CHAPTER THREE

TARIFF EVASION IN SUB-SAHARAN AFRICA: THE INFLUENCE OF CORRUPTION IN IMPORTING AND EXPORTING COUNTRIES[5]

Abstract: Multilateral organizations recommend Sub-Saharan African (SSA) countries to increase international trade in order to attain sustainable economic growth. The benefits of trade can be hampered, however, by tariff evasion. Using trade data from 2008-2014 of 31 SSA countries, we examine how the association between tariff rates and value and quantity gaps (which is indicative of tariff evasion) is enhanced by corruption in both importing and exporting countries (SSA countries are referred to as *importing countries*, and their trade partners from outside SSA are referred to as *exporting countries*). Results of a series of tests show that corruption levels in both sides of the trade partnership reinforce the (positive) association between tariff rates and value and quantity gaps. This indicates that both trade partners can influence – and therefore help reduce – tariff evasion in SSA.

[5] This chapter is based on: Worku, T., Mendoza, J. P., & Wielhouwer, J. L. (2016). Tariff evasion in sub-Saharan Africa: the influence of corruption in importing and exporting countries. *International Tax and Public Finance*, 23(4), 741-761. We thank two anonymous reviewers, participants of the 71st Congress of the International Institute of Public Finance, and seminar participants at Vrije Universiteit Amsterdam for useful comments on earlier drafts. We also thank the financial support provided by NUFFIC Netherlands.

3.1. Introduction

The IMF (2015b) identifies international trade as a key determinant of economic and social development in Sub-Saharan Africa (SSA). Moreover, countries in this region are recommended to strengthen tax collection performance and increase tax revenue in order to accelerate growth and reduce poverty (World Bank, 2015). Weak governance and corruption, however, impede the healthy expansion of trade and tax collection in SSA (IMF, 2015; Musila & Sigué, 2010; Sequeira & Djankov, 2013). This study takes these points into consideration and responds to the recent report of Transparency International (2014), which states that there is limited research on how corruption affects tax and customs administration in Africa. We focus on import tariffs, which play a central role in customs administration and revenue collection in SSA. More specifically, we examine how corruption levels in both importing and exporting countries affect tariff evasion in this region (SSA countries are referred to as *importing countries*, and their trade partners from outside SSA are referred to as *exporting countries*).

Fisman and Wei (2004) suggest that tariff evasion takes place when tariff rates correlate with trade gaps (discrepancies between exports reported in exporting countries and imports reported in importing countries). Using this methodology, we investigate whether the corruption levels of *both* trade partners reinforce tariff evasion (whether they strengthen the potential association between tariff rates and trade gaps). Prior studies have examined the independent effects of trade partners' corruption levels on tariff evasion (Javorcik & Narciso, 2008; Jean & Mitaritonna, 2010). To the best of our knowledge, however, the main and interaction effects of the corruption levels of both importing and exporting countries have not been simultaneously studied yet. This research objective is particularly relevant for SSA, where corruption is high, development

benefits directly from trade and tax revenue, and tariffs constitute an important part of government tax revenues. The crucial point is that trade and payment of tariffs involve the dynamic interaction of importers and exporters, and in this sense, tariff evasion may depend not only on the characteristics and actions of the importing country (as policy recommendations may commonly imply). Both trade partners can influence – and therefore help reduce – tariff evasion in SSA.

Building on prior research, we hypothesize that tariff evasion increases as trading partners' incentives, opportunities, and intentions to evade coincide. The incentive to evade is reflected by the tariff rate (Fisman & Wei, 2004). The opportunity to evade is mainly determined by the level of corruption in the importing country, where customs officials can be bribed (e.g., Hors 2001). The intention to evade may be however determined by the corruption levels in both importing and exporting countries, which to some extent reflect the way in which trade partners associate and conduct business together. Indeed, prior research suggests that either partner can engage in bribing activities (Musila & Sigué, 2010), and corruption can be contagious so that it spreads across business relations (Ashforth & Anand, 2003; Goel & Nelson, 2007).

In order to conduct a robust analysis of the reinforcing effect of corruption on the tariff-gap association, we use import data of 31 SSA countries (SSA countries for which trade and tariff data is available)[6], and corresponding export data of 38 non-African countries, over a period of 7 years (2008-2014). The results of a series of tests provide strong support for our hypothesis. The interaction between (i) tariff rate, (ii) corruption in the importing country, and (iii) corruption in the exporting country is positively and significantly associated with the trade gap. These findings go in line with the idea that tariff evasion is reinforced by the corruption levels in both countries.

[6] These 31 countries represent 81% of the GDP of SSA.

The contribution of our study is twofold. First, we investigate the effect of corruption on tariff evasion in SSA a region that greatly depends on international trade and tariff revenues in order to reduce poverty and attain sustainable economic development. It is also a region which has a relatively weak law enforcement capacity. Second, we provide evidence indicating that tariff evasion is driven by corruption in both countries, and more precisely, that their effect is reinforcing. We therefore conclude that curbing corruption in exporting countries can contribute to reducing tariff evasion in importing countries.

This study is different from prior research in several ways. It examines a unique research question: how trade partners' levels of corruption relate to the specific issue of tariff evasion; and focuses on the current situation in SSA. Moreover, this study reports a particularly robust panel data analysis, which employs different fixed effects, several robustness checks, and all the main and interaction effects required to properly analyze the joint effect of trade partners' levels of corruption.

3.2. Setting: SSA, trade, and corruption

3.2.1. Sub-Saharan Africa

Sub-Saharan Africa (SSA) is a region that comprises 49 countries located south of the Sahara desert. One third of these countries (16) are landlocked and have no direct access to the ocean (UNCTAD, 2013a). Recently, SSA has experienced rapid demographic and economic growth. Between 2000 and 2012, its GDP grew on average at 5% (World Bank, 2014), and at approximately 4.5% in 2015 (IMF, 2015). Its population increased from 800 million in 2007 to 934 million in 2013 (AfDB et al, 2015). Indeed, five of world's 10 fastest growing economies of 2012 were located in SSA (World Bank, 2014). However, SSA represents 2% of the world's

economy (US$1.57 trillion; World Bank, 2014), and the income level of half of its countries is categorized as low (UN, 2012).

Despite fast growth and significant advances, SSA scores relatively low in key development and competiveness indicators, including public governance and accountability, strength of democratic institutions, infrastructure, health, and education (Khan, 2012; WEF, 2015a). Moreover, the region faces challenges associated with curbing corruption and promoting efficiency and transparency in public policy, rule of law, and sustainable exploitation of natural resources (Odemba, 2010; IMF, 2015; WEF, 2015b).

In order to maintain accelerated growth, reduce poverty, and overcome the above-mentioned challenges, multilateral organizations recommend SSA economies to improve tax collection performance and increase tax revenues (OECD, 2011; World Bank, 2015). Tax revenues account for about 15% to 16% of the GDP in SSA, which is considerably lower than the OECD's 33% average (OECD, 2011; World Bank, 2015). Reduced tax revenues in the region may be attributed to low income levels and tax bases (i.e., total amount of assets or income subject to taxation), widespread informal economy, complex tax codes, pervasive evasion, and weak enforcement and administrative capacity of tax and customs authorities (AfDB et. al, 2010; Fjeldstad & Rakner, 2003; Keen & Mansour, 2009; World Bank, 2015).

3.2.2. Trade

Trade is particularly important for SSA as it represents a direct means to attain higher tax revenues, economic diversification, and sustainable growth (IMF, 2015). Indeed, for the average developing country, value-added trade can contribute to 28% of its GDP (WEF, 2015b). Although trade in

2014 represented 62% of the region's GDP, its exports accounted for 2% of the world's exports (WITS, 2016). Indeed, trade in SSA has ample potential for growth (Control Risks, 2013; IMF, 2015).

Import taxes – which comprise tariffs, VAT and excise tax – represent a significant fraction of public revenue in SSA. For comparison, international trade taxes represent 1.1%, 4.4%, 4.4%, 4.9% of total public revenue in high income countries, Latin America and the Caribbean, East Asia and the Pacific, and Middle East and North Africa, respectively (World Bank, 2016a). For SSA, in contrast, this share corresponds to 11%. As compared to high income countries, SSA has a relatively higher average tariff rate (3.9% vs. 11.4%; World Bank, 2016b). This further underscores the significance that tariffs have in SSA.

The top four countries importing from SSA are China, Switzerland, the United States, and the Netherlands, while the top four countries exporting to SSA are China, Germany, the United States, and India (WITS, 2016). Although oil and raw materials account for a large percentage of exports, the region has started to diversify its export structure and integrate into global value chains (strengthening comparative advantages in, e.g., agro-business or manufacturing; IMF, 2015). Intraregional trade represents 3% of its GDP (IMF, 2015).

SSA has barriers to trade of great magnitude (Moïsé & Sorescu, 2013; OECD, 2013b). For instance, importing goods into SSA requires on average 38 days and 9 documents, which is significantly higher than any other region in the world (although, since 2006, 46 of the 49 SSA countries have reformed the tax system to make it simpler and to promote trade within the region; World Bank, 2013b). Notably, trade in SSA has benefited from international initiatives, such as aid for trade programs, which provide assistance in trade policy, regulations, and infrastructure

(Cali & Te Velde, 2011; Langan & Scott, 2011; Cirera & Winters, 2015). Aid for trade programs have contributed to simplify border procedures, reduce trade costs, and amplify trade flows (Cali & Te Velde, 2011; Hoekman & Wilson, 2010; Langan & Scott, 2011). However, barriers to trade in SSA relate not only to procedures and infrastructure, but also to corruption in customs administration (Control Risks, 2013).

3.2.3. Trade and corruption in SSA

Corruption represents one of the most serious limitations to trade, investment, and economic growth in SSA (Baliamoune-Lutz & Ndikumana, 2008; Financial Times, 2013; Zafar, 2007). Indeed, corruption perception surveys – such as African Governance Report, Global Competitiveness Report, World Governance Indicators, Corruption Perception Index, and Global Integrity Report – tend to indicate that this is one of the most corrupt regions in the world (UNECA, 2015; World Bank, 2016c; Transparency International, 2016; Global Integrity, 2015). With regard to trade, various studies suggest that SSA suffers from widespread customs corruption, high levels of evasion, and weak institutional capacity to enforce custom laws (Barka, 2012; Moore, 2014; World Bank, 2013b; Zake, 2011).

The 2015 IMF economic outlook of the region indicates that fostering economic growth through trade is crucially dependent on improved governance and reduced corruption: "raising the index of rule of law to the average level elsewhere in the world would generate another 28 percent increase in sub-Saharan African trade flows" (IMF, 2015 p.55). For example, it is estimated that bribing officials in port authorities of Mozambique and South Africa reduced government revenue from tariffs by approximately 5% (Sequeira & Djankov, 2013). The dimension of the problem becomes more evident considering that the level of bribing of tax and custom administration

officials in Africa is higher than the world's average (Transparency International, 2014), and corruption is one of the main reasons why SSA has the highest intra-regional trade costs in the world (WEF, 2015b).

Despite these indicators and analyses, "there are very few recent studies assessing the extent to which and how corruption affects tax administration in Africa" (Transparency International, 2014, p1). In response to this, in this chapter we investigate how tariff evasion in SSA is influenced by corruption in both sides of the trade partnership (i.e., corruption in both importing and exporting countries).

3.3. Theory and hypotheses development

3.3.1. Tariff rates and tariff evasion

Trade gaps refer to discrepancies between a country's reported imports and its trading partners' reported exports, and can be indicative of tariff evasion (i.e., the illegal nonpayment or underpayment of tariffs; Bhagwati, 1964). The rationale is as follows. Imports and exports are commonly reported at the product-level, on a yearly basis, and in terms of both monetary value and quantity. Exports are recorded at free-on-board value while imports are recorded at free-on-board value *plus* the cost of freight and insurance (Ferrantino & Zhi, 2008). In the absence of tariff evasion, the difference of export value minus import value should be negative (as imports incorporate additional costs), and the difference of export quantity minus import quantity should be zero (as quantity in theory remains the same). Positive trade gaps in value and quantity imply that there is *undervaluation* of imports and *understatement* of quantities, respectively. Certainly, trade gaps can be explained by measurement error (Guo, 2009). But when wider trade gaps are systematically associated with higher tariff rates, trade gaps are indicative of tariff evasion. Indeed,

theoretical studies explain why higher tariff rates can lead to tariff evasion (Anson et al., 2006; Jean & Mitaritonna, 2010; Mishra et al., 2008; Mookherjee & Png, 1995; Slemrod, 2001).

Several empirical studies have examined how trade gaps or similar discrepancies relate to tariff evasion, misreporting, and other undesirable behaviors. These studies have analyzed trade and tariff data from Jamaica, Kenya, and Pakistan (Pritchett & Sethi, 1994); China and Hong Kong (Fisman & Wei, 2004); Germany and ten countries from Eastern Europe (Javorcik & Narciso, 2008); United States and China (Ferrantino et al., 2012); Mozambique (Van Dunem and Arndt, 2009), India (Mishra et al., 2008), Kenya and Tanzania (Levin and Widell, 2014); and United States and Canada (Stoyanov, 2012), among others.

Recent research examines potential determinants of tariff evasion. Evidence suggests that, for example, tariff evasion increases with weaker enforcement (Mishra et al., 2008), stronger political connections between trading firms and top government officials (Rijkers et al., 2015), and a larger number of ethnic migrants from the exporting country living in the importing country (Rotunno & Vézina, 2012). Additionally, trade discrepancies and tariff evasion have been associated with trade liberalization policies (Yalta & Demir, 2010), black market's foreign exchange premium (Buehn & Eichler, 2011), smuggling activities (Farzanegan, 2009; Mishra et al., 2008; Yeats, 1990), and capital account liberalization (Ferrantino, et al, 2012; Patnaik et al., 2009). Apart from these determinants, researchers have also explored the potential association between tariff evasion and corruption.

3.3.2. Tariff evasion and corruption

This study focuses on tariff evasion in SSA, and a few studies already hint on its potential association with corruption. In their study on tariff evasion in three African countries, Bouët and Roy (2012) find that the effect of tariff on evasion (on the tariff-gap elasticity) can be ranked in correspondence with corruption indices. Levin and Widell (2014) show that evasion in Tanzania may be higher than in Kenya, which, despite a higher corruption score, is performing better in the institutions that are crucial for collecting tax revenues.

The effect of corruption on tariff evasion has also been studied in other settings. In their study about trade between Germany and Eastern-European countries, Javorcik and Narciso (2008) investigate whether corruption explains differences in evasion. They find that the effect of tariffs on evasion in Eastern-European countries increases with their level of corruption, and find no evidence of an effect of corruption in the exporting country. Other studies have reported that corruption levels in both importing and exporting countries have a significant effect on trade gap (Berger & Nitsch, 2008), as well as on the tariff-gap elasticity (Jean & Mitarotinna, 2010). We note that these studies do not include all main effects and interactions found in standard moderation analysis (possibly due to collinearity with country-year fixed effects), which brings the risk of capturing main effects in the coefficients of the interactions (Edwards, 2009).

With this in mind, this study extends prior research as it (i) incorporates all main and interaction effects required to properly analyze the effect of corruption levels in both countries, (ii) focuses on a setting in which corruption is considerably high and its effects on evasion are particularly damaging (as it hampers growth and poverty reduction), and (iii) uses all available data (of

numerous countries and years) to test the expected associations, including a comprehensive set of robustness checks.

3.3.3. Hypothesis development

Building on prior research, our expectation is that evasion takes place when there are *incentives*, *opportunity*, and *intentions* to evade. In the setting of international trade, there are higher *incentives* to evade when tariff rates are higher. In line with this idea, Chu (1990) and Escobari (2012) find that higher fines for non-compliance and higher audit probabilities can encourage taxpayers to increase their bribing activities. This finding is also supported by Chander and Wilde (1992), who observe that corrupt tax auditors, higher fines, and higher tax rates increase the probability of tax audits, increasing bribing and reducing government revenue. Similarly, this argument can be used to explain why higher tariff rates increase the incentive to misreport trade data and evade.

Corruption provides the *opportunity* to evade through, for example, bribery. The opportunity is therefore specially dependent on corruption in the importing country. A possible explanation is that corrupt countries have weaker governance or are less accurate in documenting trade statistics (see, e.g., Javorcik & Narciso, 2008). Moreover, corrupt customs officials, who are responsible for the collection of duties on goods crossing the border and the implementation of trade policies, have opportunities to extract bribes from traders (Hors, 2001). Interestingly, these officials extract bribes not only to break the law (by, e.g., reducing tariffs, ignoring trade requirements, or falsifying reported information) but also to follow and obey the law (e.g., granting permissions with due diligence or in a timely manner; Bardhan, 2006; Rose-Ackerman, 1997; Parayno, 1999).

However, opportunities and incentives to evade may not translate into evasion unless trade partners have the willingness or *intention* to bribe. There are several reasons why we expect that these intentions depend on corruption in both the importing and the exporting country. First, studies show that corruption can be contagious (Becker et al, 2009; Goel & Nelson, 2007) and in the context of international trade, where cross-border business dealings involve interacting with people from another culture and with different social norms, corrupt behavior may be viewed by one trade partner as the normal way of doing business. Over time, trade partners may learn how bribe-taking and -giving take place, which later translates into actual engagement in corrupt activities (Ashforth & Anand, 2003; Goel & Nelson, 2007; Lee & Guven, 2013). Second, officials in the importing country may well be bribed by firms from either country. It may often be the *foreign* trading partner that engages in bribery (McKenzie, 2013; Sanyal, 2005). Do and Serfaty (2008) and Djankov et al. (2010) show that corrupt customs officials at exporting and importing countries delay the release of time-sensitive products and extract bribes to speed-up the customs clearance process of goods. In such cases, bribing benefits both partners. Musila and Sigué (2010) examined the impact of corruption on the size of trade flows in Africa. They find that corruption levels in African countries and their trading partners have a negative effect on trade flow. They conclude that "corruption in the exporting country is as important a factor as corruption in the importing country. Indeed, the level of corruption in both countries would determine the cost of doing business between the two countries" (Musila and Sigué, 2010, p39). Dutt and Traca (2010) also find that the levels of corruption in both countries affect trade flows, although this effect is dependent on tariff rates. In sum, the levels of corruption in both countries may affect international trade, and be indicative for their intention to, e.g., bribe and evade taxes.

Taking these arguments into consideration, we expect tariff evasion to be the highest when incentives, opportunities, and intentions coincide. Hence, we state our hypothesis as follows: *corruption levels in both exporting and importing countries reinforce tariff evasion in the importing country*.

3.4. Method

3.4.1. Data and sample

The present analysis employs data from the World Integrated Trade Solution database of the World Bank (WITS, 2016), which combines data from the UN Statistical Division Commodity Trade (COMTRADE), and the UN Trade Analysis and Information System (TRAINS). We select data based on the 2007 Harmonized Commodity Description and Coding System (HS) of the World Customs Organization, which covers the largest number of traded goods (over 5,300 products). We focus our attention on 6-digit product codes, as these provide detailed information of each traded good and are employed by the vast majority of countries.[7] We retrieve data of imports and exports from COMTRADE, in both monetary values (US Dollars) and quantities (under comparable units of measurement). Tariff data are retrieved from TRAINS. Corruption perceptions are retrieved from Transparency International (2016).

[7] Following prior research, we exclude products for which trade is either restricted or distorted (nuclear reactors: HS 8401; arms and ammunition, parts and accessories thereof, HS 93; works of art, collectors' pieces and antiques: HS 97; Kar & Freitas, 2012; Wood, 2006; Fisman & Wei, 2007), products that are subject to import excise tax in numerous countries (beverages, spirits and vinegar: HS 22; tobacco and manufactured tobacco substitutes: HS 24; Cooper & Witt, 2012), products for which there is a time lag between exportation and importation (aircraft and space crafts: HS 88; ships: HS 89), and products for which valuation is challenging and are most often diverted from their original destination (ores: HS 26; oil: HS 27; Yeats, 1978). Notably, we observe the same pattern of results without excluding these products (see robustness test G).

Table 3.1: Countries included in the analysis and mean corruption scores (2008-2014).

Importer	*M*	Exporter	*M*
Benin	6.3	Australia	1.5
Botswana	3.6	Austria	2.5
Burkina Faso	6.5	Belgium	2.6
Burundi	8.0	Brazil	6.1
Cameroon	7.3	Canada	1.5
Cape Verde	4.6	Chile	2.9
Central African Republic	7.9	China	6.3
Congo, Republic of the	7.7	Czech Republic	5.2
Cote d'Ivoire	7.5	Denmark	0.8
Djibouti	7.2	Estonia	3.4
Ethiopia	7.2	Finland	1.0
Gambia, The	6.8	France	3.0
Ghana	5.7	Germany	2.1
Kenya	7.7	Greece	6.1
Madagascar	7.1	Hungary	4.9
Malawi	6.7	Iceland	1.7
Mali	7.0	India	6.5
Mauritania	7.3	Ireland	2.5
Mauritius	4.6	Israel	4.0
Mozambique	6.9	Italy	5.8
Namibia	5.4	Japan	2.4
Niger	7.0	Korea, Republic of	4.5
Nigeria	7.5	Luxembourg	1.8
Rwanda	5.4	Mexico	6.7
Senegal	6.5	Netherlands	1.4
South Africa	5.6	New Zealand	0.8
Tanzania	7.0	Norway	1.5
Togo	7.3	Poland	4.5
Uganda	7.4	Portugal	3.9
Zambia	6.8	Russian Federation	7.6
Zimbabwe	7.8	Slovak Republic	5.4
		Slovenia	3.8
		Spain	3.8
		Sweden	0.9
		Switzerland	1.3
		Turkey	5.4
		United Kingdom	2.3
		United States	2.7

Notes: corruption is based on the reverse score of the Corruption Perceptions Index (so that higher scores represent higher corruption; Transparency International, 2016).

To generate the dataset we employ the following procedure. First, we retrieve data of tariff rates and imports from OECD and BRIC countries for all years for which SSA countries have available observations (i.e., 2008-2014; *N*=2,542,567 product-level country-year observations).

Second, we retrieve data of exports to SSA from OECD and BRIC countries (*N*=1,817,088). Finally, we match import, export, tariff rate, and corruption data of importing and exporting countries (*N*=955,546 for trade data reported in values; and *N*=884,079 for trade data reported in quantities). The list of countries included in the analysis is presented in Table 3.1.

3.4.2. Variable measurement

In the present analysis, the dependent variable is *trade gap*, and the independent variables are *average tariff rate*, *corruption in importing country*, *corruption in exporting country*, and their interactions.

Trade Gap: The trade gap measure follows from prior research, and is based on discrepancies of trade data reported by importing and exporting partners (Fisman & Wei, 2004; Mishra et al., 2008; Javorcik & Narciso, 2008; Levin & Widell; 2014; Stoyanov, 2012; Van Dunem & Arndt, 2009). Trade gaps are identified using reported export and import data from the same year, 6-digit product codes, and quantities with similar units of measurement. More specifically, trade gap is equal to the difference between the natural logs of reported export (as reported by the trade partners of SSA countries) and imports (as reported by SSA countries). The trade gap is calculated in terms of both values and quantities. The gap in value is measured as:

$$Vgap_{ptix} = \log(ExV_{ptxi}) - \log(ImV_{ptix}), \quad (3.1)$$

where ExV_{ptxi} refers to export value of product p in year t as reported by exporting country x to importing country i; ImV_{ptix} is import value of product p in year t as reported by importing country i from exporting country x. Thus, $Vgap_{ptix}$ refers to trade gap in value of product p in year t for goods imported by importing country i from exporting country x. The definition of gap in quantity

is equivalent and employs the same notation (except for the fact that it refers to quantity instead of value):

$$Qgap_{ptix} = \log(ExQ_{ptxi}) - \log(ImQ_{ptix}), \quad (3.2)$$

where $Qgap_{ptix}$ refers to trade gap in quantity of product p in year t for goods imported by importing country i from exporting country x. Value and quantity trade gaps are strongly correlated (r=.78, p<.01).

Tariff Rate: Imports are commonly subject to a number of taxes, including tariff, excise tax, and value-added tax. Except for tariff, data on other import taxes are not available at six-digit product level. As the independent variable, we use the most favored nation simple average tariff rates at HS six-digit level, which include the *ad valorem* equivalents for non-*ad valorem* tariffs. Tariff rates are divided by 100, as they are reported in percentages.

Corruption Level: We use the annual Corruption Perception Index (CPI) published by Transparency International as a measure of the corruption level in both importing and exporting countries. The CPI employs expert assessments and opinion surveys to rank countries according to the perception of corruption in the public sector (Transparency International, 2016). Higher scores represent lower corruption. Scores range from 1 to 10 until 2011, and from 1 to 100 as from 2012. Post-2011 scores are divided by 10, and then all scores are reverse-coded so that higher values represent higher corruption (ranging from 0 to 10). Table 3.1 presents the average corruption score across 2008-2014 for each country included in the analysis. Table 3.2 shows the descriptive statistics of the variables included in the analysis.

Table 3.2: Descriptive statistics

	N	*M*	*SD*	*Min*	*Max*
Value gap	955,546	0.14	2.27	-16.48	16.51
Quantity gap	884,079	-0.15	2.63	-20.67	25.89
Tariff rate	959,834	0.11	0.11	0.00	25.00
Importer's corruption	961,447	6.37	1.05	3.60	8.40
Exporter's corruption	961,447	3.80	1.92	0.50	7.90

Note: tariff rate refers to the average tariff rate (H6) divided by 100.

3.4.3. Model specification

The baseline specification follows prior research examining the association between tariff rate and trade gap, but also incorporates corruption levels of importing and exporting countries as well as their interaction with tariff rate. Furthermore, we add the three-way interaction between both corruption levels and tariff rate (which captures whether the corruption levels reinforce the tariff-gap association). The specification for value gap is as follows:

$$Vgap_{ptix}=\beta_0 + \beta_1 R_{ptix} + \beta_2 COR_{it} + \beta_3 (R_{ptix} * COR_{it}) + \beta_4 COR_{xt} + \beta_5 (R_{ptix} * COR_{xt}) +$$
$$\beta_6 (COR_{it} * COR_{xt}) + \beta_7 (R_{ptix} * COR_{it} * COR_{xt}) + D_i + D_x + D_t + \varepsilon_{ptix}\,, \qquad (3.3)$$

where R_{ptix} represents the average tariff rate in importing country *i* on product *p* imported from exporting country *x* at time *t*. COR_{it} and COR_{xt} represent the corruption scores of importing country *i* and exporting country *x* at time *t*, respectively (ranging from 0 = lowest corruption; 10 = highest corruption). Dummies D_i, D_x, and D_t represent fixed effects for import country, export country, and year, respectively. These fixed effects control for factors such as observed in Chapter 2. Additionally, we test the same model using fixed effects for partnership (i.e., importing-

exporting country pair) and year (so that D_{ix} represents the trade partnership between *x* and *i*). The baseline specification for evasion in quantity is similar to specification (3) except that $Vgap_{ptix}$ is replaced by $Qgap_{ptix}$. In order to properly assess the effect of the three-way interaction, all main and two-way interaction effects must be included as control variables (Edwards, 2009). Moreover, the tariff rate and corruption levels of importing and exporting countries are mean-centered.

If corruption levels reinforce tariff evasion, the combined effect of the interactions between corruption levels and tariff (β_3 and β_7 for the importing country; β_5 and β_7 for the exporting country) should be positive and significant (i.e., both corruption levels should strengthen the positive association between trade gap and tariff rate, which is indicative of evasion).

3.5. Results

3.5.1. Main analysis

Our hypothesis is that higher corruption levels in exporting and importing countries reinforce tariff evasion. In terms of the empirical model, we expect the association between trade gap and tariff to be increasing in both corruption levels.

The analysis comprises four regressions. While regressions 1 and 2 explain value gap, regressions 3 and 4 explain quantity gap. For each gap, we test our hypothesis using two different sets of fixed effects. Regressions 1 and 3 include fixed effects for importing country, exporting country, and year; whereas regressions 2 and 4 include fixed effects for trade partnership and year. The results of these regressions are reported in Table 3.3.

Table 3.3: Interaction effects of tariff rate (HS6), importer's corruption, and exporter's corruption on value and quantity gaps

	Value gap		*Quantity gap*	
Regression	(1)	(2)	(3)	(4)
Tariff rate (*HS6*)	1.06 ***	1.06 ***	.68 ***	.72 ***
	(.10)	(.11)	(.10)	(.11)
Importer's corruption	.08 ***	.07 ***	.17 ***	.17 ***
	(.01)	(.01)	(.01)	(.01)
Exporter's corruption	-.12 ***	-.08 ***	-.10 ***	-.09 ***
	(.01)	(.01)	(.01)	(.01)
Tariff rate (*HS6*)	.08	.05	-.03	-.05
x *Importer's corruption*	(.07)	(.06)	(.07)	(.07)
Tariff rate (*HS6*)	.12 ***	.09 **	.15 ***	.13 ***
x *Exporter's corruption*	(.04)	(.04)	(.04)	(.04)
Importer's corruption	.01 ***	-.06 ***	.01 ***	-.06 ***
x *Exporter's corruption*	(.00)	(.00)	(.00)	(.00)
Tariff rate (*HS6*) x	.13 ***	.18 ***	.13 ***	.19 ***
x *Importer's corruption*	(.04)	(.03)	(.03)	(.03)
x *Exporter's corruption*				
Fixed effects	importer	partnership	importer	partnership
	exporter	year	exporter	year
	year		year	
N	955,546	955,503	884,079	884,031
F	58.01 ***	66.42 ***	58.54 ***	73.46 ***
R^2	.02	.04	.02	.04

Notes: standard errors clustered by product are presented in parenthesis; standard errors are robust to heteroskedasticity and within–product group variation; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Given that our focus is on how corruption *enhances* the association between tariffs and gaps, we are particularly interested in the effects of the terms that include tariffs. For all regressions, the base level association between tariff and trade gap is positive and significant, which is indicative of tariff evasion. The interaction between importer's corruption and tariff is not significantly associated with gaps, while the interaction between exporter's corruption and tariff is positive and significant (regression 1: β=.12, p<.01; regression 2: β=.09, p<.01; regression 3: β=.15, p<.01; regression 4: β=.13, p<.01). Notably, the coefficient of the three-way interaction is positive and significant (regression 1: β=.13, p<.01; regression 2: β=.18, p<.01; regression 3:

β=.13, p<.01; regression 4: β=.19, p<.01). The interpretation is that, when both corruption levels increase by one, the association between tariff and trade gap increases by a magnitude equivalent to the coefficient of the three-way interaction (β_7).

Independently of the set of fixed effects employed, there is a positive association between the three-way interaction and both value and quantity gaps. The joint effect of both countries' levels of corruption is not constant across levels of tariff, but rather increases as the tariff becomes higher. Indeed, the positive and significant three-way interaction suggests that evasion becomes an increasingly bigger issue when corruption levels in both countries are high. Taken together, these results indicate that corruption levels in both countries *reinforce* tariff evasion, and thus provide strong support for our hypothesis.

The main effect of exporter's corruption, which is negative and significant in all regressions, corresponds to the effect of exporter's corruption on trade gap when tariff rate and importer's corruption are equal to zero (i.e., when these variables are at their average levels, as they are mean-centered). Although main effects should be interpreted with caution, the different signs of the main effects indicate that the trade gap increases with higher levels of importer's corruption and lower levels of exporter's corruption. One possible explanation is that, when the exporter's corruption is high, underreporting may already take place in that country. In this sense, underreporting in the exporting country could reduce the gap, as it is measured as value of exports minus value of imports. It is however noted that these main effects serve as control variables to properly assess the effect of these corruption levels on the tariff rate elasticity. In this study, we concentrate our attention on how corruption enhances the tariff-gap association, so the effects of interest are those in which corruption *interacts* with tariff.

In the Table 3A.1, we report the regression results excluding the three-way interaction and including (i) only importer's corruption and its interaction with tariff, and (ii) only exporter's corruption and its interaction with tariff. The interpretation of those results is however misleading, as it assumes that these effects are constant across levels of the other variables (Edwards, 2009). Those results show that the two-way interactions are not significant, and therefore illustrate the importance of including the joint effect of both countries' levels of corruption.

The results indicate that evasion is especially high when corruption is high in both countries. In order to better assess the magnitude of this effect and to facilitate the interpretation of these results, we conduct a median split analysis in which we analyze the effect of high corruption in both countries.

Table 3.4: Effects of tariff rate (HS6) and high levels of corruption in both countries on value and quantity gaps

	Value gap		*Quantity gap*	
Regression	(1)	(2)	(3)	(4)
Tariff rate (*HS6*)	.90 ***	.87 ***	.56 ***	.55 ***
	(.15)	(.15)	(.11)	(.11)
High corruption in	.09 ***	-.06 ***	.12 ***	.00
both countries	(.01)	(.01)	(.01)	(.02)
Tariff rate (*HS6*)	.67 ***	.75 ***	.77 ***	.84 ***
x *high corruption in*	(.17)	(.17)	(.16)	(.17)
both countries				
Fixed effects	importer	partnership	importer	partnership
	exporter	year	exporter	year
	year		year	
N	955,546	955,503	884,079	884,031
F	74.79 ***	53.47 ***	57.36 ***	26.57 ***
R^2	.02	.04	.02	.04

Notes: standard errors clustered by product are presented in parenthesis; standard errors are robust to heteroskedasticity and within–product group variation; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

First, we separately obtain the median corruption levels for importing and exporting countries. We then generate a dummy variable labeled *high corruption in both countries*, which takes the value 1 if corruption is above the median in both countries and 0 otherwise. The explanatory variables are *tariff rate*, *high corruption in both countries*, and their interaction. The results are presented in Table 3.4. It can be seen that, in all regressions, high corruption in both countries clearly enhances the positive association between tariff rates and trade gaps. This effect is not only statistically but also economically significant. The results of regression 2, for example, indicate that the tariff elasticity is 0.87 when at least one of the trading partners is from a low corruption country. When corruption is high in both countries, however, the elasticity almost doubles in magnitude (i.e., 0.87 + 0.75). So when import duties increase by 1%, tax evasion increases by 1.62%.

3.5.2. Robustness checks

In addition to the main analysis, we conduct a series of tests to examine whether the observed pattern of results is robust to alternative selections of data, sample, and clustered standard errors. The results of these tests are presented in Table 3.5. The pattern of the results is highly consistent and replicates the findings obtained in the main analysis.

In this study we employ a large dataset, which contains approximately one million observations. To control for the potential effects of outliers, in test A of Table 3.5, we winsorize value gap, quantity gap, and tariff rate at the 5th and 95th percentiles, respectively. The main pattern of results is unchanged, although we observe a marginally significant negative coefficient for the interaction between importer corruption and tariff for one of the four regressions.

Table 3.5: Robustness checks

TEST			*N*	*Tariff*	*Tariff* x *ImpCorr*	*Tariff* x *ExpCorr*	*Tariff* x *ImpCorr* x *ExpCorr*
A	Winsorizing 5% and 95%	(1)	955,546	.95 ***	.07	.10 ***	.12 ***
		(2)	955,503	.96 ***	.04	.07 **	.16 ***
		(3)	884,079	.54 ***	-.08	.11 ***	.12 ***
		(4)	884,031	.57 ***	-.10 *	.08 ***	.16 ***
B	Same set of Observations	(1)	884,002	1.11 ***	.11	.13 ***	.14 ***
		(2)	884,002	1.12 ***	.07	.10 **	.19 ***
		(3)	884,002	.68 ***	-.03	.16 ***	.13 ***
		(4)	884,002	.72 ***	-.05	.13 ***	.19 ***
C	Excluding South Africa and Nigeria	(1)	658,710	.79 ***	.31 ***	.22 ***	.00
		(2)	658,667	.85 ***	.22 ***	.17 ***	.09 **
		(3)	602,695	.24 *	.06	.26 ***	.02
		(4)	602,647	.36 ***	-.05	.18 ***	.10 ***
D	Clustering HS6 and Partnership	(1)	919,397	1.06 ***	.08	.12 *	.13 **
		(2)	919,354	1.06 ***	.05	.09	.18 ***
		(3)	851,200	.68 ***	-.03	.16 **	.13 **
		(4)	851,152	.72 ***	-.05	.13 *	.19 ***
E	Excluding Ethiopia	(1)	955,546	1.11 ***	.11	.17 ***	.16 ***
		(2)	955,503	1.12 ***	.08	.11 ***	.19 ***
		(3)	884,079	.75 ***	.01	.19 ***	.15 ***
		(4)	884,031	.79 ***	-.01	.14 ***	.19 ***
F	Excluding preferential partners	(1)	602,842	.86 ***	.23 ***	.31 ***	.02
		(2)	602,801	.85 ***	.22 ***	.32 ***	.04
		(3)	547,254	.32 **	.38 ***	.32 ***	.06
		(4)	547,209	.35 ***	.37 ***	.32 ***	.10 ***
G	Including all products	(1)	972,321	1.07 ***	.10	.12 ***	.12 ***
		(2)	972,280	1.07 ***	.06	.09 **	.17 ***
		(3)	900,334	.67 ***	-.01	.15 ***	.13 ***
		(4)	900,289	.71 ***	-.04	.12 ***	.18 ***

Notes: regression numbers are in parenthesis and correspond to the regression numbers presented in Table 3.3; for all tests, the explanatory variables are the same as in the main analysis; *ImpCorr* and *ExpCorr* correspond to corruption levels in the importing country and exporting country, respectively; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The main analysis yields the same pattern of results for both value and quantity gaps, although these are not explained by the same set of observations. Hence, in test B we employ the same set of observations (i.e., all available observations for which we can simultaneously run the four regressions; *N*=884,002).

We also note that Nigeria and South Africa are considerably larger than the other economies in SSA. It is possible that the results of the main analysis depend on what occurs in these countries, as they report a massive volume of trade operations within the sample (around one third of the observations). In test C we remove these two countries from the analysis, and observe that, for regressions 1 and 3, the effect of the three-way interaction is no longer significant. However, in line with our rationale, the interaction between each corruption level and tariff rate is positive and significant. Thus, both corruption levels reinforce the association between tariff and trade gap, but the levels do not reinforce each other's effect on this association.

The pattern of the results is, however, the same as in the main analysis for regressions 2 and 4, which include trade partnership fixed effects. The results of test C may suggest that there are structural factors that take place in each side of the trade partnership that are not entirely independent (so that separate fixed effects for each trade partner may not properly capture relevant effects that take place at the tie-level of analysis).

Following this logic, it is possible that the present analysis requires clustering standard errors not only by product (in line with prior research), but also by trade partnership. Hence, in test D we employ a multi-clustering analysis in which standard errors are clustered by both product and partnership. Ethiopia can be considered as another special case, as it is the only country in the

sample that is not a member of WTO. The results of test E show that removing Ethiopia from the analysis does not alter the observed pattern of results.

The rates available in the TRAINS database correspond to preferential and most-favored-nation tariff rates (WITS, 2016). In test F we exclude Botswana, Mauritius, Mozambique, Namibia, and South Africa, as these countries have enforced free trade agreements with preferential rates with EFTA or the EU during the period of this analysis. As in test C, excluding South Africa significantly reduces the number of observations. For all regressions, the interactions between tariff and importer's and exporter's corruption are positive and significant. The three-way interaction is positive, although only significant for regression 4. This goes in line with the idea that each country's level of corruption enhances the tariff-gap association independently of the other country's level of corruption. Finally, as indicated in footnote 1, we followed prior research and excluded several product groups from the main analysis. Hence, in test G, we included all the products that are available in the dataset. Overall, the results of these robustness tests are largely consistent with the results presented in the main analysis.

3.6. Discussion and conclusion

Import tariffs represent a major source of tax revenue in the region. Tariff evasion, however, hinders the public revenue potential of (the increasing) international trade. Preliminary evidence shows that the level of corruption in importing countries affects tariff evasion. In this chapter, we show that the level of corruption in the exporting country also matters. The results of a robust analysis indicate that corruption levels in both importing and exporting countries have a reinforcing effect on tariff evasion.

Although the results are robust to a series of alternative method-related choices, we cannot rule out the possibility of an endogeneity problem in that unobserved variables correlate with corruption indices and explain part of the effects we find. In order to mitigate this risk, we conduct different tests including fixed effects of all countries, trade partnerships, and years. Of course, specific country-year changes, such as reforms of the customs service, can certainly occur. Including country-year fixed effects is however not possible, as the corruption level in the importing country becomes a linear function of those fixed effects (and therefore corruption in the importing country is dropped from the statistical analysis). While this study builds on the literature that corruption has a positive effect on evasion, it may be argued that importer corruption and evasion may move together, as evasion may lead to high perceived corruption. We note, however, that the perception measure is based on much broader range of perceptions than just customs officials, and that such an endogeneity issue is highly unlikely for the perceived exporter corruption measure. All in all, the causal effect of corruption should be interpreted with caution.

As a second limitation, we note that the analysis is based on products that are reported by both countries, and thus focuses on evasion through understating values and quantities. Nonetheless, there may be products that only appear in the exporting countries' records and that importing countries do not report. These products are more likely smuggled and we feel that when considering the role of corruption and underreporting, it is better to use the more conservative measure (i.e., trade gaps of reported products in both countries) as smuggled products may not even pass the customs offices. Even with this more conservative approach, we show that the effect of corruption is statistically and economically significant.

In our study of the interacting influence of corruption, we focus on SSA because trade, revenue, and corruption all play crucially important roles in explaining growth and development in this region. The exporting countries included in the analysis are diverse and located all around the world. Future research may examine similar hypotheses in different settings, where the level of corruption is not necessarily skewed towards one end. It may be interesting to take the OECD or EU as the importing regions, for example, where tariffs and corruption levels are generally lower. It is not straightforward that our results extend to these regions as incentives and opportunities to evade tariffs may be considerably lower. Also, it may be relevant to study other determinants of the level of tariff evasion, such as ties between importing and exporting countries, for example measured by migrants or the amount of export from SSA to that country.

For policy-makers, the idea that both trade partners have influential roles may be especially interesting. Multilateral organizations tend to recommend SSA countries to make efforts and take actions on their own (e.g., reduce trade barriers, fight corruption). This study suggests that strategies to reduce tariff evasion may be more effective if tariff evasion is conceived as the outcome of collective action.

Table 3A.1: Effects of corruption levels on the tariff-gap association when studied in isolation.

	Value gap				*Quantity gap*			
Tariff rate	1.08***	1.05***	.99***	1.00***	.71***	.73***	.65***	.69***
Imp. Corr.	.07***	.07***			.16***	.17***		
Exp. Corr.			-.10***	-.10***			-.08***	-.11***
Tariff x Imp. Corr.	.16	.16			.05	.06		
Tariff x Exp. Corr.			.08	.01			.11*	.05
Fixed effects	importer exporter year	partner. year	importer exporter year	partner. year	importer exporter year	partner. year	importer exporter year	partner. year
N	955,546	955,503	955,546	955,503	884,079	884,031	884,079	884,031
F	63.38***	60.53***	43.09***	43.55***	91.80***	95.03***	19.81***	30.52***
R^2	.02	.04	.02	.04	.02	.04	.02	.04

Notes: *Imp. Corr.* and *Exp. Corr.* refer to importer's and exporter's corruption, respectively; *partner.* refers to partnership; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.