	(0.286)	(0.171)	(0.146)	(0.198)	(2.008)	(1.978)
Trade partner dummies		Yes	Yes			Yes	Yes	
HS-2 industry dummies			Yes				Yes	
Couple dummies				Yes				Yes
Estimator	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Observations	6,836	6,836	6,836	6,836	6,836	6,836	6,836	6,836
R-squared	0.053	0.084	0.114	0.243	0.053	0.083	0.112	0.240
Adjusted R-squared	0.053	0.077	0.095	0.131	0.052	0.076	0.093	0.128

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Weight\ gap = \ln(Exported\ weight) - \ln(Imported\ weight)$.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) Couple dummies: HS-2 industry-trade partner dummies.
(vi) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Use of an alternative proxy. In this subsection, we wish to test the robustness of our findings to the use of an alternative proxy aiming to quantify the internal information available. We use a less disaggregated variable. Specifically, we use the number of trade partners exporting the HS6-product to Country A. This novel proxy also aims at capturing the customs officer's knowledge of the product. The underlying assumption is that, the more an HS6-product is exported by a large number of trading partners, the more the customs officer has information on the product's characteristics (e.g. the usual unit value, the usual unit weight, etc.). Not surprisingly, this variable is highly correlated with the number of import declarations from the world.[40] Figure 3 illustrates the strong uphill positive relationship. Results confirm previous findings, see Columns (1)-(2), Table 10, Appendix B. Estimates outline that the entry of a new supplier country lowers underreporting by 3.2 per cent (see Column 2, Table 10, Appendix B).

[40] The Pearson's correlation coefficient between these two variables is high and positive (0.867) and significant at 1%. The correlation coefficient between the number of import declarations from the trade partner (in logarithm) and the number of exporting countries is also positive (0.236) and significant at 1%.

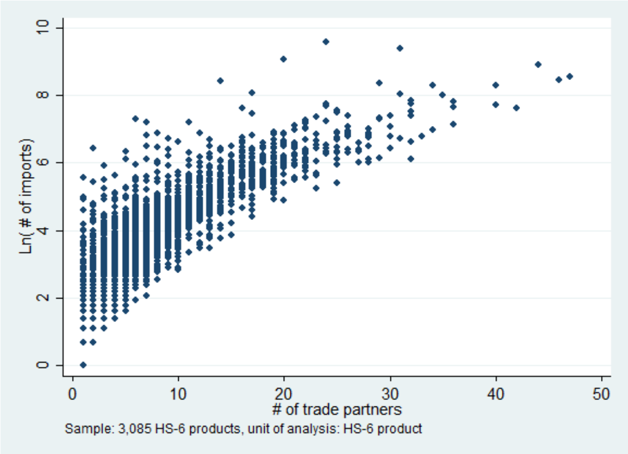


Figure 3 A positive relationship between the # of exporting countries and the (ln)# of imports from the world

Overall, these various robustness checks indicate that there is a negative association between our proxies quantifying the internal information available and tax evasion. We argue that this relationship is due to the fact that officers exploit customs' internal information (use their prior experience) to better assess the compliance of import declarations.

4.2.3 Further robustness checks

We validate previous findings through a number of additional robustness checks. Results are reported in Table 10 in Appendix B. In Columns (3)-(4), we use the Rauch classification of goods based on the liberal definition instead of the conservative definition. Next, in order to increase the sample size, we exclude from regressors the differentiation variable (Columns (5)-(6)). As for the *Weight gap* specification, previous findings are also confirmed (see Table 12, Appendix B).

We also check whether results remain robust across various sample restrictions. In Table 11 (Appendix B), the sample is restricted by successively removing (i) products subject to specific tariffs, (ii) HS-2 industries for which customs valuation is typically difficult (worn clothing, textile, mineral fuels, mineral oils, miscellaneous manufactured articles, art, collectors' pieces and antiques)[41] and (iii) potential outliers (first and last 0.05 quantile). Table 13 (Appendix B) presents regression results for the *Weight gap* specification. Estimated coefficients remain essentially unchanged.[42]

A final concern with our empirical estimates is related to intra-regional trade. As neighbouring countries do not report their exports to UN COMTRADE, intra-regional transactions are excluded from the sample. If the biggest tax evaders have a strategy that consists of importing through customs offices where enforcement is quite weak – through land ports – then we underestimate the semi-elasticy of evasion. However, it is noteworthy that implementing such a strategy may actually induce little (or no) benefit since intra-regional transport costs are high due to a lack of road infrastructure and poor trade logistics. To test whether this (potential) tax evasion strategy may change our results, we remove all HS-6 products having been imported at least once through a land border.[43] This sample restriction

---

41 We exclude the following HS-2 chapters: 61, 62, 63, 94, 95, 96, 97.

42 Notice that results also hold to the exclusion of African trade partners, for which reports are probably quite inaccurate. Results are available upon request.

43 Keep in mind that, since informal cross-border trade is not recorded by local customs, we are unfortunately not able to precisely identify HS-6 products coming informally.

yields similar results in terms of magnitude of coefficients and significance levels (see Columns (13)-(14), Tables 11 and 13).[44]

5 Conclusion and policy implications

This micro-level study contributes to the literature on evasion mainly by identifying factors reducing (customs) fraud in developing countries. We first provide suggestive evidence that the more frequently a product is imported, the stronger the tax enforcement. Estimates indicate that 1 per cent increase in the number of import declarations implies a 0.41 per cent decline in evasion. We argue that this negative correlation is indicative of the fact that in the field customs officers use information contained in previous import declarations to determine the compliance of declarations. Further, results show that PSI programmes significantly reduce observed trade statistics discrepancies. These findings are supported by a variety of robustness checks.

From an operational perspective, this paper suggests that revenue-collection authorities should exploit ‘non-usual’ sources of information to improve their performance. In particular, authorities should internalise the inspectors’ experience. To this end, they should modernise their risk analysis system in order to fully exploit the informational component of historical data. This study also shows that relying on an (ideally free) information provider may be a valuable help in reaching the revenue collection target. As stressed by Zucman (2013), in tax matters a powerful free information provider may entail setting up an automatic system to exchange information between customs authorities.

[44] Finally, note that the results also hold to the exclusion of imports from all African countries.

Appendices

Appendix A Supplementary tables

Table 6 Number of observations per country

Country name	# observations	Country name	# observations
Algeria	2	Mauritius	2
Argentina	11	Mexico	38
Australia	15	Namibia	5
Belarus	4	New Zealand	7
Bosnia and Herzegovina	2	Norway	55
Brazil	102	Oman	3
Cambodia	2	Pakistan	30
Canada	197	Peru	6
Chile	7	Republic of Korea	187
China	1,678	Russian Federation	35
Colombia	6	Saudi Arabia	10
Costa Rica	8	Serbia and Montenegro	1
European Union	2,837	Singapore	126
Georgia	1	South Africa	469
Ghana	28	Sri Lanka	6
Guatemala	7	Switzerland	244
Hong Kong	73	Taiwan	115
India	532	Thailand	130
Indonesia	107	Tunisia	92
Israel	26	Turkey	397
Japan	130	United Republic Of Tanzania	7
Jordan	2	United States	711
Kuwait	1	Uruguay	3
Lebanon	128	Vietnam	67
Madagascar	3	Yemen	2
Malaysia	91	Zambia	1

Table 7 First stage regressions

Variables	PSI frequency	PSI frequency	PSI frequency	PSI frequency	PSI frequency
	(1)	(2)	(3)	(4)	(5)
Office #1 frequency	0.634***	0.585***	0.626***	0.579***	0.588***
	(0.017)	(0.022)	(0.022)	(0.017)	(0.018)
Ln'(# of imports)		-0.000	-0.002	0.003	0.001
		(0.003)	(0.004)	(0.002)	(0.003)
Taxes		0.171***	0.179***	0.222***	0.229***
		(0.035)	(0.035)	(0.042)	(0.045)
Differentiated product		-0.036***	-0.028***	-0.010	-0.019
		(0.011)	(0.010)	(0.016)	(0.017)
Constant	0.344***	0.345***	0.409***	0.405***	0.309***
	(0.016)	(0.014)	(0.065)	(0.053)	(0.020)
Trade partner dummies			Yes	Yes	
HS-2 industry dummies				Yes	
Couple dummies					Yes
Estimator	OLS	OLS	OLS	OLS	OLS
Observations	8,749	7,073	7,073	7,073	7,073
R-squared	0.491	0.492	0.518	0.604	0.677
Adjusted R-squared	0.491	0.492	0.514	0.596	0.630

Notes:
(i) Observations are at the HS-6 product-trade partner level
(ii) The dependent variable is *PSI frequency*. Please refer to the Appendix C for a detailed definition.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) OLS is Ordinary Least Squares.

Table 8 Preliminary sensitivity analysis

Variables	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PSI frequency	-0.340**	-0.511***	-0.342**	-0.534***	-0.353**	-0.548***	-0.349**	-0.535***	-0.364**	-0.554***
	(0.137)	(0.188)	(0.140)	(0.194)	(0.146)	(0.199)	(0.151)	(0.204)	(0.155)	(0.209)
Ln(# imports)	-0.426***	-0.412***	-0.438***	-0.424***	-0.451***	-0.436***	-0.470***	-0.454***	-0.484***	-0.468***
	(0.021)	(0.020)	(0.021)	(0.021)	(0.022)	(0.021)	(0.023)	(0.022)	(0.024)	(0.023)
Taxes	1.587***	1.641***	1.599***	1.671***	1.632***	1.700***	1.665***	1.719***	1.694***	1.753***
	(0.310)	(0.289)	(0.319)	(0.299)	(0.334)	(0.311)	(0.348)	(0.321)	(0.362)	(0.334)
Differentiated product	0.230*	0.214*	0.264**	0.246**	0.280**	0.262**	0.260*	0.243*	0.268*	0.250*
	(0.127)	(0.118)	(0.129)	(0.119)	(0.134)	(0.123)	(0.141)	(0.129)	(0.152)	(0.140)
Constant	0.567***	0.665***	0.559***	0.660***	0.568***	0.669***	0.606***	0.718***	0.620***	0.732***
	(0.152)	(0.186)	(0.154)	(0.188)	(0.160)	(0.193)	(0.166)	(0.200)	(0.176)	(0.209)
Couple dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Discrepancies smaller than *x*% are excluded	5%	5%	10%	10%	15%	15%	20%	20%	25%	25%
Estimator	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Observations	6,857	6,857	6,655	6,655	6,439	6,439	6,194	6,194	5,966	5,966
R-squared	0.272	0.245	0.277	0.249	0.280	0.253	0.287	0.259	0.293	0.264
Adjusted R-squared	0.163	0.150	0.166	0.153	0.168	0.155	0.174	0.161	0.177	0.164

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) Couple dummies: HS-2 industry-trade partner dummies.
(vi) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Table 9 Robustness check: Ln(# imports from the world)

Variables	**Trade gap**	**Trade gap**	**Trade gap**	**Trade gap**	**Trade gap**	**Trade gap**	**Trade gap**	**Trade gap**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PSI frequency	-0.235**	-0.343***	-0.383***	-0.392***	-0.298*	-0.604***	-0.704***	-0.755***
	(0.105)	(0.106)	(0.118)	(0.136)	(0.166)	(0.178)	(0.198)	(0.211)
Ln(# imports from the world)	-0.211***	-0.245***	-0.232***	-0.227***	-0.212***	-0.249***	-0.234***	-0.229***
	(0.019)	(0.018)	(0.019)	(0.020)	(0.019)	(0.018)	(0.019)	(0.018)
Taxes	1.487***	1.557***	1.494***	1.537***	1.521***	1.684***	1.641***	1.707***
	(0.201)	(0.218)	(0.280)	(0.304)	(0.223)	(0.249)	(0.313)	(0.323)
Differentiated product	0.466***	0.420***	0.165	0.207	0.458***	0.385***	0.147	0.185
	(0.078)	(0.079)	(0.118)	(0.127)	(0.081)	(0.081)	(0.115)	(0.118)
Constant	0.416***	0.876***	0.819***	0.785***	0.457***	1.136***	0.846**	1.940***
	(0.112)	(0.220)	(0.248)	(0.156)	(0.130)	(0.253)	(0.343)	(0.201)
Trade partner dummies		Yes	Yes			Yes	Yes	
HS-2 industry dummies			Yes				Yes	
Couple dummies				Yes				Yes
Estimator	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Observations	7,073	7,073	7,073	7,073	7,073	7,073	7,073	7,073
R-squared	0.045	0.077	0.094	0.231	0.045	0.076	0.092	0.230
Adjusted R-squared	0.045	0.070	0.075	0.118	0.045	0.069	0.074	0.116

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) Couple dummies: HS-2 industry-trade partner dummies.
(vi) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Appendix B Additional robustness checks

Table 10 Robustness checks, continuation

Variables	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap
	(1)	(2)	(3)	(4)	(5)	(6)
PSI frequency	-0.410***	-0.748***	-0.356***	-0.690***	-0.450***	-0.725***
	(0.136)	(0.210)	(0.134)	(0.206)	(0.115)	(0.176)
Quantity of internal information available	-0.031***	-0.032***	-0.416***	-0.416***	-0.414***	-0.415***
	(0.004)	(0.004)	(0.020)	(0.019)	(0.018)	(0.017)
Taxes	1.475***	1.633***	1.532***	1.687***	1.702***	1.837***
	(0.292)	(0.310)	(0.296)	(0.313)	(0.268)	(0.279)
Differentiated product	0.160	0.142	0.241**	0.229**		
	(0.126)	(0.117)	(0.116)	(0.108)		
Constant	-0.784***	1.545***	2.207***	1.488***	-7.172***	1.630***
	(0.136)	(0.195)	(0.147)	(0.187)	(1.239)	(0.161)
Couple dummies	Yes	Yes	Yes	Yes	Yes	Yes
Alternative internal information variable	Yes	Yes				
Differentiated product: liberal definition			Yes	Yes		
No differentiation variable					Yes	Yes
Estimator	OLS	2SLS	OLS	2SLS	OLS	2SLS
Observations	7,073	7,073	7,073	7,073	8,749	8,749
R-squared	0.222	0.221	0.266	0.265	0.262	0.261
Adjusted R-squared	0.108	0.106	0.158	0.156	0.167	0.166

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$.
(iii) Quantity of internal information available: # of exporting countries (columns (1) and (2) or Ln(# imports) (columns (3)-(6)).
(iv) Standard errors are in parentheses, clustered by HS-4 products.
(v) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(vi) Couple dummies: HS-2 industry-trade partner dummies.
(vii) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Table 11 Robustness checks, restricted sample

Variables	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap	Trade gap
	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
PSI frequency	-0.506***	-0.982***	-0.529***	-0.945***	-0.200**	-0.401***	-0.314**	-0.596***
	(0.127)	(0.198)	(0.132)	(0.209)	(0.090)	(0.146)	(0.145)	(0.216)
Ln(# imports)	-0.393***	-0.393***	-0.399***	-0.400***	-0.255***	-0.255***	-0.441***	-0.439***
	(0.020)	(0.019)	(0.021)	(0.019)	(0.016)	(0.015)	(0.024)	(0.023)
Taxes	2.157***	2.455***	2.171***	2.434***	1.021***	1.116***	1.486***	1.613***
	(0.192)	(0.197)	(0.195)	(0.202)	(0.140)	(0.151)	(0.331)	(0.344)
Differentiated product	0.170	0.136	0.169	0.138	0.178**	0.165**	0.177	0.165
	(0.126)	(0.117)	(0.125)	(0.117)	(0.088)	(0.082)	(0.138)	(0.129)
Constant	-0.376*	1.122***	-9.522***	0.101	1.429***	1.770***	0.671***	1.611***
	(0.192)	(0.151)	(0.912)	(0.155)	(0.105)	(0.113)	(0.166)	(0.221)
Couple dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Excluding specific tariffs	Yes	Yes						
Excluding sensitive HS-2 industry			Yes	Yes				
Excluding first and last 0.05 quantile					Yes	Yes		
Excluding HS6 products imported from a neighbouring country							Yes	Yes
Estimator	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Observations	6,683	6,683	6,226	6,226	6,367	6,367	5,723	5,723
R-squared	0.264	0.261	0.258	0.256	0.232	0.231	0.257	0.256
Adjusted R-squared	0.153	0.149	0.151	0.149	0.111	0.110	0.142	0.141

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Trade\ gap = \ln(Export\ value) - \ln(Import\ value)$.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) Couple dummies: HS-2 industry-trade partner dummies.
(vi) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Table 12 Robustness checks, *Weight gap*

Variables	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap
	(1)	(2)	(3)	(4)	(5)	(6)
PSI frequency	-0.714***	-1.269***	-0.663***	-1.219***	-0.743***	-1.164***
	(0.149)	(0.233)	(0.145)	(0.230)	(0.127)	(0.198)
Quantity of internal information available	-0.029***	-0.031***	-0.413***	-0.413***	-0.414***	-0.414***
	(0.005)	(0.005)	(0.024)	(0.022)	(0.022)	(0.020)
Taxes	0.338*	0.595***	0.422**	0.678***	0.376**	0.580***
	(0.202)	(0.230)	(0.204)	(0.234)	(0.180)	(0.199)
Differentiated product	-0.037	-0.066	-0.015	-0.034		
	(0.140)	(0.130)	(0.148)	(0.140)		
Constant	0.683***	-1.796	2.504***	-1.194	-2.791***	-1.240
	(0.149)	(2.170)	(0.170)	(1.979)	(0.845)	(1.978)
Couple dummies	Yes	Yes	Yes	Yes	Yes	Yes
Alternative internal information variable	Yes	Yes				
Differentiated product: liberal definition			Yes	Yes		
No differentiation variable					Yes	Yes
Estimator	OLS	2SLS	OLS	2SLS	OLS	2SLS
Observations	6,836	6,836	6,836	6,836	8,431	8,431
R-squared	0.207	0.204	0.243	0.240	0.238	0.236
Adjusted R-squared	0.090	0.086	0.131	0.128	0.138	0.135

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Weight\ gap = \ln(Exported\ weight) - \ln(Imported\ weight)$.
(iii) Quantity of internal information available: # of exporting countries (columns (1) and (2) or Ln(# imports) (columns (3)-(6)).
(iv) Standard errors are in parentheses, clustered by HS-4 products.
(v) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(vi) Couple dummies: HS-2 industry-trade partner dummies.
(vii) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Table 13 Robustness checks, *Weight gap*, restricted sample

Variables	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap	Weight gap
	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
PSI frequency	-0.765***	-1.400***	-0.751***	-1.369***	-0.399***	-0.739***	-0.664***	-1.133***
	(0.148)	(0.239)	(0.156)	(0.250)	(0.101)	(0.158)	(0.160)	(0.243)
Ln(# imports)	-0.382***	-0.383***	-0.384***	-0.384***	-0.222***	-0.222***	-0.450***	-0.447***
	(0.023)	(0.022)	(0.024)	(0.023)	(0.018)	(0.016)	(0.029)	(0.027)
Taxes	0.510**	0.905***	0.593***	0.981***	0.194	0.351**	0.440*	0.649**
	(0.219)	(0.235)	(0.228)	(0.245)	(0.132)	(0.139)	(0.228)	(0.255)
Differentiated product	0.021	-0.025	-0.001	-0.046	0.006	-0.019	-0.001	-0.022
	(0.143)	(0.134)	(0.140)	(0.131)	(0.098)	(0.093)	(0.157)	(0.146)
Constant	-0.364**	-1.211	2.475***	1.467***	-2.264***	0.686	0.885***	-1.175
	(0.158)	(1.972)	(0.185)	(0.179)	(0.624)	(1.524)	(0.191)	(1.976)
Couple dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Excluding specific tariffs	Yes	Yes						
Excluding sensitive HS-2 industry			Yes	Yes				
Excluding first and last 0.05 quantile					Yes	Yes		
Excluding HS6 products imported from a neighbouring country							Yes	Yes
Estimator	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Observations	6,451	6,451	6,000	6,000	6,146	6,146	5,523	5,523
R-squared	0.239	0.235	0.234	0.231	0.218	0.215	0.242	0.239
Adjusted R-squared	0.124	0.119	0.123	0.119	0.093	0.09	0.123	0.121

Notes:
(i) Observations are at the HS-6 product-trade partner level.
(ii) The dependent variable is $Weight\ gap = \ln(Exported\ weight) - \ln(Imported\ weight)$.
(iii) Standard errors are in parentheses, clustered by HS-4 products.
(iv) Coefficient is statistically different from zero at the ***1%, **5%, and *10% level.
(v) Couple dummies: HS-2 industry-trade partner dummies.
(vi) OLS is Ordinary Least Squares, 2SLS is Two Stage Least Squares.

Appendix C Variable definitions

Differentiated product: Equals one if the HS6-product is not traded on an organised market or listed in a trade publication. Conservative definition (if not specified). Source: Rauch (1999) classification of goods.

Office #1 frequency: At the HS-6 product-trade partner level, the fraction of import declarations handled by Customs Office #1. Computed from information on the customs office of entry provided by the IT department, local customs.

Export value: Value of exports (US dollars) by the trade partner to country A at the HS 6-digit HS level. The nomenclature is HS 2012. Source: UN COMTRADE.

Import value: Value of imports (US dollars) from the trade partner into country A at the HS 6-digit HS level. Note that values (expressed in local monetary unit) are converted into US dollars using the exchange rate of the day of the import.

Ln(# imports): At the HS-6 product-trade partner level, the Naperian logarithm of the total number of import declarations. Computed from information provided by the IT department, local customs.

Ln(# imports from the world): At the HS-6 product level, the Naperian logarithm of the total number of import declarations (from the world). Computed from information provided by the IT department, local customs.

PSI frequency: At the HS-6 product-trade partner level, the fraction of import declarations in the original database submitted to a PSI. When a PSI is carried out, a report of findings is sent to the local customs service. This document specifies, among others, the total value, the incoterm, the exchange rate and the classification of goods. Information about the presence of a ROF attached to the declaration is provided by the IT department, local customs.

Taxes: Sum of effectively paid taxes – tariffs, excises and VAT – divided by the value of imports. Sources: IT department, local customs.

References

Allingham, M. and Sandmo, A. (1972) ‘Income tax evasion: A theoretical analysis,’ *Journal of Public Economics*, 1(3), 323-338

Almunia, M. and Lopez-Rodriguez, D. (2015) *Under the radar: The effects of monitoring firms on tax compliance*, Warwick Economics Research Paper Series No. 1070, University of Warwick

Andreoni, J., Erard, B. and Feinstein, J. (1998) ‘Tax compliance', *Journal of Economic Literature* 36(2): 818-860

Anson, J., Cadot, O. and Olarreaga, M. (2006) ‘Tariff evasion and customs corruption: Does pre-shipment inspection help ?', *Contribution to Economic Analysis and Policy* 5(1): 1600-1623

Bachas, P. and Jensen, A. (2014) ‘An empirical test of information trails : Do firm finance and size matter for tax collection?', *mimeo*

Bayer, R., and Cowell, F. (2016) ‘Tax compliance by firms and audit policy', *Research in Economics* 70(1): 38-52

—— —— (2009) ‘Tax compliance and firms’ strategic interdependence', *Journal of Public Economics* 93(11): 1131-1143

Bhagwati, J. (1964) ‘On the underinvoicing of imports', *Bulletin of the Oxford University Institute of Economics & Statistics* 27(4): 389-397

Bouet, A. and Roy, D. (2012) ‘Trade protection and tax evasion: Evidence from Kenya, Mauritius, and Nigeria', *The Journal of International Trade & Economic Development* 21(2): 287-320

Cantens, T., Ireland, R. and Revesz, P. (2014) *The Why & How of Performance Measurement Contracts*, World Customs Organization Research Paper Series No. 32

Cariolle, J., Chalendard, C., Geourjon, A-M. and Laporte, B. (2016) *‘Décloisonner l’analyse des données pour appuyer la modernisation des douanes: une illustration à partir du Gabon’*, Ferdi Working Paper

Carrère, C. and Grigoriou, C. (2014) *Can mirror data help to capture informal international trade?*, Policy Issues in International Trade and Commodities Research Study Service No. 65, UNCTAD

Carrillo, P., Pomeranz, D. and Singhal, M. (forthcoming) ‘Dodging the taxman: Firm misreporting and limits to tax enforcement', *American Economic Journal: Applied Economics*

Chalendard, C (2016) *Modernization of revenue collection authorities in developing countries. The case of customs*, Ph.D. Dissertation, CERDI, University of Auvergne

—— Raballand G. and Rakotoarisoa, A. (2016) *The use of detailed statistical data in customs reform: the case of Madagascar*, World Bank Policy Research Working Paper No WPS 7625, Washington DC: World Bank

De Wulf, L. and Sokol, J. (2005) *Customs Modernization Handbook*, World Bank Publications

Dequiedt, V., Geourjon, A-M. and Rota-Graziosi, G. (2012) ‘Mutual supervision in preshipment inspection programs', *Journal of Development Economics* 99(2): 282-291

Doe, L. (2006) *Reforming external tariffs in Central and Western African Countries*, IMF Working Paper WP/06/12, International Monetary Fund

Fack, G., and Landais, C. (2016) ‘The effect of tax enforcement on tax elasticities: Evidence from charitable contributions in France', *Journal of Public Economics* 133: 23-40

Fernandes, A., Hillberry, R. and Mendoza Alcántara, A. (2015) *Trade effects of customs reform : Evidence from Albania*, World Bank Policy Research Working Paper WPS 7210, Impact Evaluation Series, Washington DC: World Bank

Ferrantino, M., Liu, X. and Wang, Z. (2012) ‘Evasion behaviors of exporters and importers : Evidence from the US-China trade data discrepancy', *Journal of International Economics* 86(1): 141-157

Fisman, R., and Wei, S.-J. (2009) ‘The smuggling of art, and the art of smuggling: Uncovering the illicit trade in cultural property and antiques', *American Economic Journal: Applied Economics* 1(3): 82-96

—— —— (2004) ‘Tax rates and tax evasion: Evidence from "missing imports" in China', *Journal of Political Economy* 112(2): 471-496

—— Moustakerski, P. and Wei, S-J. (2008) ‘Outsourcing tariff evasion: A new explanation for entrepot trade', *The Review of Economics and Statistics* 90(3): 587-592

Geourjon, A.-M., and Laporte, B. (2012) ‘Risk management in customs: Initial lessons from experiences in some African countries', *Revue d’Économie du Développement* 20(3): 67-82

—— —— (2005) ‘Risk management for targeting customs controls in developing countries: A risky venture for revenue performance?', *Public Administration and Development* 25(2): 105-113

Golub, S. (2012) ‘Entrepôt trade and smuggling in West Africa: Benin, Togo and Nigeria', *The World Economy* 35(9): 1139-1161

Hallak, J. and Schott, P. (2011) ‘Estimating cross-country differences in product quality', *The Quarterly Journal of Economics* 126(1): 417-474

Han, C.-R. and McGauran, R. (2014) ‘Tracing trails: Implications of tax information exchange programs for customs administrations', *World Customs Journal* 8(2): 3-13

Hashimzade, N., Myles, G. and Tran-Nam, B. (2013) ‘Applications of behavioural economics to tax evasion', *Journal of Economic Surveys* 27(5): 941-977

Herrigan, M., Kochen, A. and Williams, T. (2005) *Analysis of asymmetries in intra-community trade statistics with particular regard to the impact of the Rotterdam and Antwerp effects*, Discussion paper, HM Revenue & Customs

Javorcik, B. and Narciso, G. (2008) ‘Differentiated products and evasion of import tariffs', *Journal of International Economics* 76(2): 208-222

Jean, S. and Mitaritonna, C. (2010) *Determinants and pervasiveness of the evasion of custom duties*, CEPII Working Paper No 2010-26, Centre d'Études Prospectives et d'Informations Internationales

Keen, M. (2003) *Changing Customs: Challenges and Strategies for the Reform of Customs Administration*, International Monetary Fund

Kleven, H., Kreiner, C. and Saez, E. (2016) ‘Why can modern governments tax so much ? An agency model of firms as fiscal intermediaries', *Economica* 83(330): 219-246

—— Knudsen, M., Kreiner, C., Pedersen, S. and Saez, E. (2011) ‘Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark', *Econometrica*, 79(3): 651-692

Levin, J. and Widell, L. (2014) ‘Tax evasion in Kenya and Tanzania: Evidence from missing imports', *Economic Modelling* 39: 151-162

Low, P. (1995) *Preshipment inspection services*, World Bank Discussion Paper 278, Washington DC: World Bank

Martincus, C., Carballo, J. and Graziano, A. (2015) ‘Customs', *Journal of International Economics* 96(1): 119-137

McLinden, G., Fanta, E., Widdowson, D. and Doyle, T. (2011) *Border Management Modernization*, World Bank Publications

Mishra, P., Subramanian, A. and Topalova, P. (2008) ‘Tariffs, enforcement, and customs evasion: Evidence from India', *Journal of Public Economics* 92(10): 1907-1925

Montagnat-Rentier, G. and Parent, G. (2012) *Customs administration reform and modernization in francophone sub-Saharan Africa, 1995–2010*, IMF Working Paper WP/12/259, International Monetary Fund

Nitsch, V. (2012) 'Trade mispricing and illicit flows', in P. Reuter (ed), '*Draining Development? Controlling flows of illicit funds from developing countries*', Washington DC: World Bank Publications

Pomeranz, D. (2015) ‘No taxation without information: Deterrence and self-enforcement in the value added tax', *American Economic Review* 105(8): 2539-2569

Pritchett, L., and Sethi, G. (1994) ‘Tariff rates, tariff revenue, and tariff reform: some new facts', *The World Bank Economic Review* 8(1): 1-16

Rauch, J. (1999) ‘Networks versus markets in international trade', *Journal of international Economics* 48(1): 7-35

Rijkers, B., Baghdadi, L. and Raballand, G. (2015) ‘Political connections and tariff evasion: evidence from Tunisia', *The World Bank Economic Review*, doi: 10.1093/wber/lhv061

Rotunno, L., and Vézina, P-L. (2012) ‘Chinese networks and tariff evasion', *The World Economy* 35(12): 1772-1794

Saez, E., Slemrod, J. and Giertz, S. (2012) ‘The elasticity of taxable income with respect to marginal tax rates: A critical review', *Journal of Economic Literature* 50(1): 3-50

Sandmo, A. (2005) ‘The theory of tax evasion : A retrospective view', *National Tax Journal* 58(4): 643

Sequeira, S. (2016) ‘Corruption, trade costs and gains from tariff liberalization: evidence from Southern Africa', *American Economic Review* 106(10): 3029-3063

—— and Djankov, S. (2014) ‘Corruption and firm behavior: Evidence from African ports', *Journal of International Economics* 94: 277-294

Slemrod, J., and Yitzhaki, S. (2002) 'Tax avoidance, evasion, and administration', in A. Auerbach and M. Feldstein (eds), *Handbook of Public Economics Vol. 3*, Elsevier Science

Stoyanov, A. (2012) ‘Tariff evasion and rules of origin violations under the Canada-US Free Trade Agreement', *Canadian Journal of Economics* 45(3): 879-902

Van Dunem, J. and Arndt, C. (2009) ‘Estimating border tax evasion in Mozambique', *The Journal of Development Studies* 45(6): 1010-1025

Worku, T., Mendoza, J. and Wielhouwer, J. (2016) ‘Tariff evasion in sub-Saharan Africa: The influence of corruption in importing and exporting countries', *International Tax and Public Finance* 1-21

Yang, D. (2008a) ‘Can enforcement backfire? Crime displacement in the context of customs reform in the Philippines', *The Review of Economics and Statistics* 90(1): 1-14

—— (2008b) ‘Integrity for hire : An analysis of a widespread customs reform', *Journal of Law and economics* 51(1): 25-57

Zake, J. (2011) *Customs administration reform and modernization in Anglophone Africa - early 1990s to mid-2010*, IMF Working Paper 11/184, International Monetary Fund

Zucman, G. (2013) ‘The missing wealth of nations: Are Europe and the US net debtors or net creditors?', *The Quarterly Journal of Economics* 128(3): 1321-1364

ICTD

Centre International pour la Fiscalité et le Développement

International Centre for Tax and Development

International Centre for Tax and Development
at the Institute of Development Studies
Brighton BN1 9RE, UK
T: +44 (0)1273 606261
F: +44 (0)1273 621202
E: info@ictd.ac
www.ictd.ac