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Catch Me If You Can: Trade Mis-invoicing and Capital Flight in Ethiopia

Adugna Lemi¹ *

Abstract

With increased globalization comes increased opportunities to manipulate export and import invoices (trade mis-invoicing) as a vehicle to move capital unrecorded (and illegally) out of a country. Trade mis-invoicing, which is seemingly negligible in other parts of the world, is significant for developing countries in general and African countries in particular. This paper presents the extent of trade mis-invoicing and the resulting capital flight for the case of Ethiopia. Using commodity-group level trade flow data between Ethiopia and its trading partners, as well as disaggregated CIF-FOB ratios, this paper sheds light on commodity groups and trading partners that had significant impacts on trade mis-invoicing. Results show that previous studies reported underestimated trade mis-invoicing and capital flight figures from Ethiopia. I argue that underestimation was due to the exclusion of major trading partners (like China and India) and the use of fixed CIF-FOB ratios that don't reflect variations across commodity groups and trading partners. Results also show, for trade with only advanced countries, trade mis-invoicing has cost Ethiopia \$6-35 billion between 2008 and 2016; for trade with emerging economies (including China and India), Ethiopia has lost \$15 -78 billion to trade mis-invoicing during the same period. If we just take the sum of the lowest estimates of trade mis-invoicing, Ethiopia had lost over \$20 billion due to trade mis-invoicing with all its trading partners during the study period. A handful of commodity groups (vegetables, machinery, and transport equipment) has contributed to trade mis-invoicing in a significant way. The study also shows that India, United Arab Emirates (UAE), Finland, New Zealand, China (Hong Kong), Ireland, Australia, the US, Japan, and the Czech Republic tops the list of Ethiopia's trading partners with the highest share of trade mis-invoicing in total trade.

Keywords: Trade, mis-invoicing, Ethiopia

JEL Codes: F1, F2

¹ University of Massachusetts Boston, Department of Economics, 100 Morrissey Blvd., Boston, MA 02125

Email: Adugna.lemi@umb.edu

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1. Introduction

Trade mis-invoicing is not a new phenomenon; its impacts and implications grew significantly in recent years as previously marginalized countries increased their engagement in global trade and investment. Naya and Morgan (1969), Yeats (1990), Beja (2007), and Berger and Nitsch (2012) documented the prevalence and extent of trade mis-invoicing without going into its motivations and determinants. The question often asked in recent years is not as such on its prevalence but on the motives behind it and the magnitude of mis-invoicing (Buehn and Eichler, 2011; Geda and Yimer, 2016; Bahmani-Oskooee and Goswami, 2003; Fisman and Wei, 2004; Fisman and Wei, 2007; Farzanegan, 2009; Ndikumana and Boyce, 2010; Ndikumana et al., 2015).

Studies on the welfare implications of trade mis-invoicing are also another strand in the literature, although very few of these studies subject the theoretical implications of trade mis-invoicing on welfare to empirical test (Buehn and Eichler, 2011). The welfare analysis studies clearly state the social, economic, and political implications of capital flight in general and trade mis-invoicing in particular. Ortega et al. (2018) did a more specific study to link the impact of illicit capital flow to Human Development Index (HDI); their result shows that, in the most corrupt countries, a 10% increase in illicit financial flow would result in 21.7 points decrease in HDI levels. Ortega et al. (2018) further note that illicit financial flows "weaken financial systems and allow wealthy individuals to hide stolen assets, evade taxes, and avoid the adverse impacts of currency depreciation. Thus, the people benefiting from the capital flight are the elites involved in the embezzlement of resources and transfer of funds to various offshore destinations." They added that "the money ends up in offshore tax havens and anonymous shell companies which, instead of benefiting the people, provide a home for opaque ownership structures that foster corrupt behavior in developing countries." Ethiopia is not an exception to this; in fact, given the size of capital flight estimated in previous studies, the socio-political impact can't be overstated. This robs the country the valuable foreign currency that the country supposed to use to build infrastructure and institutions. The implication of this is that a government can save a lot of foreign currency with the right regulation (e.g. closing leakages and loopholes) to mitigate capital flight. Such potential benefits warrant the need to estimate the magnitude of capital flight (and correcting

previously underestimated capital flight numbers) and provide insights on the channels and motivations of trade mis-invoicing for policy-makers to design necessary regulatory measures to combat trade mis-invoicing.

In those studies that use African countries as a case study, the aim has been to estimate the magnitude of trade mis-invoicing as part of the overall capital flight estimation that is robbing the continent of the much-needed capital (Ndikumana and Boyce, 2010; Ndikumana et al., 2015; Geda and Yimer, 2016). Ndikumana and Boyce (2010) provide estimates of capital flight from most African countries, and they note the significance of trade mis-invoicing in their capital flight estimation. One common feature of most previous studies is that they lump sample countries together to estimate trade discrepancy equations. This is especially true for the case of African countries, where there is limited information on an individual country. Since sample countries have different customs regulations, exchange rate regimes, and tax and tariff structures, it is warranted to conduct such estimation at a country level for which sufficient data is available.

The focus of the present study is to estimate trade mis-invoicing for Ethiopia between 2008 and 2016, and to provide insights for policy-makers on trading partner countries and commodity groups responsible for this. As an improvement over previous studies, the present study looks into previously ignored or assumed away dimensions of trade mis-invoicing. These are trade flows with new and emerging trading partners in Asia and African economies; and commodity group level variations in estimated cost insurance and freight values (CIF-FOB ratio) that has often been ignored as insignificant or assumed away as inaccurate. To account for these omissions, the present study zooms in trade mis-invoicing activities in Ethiopia to highlight on the commodity groups and partner countries involved in such practices. The aim is to identify the commodities and countries affected/involved in trade mis-invoicing practices to help authorities in Ethiopia and its trading partners to design targeted policies to curb the ever-increasing capital flight due to trade mis-invoicing. For each trading partner country and commodity groups, I report disaggregated estimates of trade mis-invoicing by their export and import components.

The specific questions I ask in this study are: Were there systematic discrepancies in trade flow data between Ethiopia and its trading partners? Which commodity groups and partner countries were susceptible to this practice? How much does non-advanced trading partners contribute to trade mis-invoicing in

Ethiopia? I investigate these questions both by country and by commodity groups to get to the bottom of the issue, and to relate the findings to ground level anecdotes. I will also compare the findings of this study to previous studies to highlight the discrepancies in trade mis-invoicing numbers for Ethiopia.

Illicit capital outflow from developing countries in general, and Africa, in particular, is estimated to be in tens of billions (Kar and Spanjers, 2015; Global Financial Integrity, 2017). Ethiopia is not an exception, in fact, trade mis-invoicing accounts for one of the most significant shares of capital flight in Ethiopia compared to other African countries (Ndukmana and Boyce, 2010; Spanjers and Salamon, 2017), see Table 1 below for details.

For a country that only recently started integration into the world market, and with weak institutions to support these increased transactions, it is not difficult to imagine the existence of unrecognized loopholes that could easily be used by traders. It is necessary for developing countries' governments to understand the determinants of trade mis-invoicing to design custom regulations in line with the changing nature of global transactions. For instance, in places where it is difficult to countercheck invoices supplied by traders for the values of imports and exports, customs authorities should design a price determination formula to close some of the loopholes.

Traders, who buy and sell goods from and to overseas businesses or customers, engage in mis-invoicing import and export values for various reasons. Some of the reasons are tax evasion, gains from black market premium, and the opportunity to save in convertible currency in a foreign bank (i.e., capital flight). These possible explanations provide insight into whether the gain (it could be in local or foreign currency) from mis-invoicing stay in the country or leave the country through the back doors. The implication is paramount for policy-makers to cope with the fast-changing and integrated world.

I have organized the remaining parts of this study as follows. The next section presents a literature review on estimation and determinants of trade mis-invoicing with a focus on studies on African countries. Section three presents a description of data, sources of data, and methodology. I discuss the results of the study in section four. The final section concludes and draws implications.

2. Literature Review

The literature on the implications of trade mis-invoicing falls into two strands. The first strand looks into attempts to build a theoretical framework to understand the channels through which trade mis-invoicing affects an economy and how individuals make decisions on trade mis-invoicing to maximize individual welfare. The second strand focuses on empirical estimation of the magnitude of trade mis-invoicing to shed light on the resulting amount of capital flight; in essence, this is an empirical test of one component of the broader welfare implication that the first strand presents. Both the theoretical and empirical works look at the determinants and deterrents of trade mis-invoicing. The focus of the most recent studies is on the motives and deterrents behind trade mis-invoicing. The present study, taking Ethiopia as a case study, adds to this strand by attempting to fill a void in a country-level analysis. Specifically, the study looks at the links between trade mis-invoicing and capital flight, as well as the magnitude and channels of trade mis-invoicing in Ethiopia. It is important to note that there are several other studies that look into the impact of capital flight on economic growth, human development index, and other macroeconomic implications (Ortega et al. (2018)). Since these implications are well-documented and well-understood both among policy-makers and academicians (see UNCTAD, 2016), I didn't focus on this literature to save space. In the paragraphs that follow, I have presented specific motivations of trade mis-invoicing and their implications.

2.1 Motivations of Trade Mis-invoicing

What are the motivations for a trader mis-invoicing import and export transactions? Whatever the motivations, such practice is often portrayed as harmful for a country (UNCTAD, 2016). However, there are cases where this practice may end up helping a country positively in the form of capital inflow or allocation of resources free of regulatory barriers. The debate on whether trade mis-invoicing results in positive or negative welfare effects is not yet settled (Buehn and Eichler, 2011).

Some of the motivations are in response to the foreign currency control (to take hard currency out of the country through illegal means) while others are to bring in foreign currency illegally (to benefit from the wide gap between the

official and the parallel exchange rate). Tax evasion and customs administrative burden are also recognized as factors in Africa in influencing both the decision to engage in and the amount of trade mis-invoicing (Buehn and Eichler, 2011). As such, UNCTAD (2016), based on a review of the literature (Buehn and Eichler, 2011; Patnaik et al., 2012), classifies the motives for exporting and importing firms to engage in trade mis-invoicing into three. These motives are related to tax evasion, exchange rate controls, and administrative burden.

Financial motives, through tax evasion, are driven by profit maximization. This motivation can be done through the under-invoicing of exports and imports to minimize tax liabilities. In a country where trade barriers (tariffs, quotas, etc.) are discouragingly high, tax evasion seems to be the main driving force that encourages trade mis-invoicing. Several studies provide empirical evidence on this (see Bhagwati, 1964; McDonald, 1985; Epaphra, 2015; Fisman and Wei, 2004; Buehn and Eichler, 2011). In a reverse case, where there is an incentive to export (through export subsidies) and import of intermediate input (through import tariff exemptions), firms tend to over-invoice (overstate) exports and imports to maximize profit. Such a scenario may seem rare, but it may happen in a country where the promotion of trade is at the center of its development strategy. In a country like Ethiopia where the tariff rates are significantly high for some products (up to 150% tariff on some automobiles) and where there is taxation on exports (for instance, 6.5% tax on coffee exports (Minten et al., 2014)), traders may be tempted to under-invoice both imports and exports to minimize tax/tariff burdens. Minten et al. (2014) also report anecdotal evidence of coffee hoarding in Ethiopia, which may eventually result in export under-invoicing.

A country with excessive customs and exchange controls may also experience trade mis-invoicing as traders try to jump over or hide from such control mechanisms. Under such circumstances, traders attempt to hide foreign currency from official channels. One way to do this is to mis-invoice trade to take advantage of the prevailing Black-Market Premium (BMP) or to hoard cash in foreign currency in a foreign bank account (hence engage in capital flight). Under such motives, traders engage in over-invoicing of imports so that they obtain undeserving foreign currency from the authority that controls the foreign currency and under-invoicing of exports so that they can hide some of their export earnings abroad. Traders may use this ill-obtained foreign currency for various purposes, including paying for smuggled imports and selling it in a black market for a higher

premium (for empirical evidence on this see, Bahmani-Oskooee and Goswami, 2003; Barnett, 2003; and Biswas and Marjit, 2005). For a country like Ethiopia, this channel is the best way to take money out of the country in the form of hard currency. For instance, between 2004 and 2013, on average, there was an illicit outflow of capital from Ethiopia to the tune of \$2.6 billion per year (Kar and Spanjers, 2015). Trade mis-invoicing is suspected to be one of the channels through which this illicit capital outflow occurs. For instance, between 2000 and 2009, Ethiopia had lost over \$11 billion due to trade mis-invoicing (Kar and Freitas, 2011), of this \$11 billion capital flight, over \$7 billion was due to trade mis-invoicing. Ndikumana and Boyce (2010) also estimated that trade mis-invoicing accounts for 60% of capital flight in Ethiopia between 1970 and 2004.

Another motive for traders to engage in trade mis-invoicing is to minimize administrative burden. This motive is somewhat related to the second motive above, but in this case the attempt is to hide exports and imports from customs authorities through under-invoicing. The less the volume of the trade, the less the time and administrative hurdles it needs to pass through to clear customs. Corruption and ease of smuggling drive this motive. Therefore, in a country like Ethiopia, where the incident of corruption is growing (as evidenced in a recent (2018 and 2019) arrest of high-profile officials), this motive encourages traders to under-invoice both imports and exports. Fisman and Wei (2007), and Berger and Nitsch (2012) provide empirical evidence to support the correlation between trade mis-invoicing and corruption.

Finally, a trader mis-invoice imports and exports to bring in foreign currency stashed in a foreign country. This is not one of the top motives that previous studies have documented, but it is another possible reason for traders in emerging economies where there is a severe shortage of foreign currency. One reason to try to bring money previously sent abroad illegally into the country is for investment purposes. Traders implement this through export over-invoicing, which is a practice to launder illegal money back into a country through a legal channel. This has been less of a concern for studies that estimate capital flight from African countries for the reason that the money is coming back to the country, which is good for a country if one looks at this from just an economic growth perspective. It, however, comes through illegal means and may be spent on activities not that helpful for the country. As I will present in the discussion later, this motivation was driving part of the trade mis-invoicing in Ethiopia at least until 2010.

As to which of these motives are more relevant and prevalent in a country like Ethiopia is an empirical question. To reach the bottom of this issue, one needs to use disaggregated data by commodity and trading partners to pinpoint the conditions facilitating one motive over the other for each commodity group and partner country. The net effect of these motives varies by partner country, year, and commodity group. That is, it may be easier to under-invoice or over-invoice trade with a partner whose customs system is not as sophisticated; similarly, it may be easier to mis-invoice some commodities that are cumbersome to count or weight. It is also possible that during periods when there are political and security concerns in a country, smuggling may be easier, which results in under-invoicing of both imports and exports.

2.2 Estimates of Capital Flight and Trade Mis-invoicing in Ethiopia

A handful of studies present estimates for trade mis-invoicing and capital flight from Ethiopia. Almost all of these estimates follow the traditional estimation method to arrive at capital flight numbers and adjusted their estimates with trade mis-invoicing and other factors. Table 1 below provides estimates from four previous studies (Ndikumana and Boyce, 2010; Spanjers and Salamon, 2017; Kar and Spanjers, 2015; Kar and Freitas, 2011) that report a capital flight from Ethiopia for various years. Geda and Yimer (2016) also report estimates of capital flight from Ethiopia between 1970 and 2012 with adjustment for trade mis-invoicing, though they did not report estimates for the trade mis-invoicing component separately.

Ndikumana and Boyce (2010) report that during the period 1970-2004, Ethiopia had lost \$17 billion to capital flight, and \$10 billion (60% of capital flight) of that was through positive trade mis-invoicing (capital inflow). The study covers periods when the country had experienced a regime change and moved from strict exchange control (1970-1990) to a bit more relaxed exchange control system (1991-2004) that may explain the inflow of capital through trade mis-invoicing. However, this trend has been reversed in the subsequent decades as trade mis-invoicing contributed to capital outflow. Results from Kar and Freitas (2011) confirm this reversal, in that between 2000 and 2009, Ethiopia has lost over \$7 billion due to trade mis-invoicing, which accounts for 65% of cumulative illicit financial outflow (\$11.7 billion) during the same period. This trend confirms that as the country expanded its trade engagement with the rest of the

world, trade mis-invoicing grew with it. Kar and Spanjers (2015) break the trade mis-invoicing part of capital flight into its two components: Import and export mis-invoicing. According to their study, Ethiopia has been experiencing over-invoicing of both exports and imports. Over the study period that covers between 2004 and 2013, import over-invoicing (capital outflow) resulted in a loss of over \$19 billion whereas export over-invoicing (capital inflow) brought in over \$6 billion, with a net outflow of \$13 billion during the same period (Kar and Spanjers, 2015). Spanjers and Salamon (2017) report similar statistics in percentage terms (see Table 1 for more). Although the motives for import over-invoicing is clear from the literature summarized above, the motivation behind export over-invoicing has not been addressed in the literature as it has been considered either as insignificant or unimportant. As the above estimates indicate, though, this is not the case for Ethiopia.

Table 1: Estimates of capital flight from Ethiopia

1970-2004a		2005-2014b (% of total trade)		2004-2013C (in billion USD)		2000-2009d (in billions USD)	
Real Capital Flight (2004 US\$ Billion)	\$17.031	Illicit Financial Outflows	11-29%	Cumulative Illicit Financial Outflow	\$25,835	Cumulative Illicit financial flows (high-end)	\$11.694
Total Real Capital Flight/GDP in 2004 (%)	175%	Outflows due to trade mis-invoicing	6-23%	Cumulative outflows due to trade mis-invoicing	\$19,712	Cumulative illicit financial flows (conservative	\$7.944
Trade mis-invoicing (2004 US\$ Billion)	-\$10.234	Balance of Payment (BOP) Leakages	5-6%	Cumulative outflow due to import over-invoicing	\$19,709	Cumulative illicit capital flow (using the World Bank's residual method)	-\$5.62
Trade mis-invoicing as % of total capital flight	-60.1%	Import over-invoicing	6-23%	Cumulative inflow due to export over-invoicing	\$6,482	Cumulative illicit capital flow due to trade mis-invoicing (traditional method)	\$7.569
Remittance Adjustment (2004 US\$ Billion)	\$3.801	Import under-invoicing	0%	Total trade mis-invoicing inflows	\$6,482	Cumulative Financial Flow (traditional method)	\$1.949
Stock of capital flight/debt in 2004 (%)	342.6%	Export over-invoicing	3-5%	Gross trade mis-invoicing	\$26,194		
Net foreign assets in 2004 (in Billion)	\$15.95	Export under-invoicing	0%				

Source: a) Ndikumana and Boyce, 2010 (note that the GDP value used for this calculation is the 2004 GDP in 2004 prices, which was \$10.13 billion USD); b) Spanjers and Salamon, 2017; c) Kar and Spanjers, 2015; d) Kar and Freitas, 2011.

In the present study, I attempt to provide similar results, but with expanded coverage to previously excluded trading partners and commodity groups for recent using more detailed CIF-FOB ratios.

3. Data and Methodology

To arrive at the estimated amount of trade mis-invoicing and to generate corresponding capital flight numbers, one needs datasets on exports and imports as reported by a country under consideration (Ethiopia in this case) and its trading partners (mirror trade data). For the case of Ethiopia, I have extracted values of export and import flow from the UN COMTRADE using the World Bank's WITS (World Integrated Trade Solution) tool by two-digit commodity groups. UN's COMTRADE database is the only source that provides data at such a level of disaggregation.

Based on trade flow data from COMTRADE, Table 2 reports Ethiopia's major trading partners from 2013-2016 ranked by the value of total trade in 2016. The top ten trading partners are dominated by advanced countries, but also by two emerging economies, China and India. China tops the list, whereas India holds 7th place. Previous studies that estimate trade mis-invoicing in Africa (and developing countries of Asia and Latin America) often calculate estimates from trade flows only with advanced countries, excluding emerging economies. This approach underestimates trade mis-invoicing numbers. The justification for excluding these emerging economies from the list rests on the idea that data from these economies are not reliable and hence should not be used to estimate trade mis-invoicing. This argument might have been acceptable before these countries started their economic success and technical advances, at least, since the early 2000s and even before (for the case of India). For recent years, statistical reporting from such countries is believed to be of high quality and catching-up (if not comparable) to those of advanced nations. For instance, Reuter (2012) indicates that the comparison between developing and advanced economies is not an easy matter given the structure and the political economy setting of each country. Reuter further claims that developing countries are now catching up with advanced economies in terms of improving rules and regulations to minimizing illicit flow and its damaging effects. Therefore, I argue that such emerging countries should be included when estimating trade mis-invoicing for African countries. To take this into account, the present study reports results both for

advanced countries (as in previous studies) and for other major trading partners (including emerging economies that are major trading partners of Ethiopia) for purposes of comparison and correcting underestimated capital flight numbers.

Table 2: Ethiopia's top 20 trading partners, ranked by total trade in 2016

Country	2013	2014	2015	2016
China	127.33	234.35	283.13	287.31
United States	115.47	193.99	225.11	145.01
Germany	86.99	99.71	91.31	99.27
France	55.46	35.81	53.27	91.44
Italy	92.51	85.35	76.02	81.85
Netherlands	44.70	38.82	59.71	79.89
India	79.77	65.08	68.37	66.16
Switzerland	49.12	64.71	100.79	55.71
United Kingdom	40.61	46.04	71.60	54.41
Belgium	104.97	92.27	46.35	46.84
Turkey	46.58	37.06	35.85	41.76
Japan	52.18	45.61	48.44	35.45
Korea	23.10	45.78	37.48	31.23
Spain	18.30	13.91	25.14	19.23
Canada	6.75	31.73	8.16	16.17
Israel	19.73	21.91	14.58	15.87
Sweden	10.28	12.16	43.20	13.50
Russia	9.65	11.14	11.68	13.06
Finland	5.79	2.20	2.87	9.94
Czech Republic	2.83	8.33	7.60	9.17
Singapore	8.22	6.01	6.60	8.81

Source: author's computation from COMTRADE data, various years.

The other dataset needed to compare trade flows between two trading partners is the transport and insurance costs associated with imports. That is, the

cost-insurance-freight (CIF) to free-on-board FOB ratios that one needs to convert exports of a country into its mirror flow of imports reported by a country's trading partners. To compare exports (reported by Ethiopia) to imports (reported by Ethiopia's trading partners), one needs to convert free on board (FOB) export values into their import equivalents using cost-insurance-freight (CIF) values. Similarly, one needs to convert exports that Ethiopia's trading partners reported into equivalent Ethiopia's imports using CIF values.

Previous studies have used fixed proportions of exports (10% or 5%) as an approximation for CIF values and assumed a fixed CIF value of exports for all commodities and trading partners. Reports from Global Financial Integrity (GFI) and other studies (Ndikumana and Boyce, 2010; UNCTAD, 2016) have used 10% or 5% of the FOB value of exports to approximate CIF values. There are also CIF-FOB ratios computed from the IMF's Direction of Trade statistics, by just taking the ratio of imports to their mirror exports. This is, ratio of Ethiopia's imports to the corresponding exports from its trading partners. Studies that opted for a fixed CIF-FOB has criticized the CIF-FOB values computed from the IMF's Direction of Trade statistics as inconsistent (Ndikumana and Boyce, 2010; Ndikumana et al., 2015; UNCTAD, 2016; Berthou & Emlinger, 2011; Miao and Fortanier, 2016; Hummels and Lugovskyy, 2003¹). However, the fixed CIF-FOB values that these studies (UNCTAD, 2016; Ndikumana and Boyce, 2010) adopted in their estimation is not perfect either, since it assumes fixed CIF values for all trading partners and all commodity groups. It is unreasonable to expect a fixed CIF-FOB ratio for all partners and for all commodity groups. The only reason to justify the use of a fixed CIF-FOB ratio is the lack of data at the commodity group level. This study attempts to overcome that using an innovative estimation method that computes CIF-FOB ratios at country and commodity group level.

I argue that the use of a fixed CIF-FOB ratio may underestimate or overestimate trade mis-invoicing depending on the commodities and how far a country is from its trading partners. In an improvement over previous studies, Miao and Fortanier (2016) and Berthou & Emlinger (2011) have estimated

¹ After their investigation of the datasets, Hummels and Lugovskyy (2003) concluded that "... IMF's cif/fob ratios are badly error-ridden in levels, and contain no useful information for time series or cross-commodity variation. However, the IMF data do appear to reveal some meaningful cross-exporter variation that might be usefully exploited by researchers."

country and commodity-specific CIF values to highlight the significant variation across commodity groups and trading partners.

As part of a related project, Miao and Fortanier (2016) 's work (as part of OECD project) on international transport and insurance cost (ITIC) of merchandise trade provides estimates of CIF-FOB values as a fraction of imports (at CIF value) for each country over time by trading partners and commodity groups. Following their estimation, unlike previous studies, the present study uses the estimated CIF-FOB values (Miao and Fortanier, 2016) to convert exports to import equivalents. Estimated CIF-FOB values take into account distance, trade volume, and other factors to arrive at a better approximation of the CIF values. Specifically, OECD's approach uses a gravity model with a list of independent variables identified as relevant in previous studies. These independent variables include the geographic distance between trading partners, the infrastructure quality of importing and exporting country (measured using GDP per Capita), the median unit value of each 6-digit product, dummies for partner contiguity and for partners being on the same continent, and a set of product and year dummies to arrive at estimated CIF values. Their estimation generates CIF-FOB margin of a specific commodity c , imported by a country, E , from a trading partner, P , at a given year t . Since it uses trade partner-commodity-time specific CIF-FOB values, this study is an improvement over previous studies that use fixed values for all partners and commodities (Ndikumana and Boyce, 2010; Ndikumana et al., 2015).

Once the CIF-FOB values are computed, the remaining question is whether to use CIF-FOB values estimated from trade flow data reported by a country or its trading partners. Figures 1 and 2 plot estimated values of CIF-FOB from Ethiopia and its trading partners for 2008-2016, and 2014, respectively. As is clear from the plots, there are variations in the average values of the computed CIF-FOB ratios. The data estimated from partner countries concentrate around 0.09, whereas those estimated from Ethiopia vary widely. Figure 1 plots the average CIF-FOB ratio for the period between 2008 and 2016; whereas Figure 2 plots estimates for 2014² (the latest year data on CIF-FOB ratio is available). In this study, I use the CIF-FOB ratio (CIF-FOB_repo) obtained from Ethiopia's trade flow data to compute values of Ethiopia's imports from partners' exports.

² For the years 2015 and 2016, I use the numbers from 2014 to extrapolate to the two recent years for each country and commodity group.

Similarly, I used the CIF-FOB ratio (CIF-FOB_part) obtained from partners' trade flow data to compute the values of partners' imports from Ethiopia's exports. This approach is justifiable since estimates of CIF-FOB values are computed based on each country's actual trade flow, and it is reasonable to use the same estimates to compute import values for each country.

Figure 1: Kernel density of average cost insurance and freight estimates from data reported by Ethiopia and its partners 2008-2016

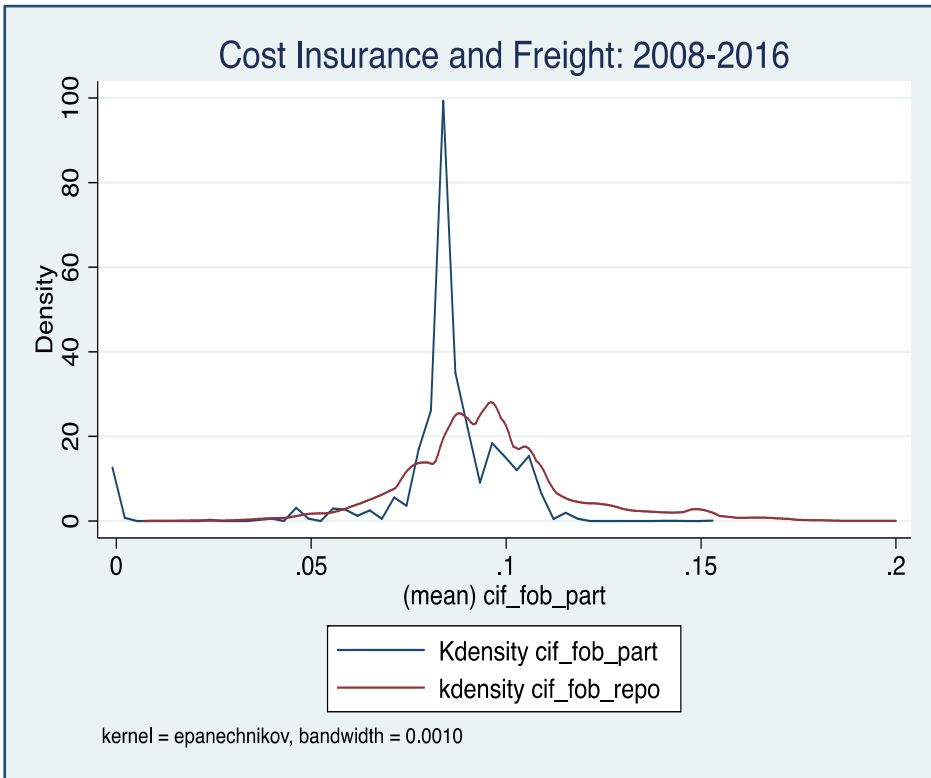
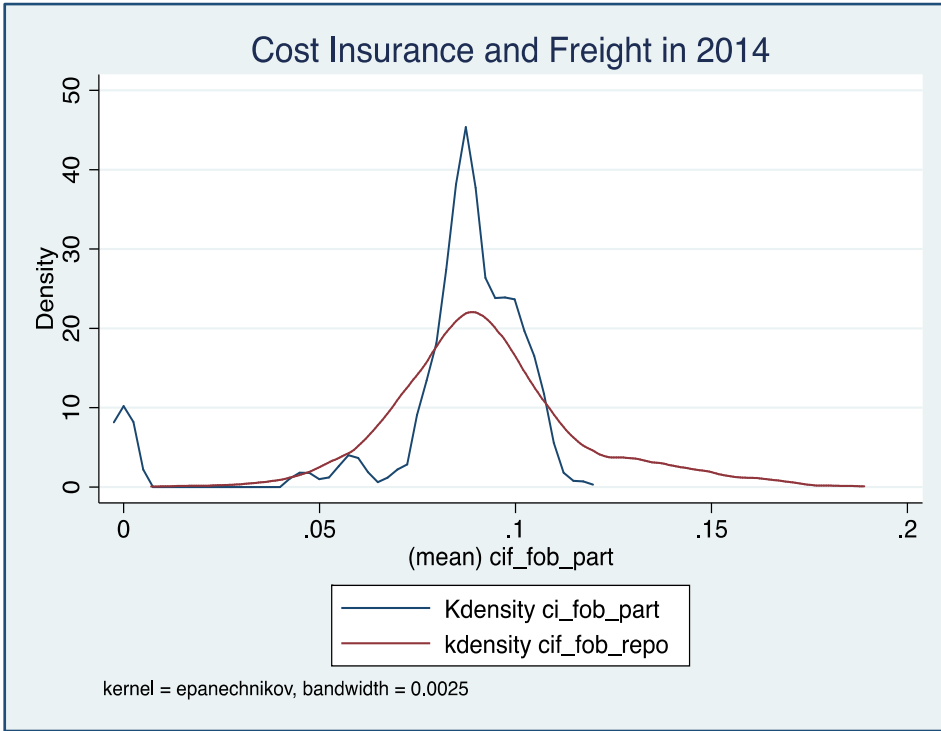


Figure 2: Kernel density of average cost insurance and freight estimates from data reported by Ethiopia and its partners 2014



Methodology

There is as much no debate or controversy on how to compute trade mis-invoicing numbers as much as what CIF-FOB ratios and which countries to include in the computation. Most previous studies have adopted the standard estimation technique that compares exports of a country to its' trading partners' imports and vice-versa. Some studies estimate trade mis-invoicing numbers to adjust gross capital flight estimates (Chang et al., 1997; Ndikumana and Boyce, 2010; Geda and Yimer, 2016; Global Financial Integrity, 2017; Kwaramba et al., 2016) while others just estimate trade mis-invoicing to highlight its importance at a commodity level (UNCTAD, 2016; Beja, 2006; Buehn and Eichler, 2011).

The estimation formula (to compute mis-invoicing) adopted in this study is not different from previous studies. The variables used in the computations, however, are a bit different. To have a focused discussion on this, consider two

countries: Ethiopia (E) and its partner (P). Ethiopia both imports from and exports to its partner country, P. As described above in the data, I have gathered data on Ethiopia's exports to and imports from P as reported by Ethiopia. I have also gathered data on partner P's imports from and exports to Ethiopia. Ideally, imports of P from E should be the same as exports of E to P (plus costs of insurance and transportation, CIF). Similarly, imports of E from P should be the same as exports of P to E (plus CIF). In practice, however, there is no such perfect equality in trade flows for various reasons, as discussed above. I follow a simple formula to calculate the discrepancies between these values both for exports and imports to see if there are any systematic discrepancies between the numbers reported by Ethiopia (E) and its' trading partner (P) by commodity (c), and over time (t). I have reported CIF-FOB values as a fraction of exports at CIF values. In the formula below, I added the CIF-FOB fraction of exports to export values to generate equivalent import values.

For export mis-invoicing by exporters from E, I compute the following: $DX_{EP,t}^c = M_{PE,t}^c - (1 + CIF) * X_{EP,t}^c$, labelled as differences in exports (exportdiff) in the data. Where $M_{PE,t}^c$ is imports of commodity c by partner country, P, from Ethiopia, E, in year t. Similarly, $X_{EP,t}^c$ represent exports of commodity c, by Ethiopia to partner country, P. $DX_{EP,t}^c$ represents the difference between what is reported as import by country P and as exports by Ethiopia.

Positive values of the difference are evidence for export under-invoicing (evidence for capital flight); whereas negative values of the difference are evidence for export over-invoicing (evidence for capital inflow).

For import mis-invoicing by exporters from E, I compute the following: $DM_{EP,t}^c = M_{EP,t}^c - (1 + CIF) * X_{PE,t}^c$, labelled as differences in imports (importdiff) in the data. That is, imports by Ethiopia from partner, P, must be the same as exports from P to E (after taking into account CIF values). If these two values are not the same, the difference may be positive or negative depending on the magnitude of each value.

Similarly, positive values of the difference are evidence for import over-invoicing (evidence for capital flight), whereas negative values of the difference are evidence for import under-invoicing (evidence for capital inflow).

Export over-invoicing and import under-invoicing result in capital inflow (although illegally), and because of that, some studies (for instance, Global Financial Integrity, 2016) exclude these values from capital flight estimation, not

just because it brings capital back to a country but also by assuming it as insignificant. As we will discuss below, though, these values are not negligible for the case of Ethiopia. I compute total trade mis-invoicing as the sum of export mis-invoicing and import mis-invoicing. Positive values of trade mis-invoicing give us net capital flight estimates due to trade mis-invoicing, which means more export under-invoicing (compared to export over-invoicing) and more import over-invoicing (compared to import under-invoicing). I compute these differences by partner and commodity groups, and then I regroup the values to highlight the commodities and partners by the sign and magnitude of the difference.

4. Results and Discussion

Before getting into detailed estimates of trade mis-invoicing and its components, first, I compared trade flows that Ethiopia and its trading partners have reported (Figure 3). Differences in total trade flows are in the range of hundreds of millions of dollars, especially since 2012. In 2012, 2014 and 2015, Ethiopia's trading partners reported more trade flow than what Ethiopia has reported; whereas, in 2016, Ethiopia reported more trade flow than reported by its trading partners. The last five years have driven much of the differences in trade flows between Ethiopia and its trading partners.

Tables 4-7 in the appendix provide details on alternative ways of measuring trade mis-invoicing (and its components) over time (Table 4) and trade mis-invoicing (and its components) by major commodity groups and trading partners (Tables 5-7).

Figure 3. Differences in total trade flow as reported by Ethiopia and its partners

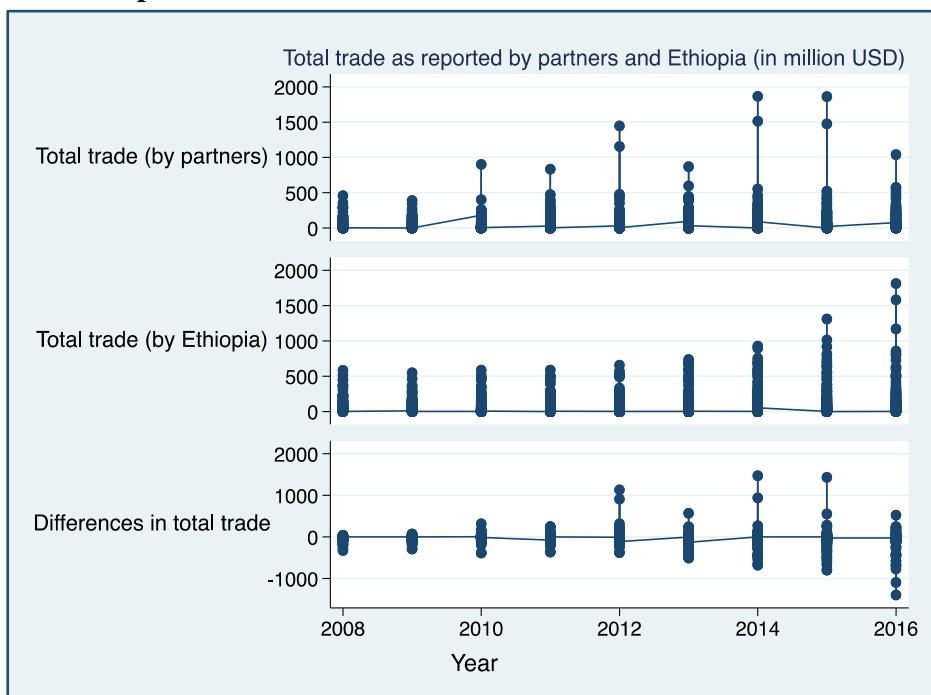


Table 3 presents estimates of export, import, and trade mis-invoicing using three alternative approximations of CIF-FOB ratios for advanced countries as well as for emerging trading partners of Ethiopia. Table 4 in the appendix provides similar estimates for all countries and major trading partners over time. To compare results with previous studies, I computed estimates of trade mis-invoicing not just with estimated values of CIF-FOB ratio but also using fixed ratios (10% and 5%) of exports at FOB values to generate corresponding import values. It is important to note from the outset that there is no difference in the direction (sign) of mis-invoicing using all three estimates of CIF-FOB ratios, but there is a significant difference in magnitude³. In all three cases, estimates that use 10% and 5% CIF-FOB ratios overestimate values of trade mis-invoicing; the same result is obtained for all countries and major trading partners (see Table 4).

³ Similar estimates for all countries and for major trading partners (including India and China) confirm the same finding. Tables for these estimates are not reported here but are available upon request.

As noted in the methodology section, positive values for exports imply under-invoicing, whereas negative values imply over-invoicing. For imports, positive values imply over-invoicing and negative values imply under-invoicing.

The results in Table 3 confirm that both exports and imports are over-invoiced, which suggested both capital inflow (due to export over-invoicing) and capital outflow (due to import over-invoicing). The results that use 10% and 5% for CIF-FOB ratio tend to overestimate these values even more than what it supposed to be. That is, both ratios overstate estimated values of Ethiopia's exports (or underestimate partner countries' imports from Ethiopia) and also overestimate Ethiopia's imports from partner countries (or underestimate partners countries' exports to Ethiopia). As I noted above, I argue that the estimated CIF-FOB ratios give a closer approximation to what is really happening in terms of trade mis-invoicing in the country. For instance, in 2016, for Ethiopia's trade with advanced economies, estimated CIF-FOB ratio result in mis-invoicing of \$0.6 billion (exports), \$3.1 billion (imports), and \$3.6 billion (total trade); whereas the 5% fixed CIF-FOB ration result in mis-invoicing of \$2.7 billion (exports), \$11.9 billion (imports), and \$14.4 billion (total trade). In other words, the estimate that uses the fixed CIF-FOB ratio overstates estimated trade mis-invoicing by about three times compared to that of estimated CIF-FOB ratio.

Table 3: Trade mis-invoicing computed using three different estimates of CIF-FOB ratios (estimated, 10% and 5%) for advanced countries and emerging economies (in mill. USD)

Year	Exports (estimated)	Exports (10%)	Exports (5%)	Imports (estimated)	Imports (10%)	Imports (5%)	Trade (estimated)	Trade (10%)	Trade (5%)
For Advanced economies trading partners									
2008	-172.64	-700.23	-515.84	818.25	3299.67	3604.07	404.95	2700.48	3160.18
2009	-54.83	-162.15	-16.66	529.06	3026.86	3297.19	210.61	2601.91	3000.22
2010	-170.92	-746.40	-539.57	131.91	1849.07	2209.08	3.40	760.38	1275.70
2011	-82.15	-419.42	-163.90	-50.50	963.89	1361.99	-11.67	637.01	1238.69
2012	-79.78	-314.97	-48.26	582.38	37.55	551.46	36.88	-688.49	64.29
2013	-458.82	-1881.02	-1545.62	1129.07	3496.80	3945.35	56.51	1365.94	2114.37
2014	-491.46	-1980.65	-1601.66	1628.92	3502.83	4091.31	139.91	1351.29	2270.28
2015	-325.63	-1159.41	-779.33	2760.28	8484.39	9095.59	2196.69	7086.46	8036.50
2016	636.73	2553.41	2710.85	3156.29	11345.42	11940.40	3600.40	13688.84	14417.18
Total	-1199.49	-4810.85	-2499.98	10685.65	36006.47	40096.45	6637.67	29503.81	35577.41

Year	Exports (estimated)	Exports (10%)	Exports (5%)	Imports (estimated)	Imports (10%)	Imports (5%)	Trade (estimated)	Trade (10%)	Trade (5%)
For emerging trading partners (Brazil, China, Egypt, India, Mexico, Poland, Russia, South Africa, Thailand, and Turkey)									
2008	-4.39	-39.02	-9.10	490.27	1927.82	2261.46	328.60	1711.06	2047.38
2009	-52.53	-225.05	-161.18	1043.75	4141.30	4552.27	748.59	3709.75	4155.13
2010	-85.25	-412.36	-325.48	1346.07	5370.02	5750.56	952.34	4536.71	4981.99
2011	-45.86	-219.78	-132.48	1414.30	5712.43	6089.34	1035.33	5264.52	5718.45
2012	-77.55	-317.24	-219.28	1495.81	5993.18	6583.26	1173.34	5461.52	6098.27
2013	-142.03	-636.33	-520.86	1897.08	7289.19	7987.60	1621.81	6538.44	7305.66
2014	-151.98	-672.78	-515.35	3267.21	13465.69	14333.56	2875.11	12467.43	13471.42
2015	-76.58	-355.30	-240.39	4292.37	17932.85	18918.32	3811.87	17195.43	18277.21
2016	428.72	1694.32	1720.39	3750.56	14957.85	15931.65	3275.14	15945.13	16904.68
Total	-207.46	-1183.54	-403.73	18997.42	76790.33	82408.01	15822.12	72830.00	78960.18

Results in Table 3 also show that Ethiopia has lost \$6-35 billion to trade mis-invoicing between 2008 and 2016 just from trade with advanced countries (top panel of the table). That is, the range for the total values under trade using estimated CIF-FOB ratio and 5% CIF-FOB ratio. Import over-invoicing contributed to this mis-invoicing in its entirety; that is, \$10-40 billion of the capital flight during the study period was due to import over-invoicing. The lower panel of the table reports results for emerging trading partners of Ethiopia, that is often not included in the estimation of capital flight or trade mis-invoicing. Ethiopia's trade with just these emerging economies alone adds \$15-78 billion to trade mis-invoicing numbers, which is more than double the estimate for advanced countries. Even if we just take the sum of the lowest estimates of trade mis-invoicing, Ethiopia had lost over \$20 billion (6 billion + 15 billion) due to trade mis-invoicing with both advanced and emerging economies. For emerging economies, import over-invoicing contributed \$18-82 billion during the same period between 2008 and 2016. I argue that ignoring these estimates from emerging economies underestimate trade mis-invoicing and overall capital flight number for Ethiopia. Fortunately, or unfortunately, export mis-invoicing resulted in capital inflow, in that export over-invoicing brought in about \$1-4.8 billion from advanced countries and \$0.2 – 1 billion from emerging trading partners. As noted in the literature review, estimates from the Global Financial Integrity (2017) exclude export over-invoicing since it results in capital inflow. However, I believe that since this capital inflow comes through illegal means, it may end up financing illegal activities, that may not help the development process in general, and priority sectors, in particular, in the country.

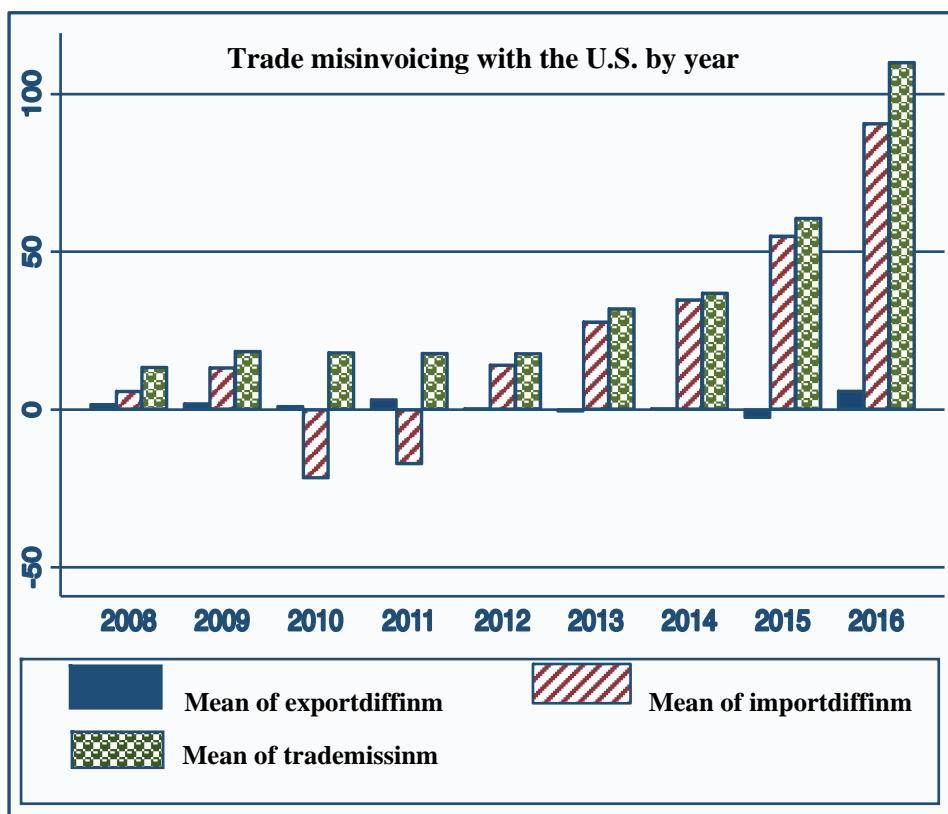
In the following two figures (Figures 4 and 5), I present trade mis-invoicing numbers for the two top trading partners of Ethiopia, China and the US. The figures depict average values of export, import, and total trade mis-invoicing for the two countries from 2008-2016. For the case of China (Figure 4), import over-invoicing is by far account for the largest share of trade mis-invoicing. For instance, in 2015, import over-invoicing was over \$200 million, whereas export under-invoicing is almost negligible.

Figure 4: Trade mis-invoicing estimates for Ethiopia-China trade flow (in millions): 2008-2016



The comparable number for the US is not as high (see Figure 5); in fact, trade mis-invoicing of Ethiopia with the US is about one-fourth of what it was in China in 2015. In 2016, trade mis-invoicing with the US jumped to \$100 million, which is about half of what it was in China. In recent years, there may be trade diversion from China to the US as the country expand factories to target the US market to take advantage of the Africa Growth Opportunity Act signed between selected African countries and the US government.

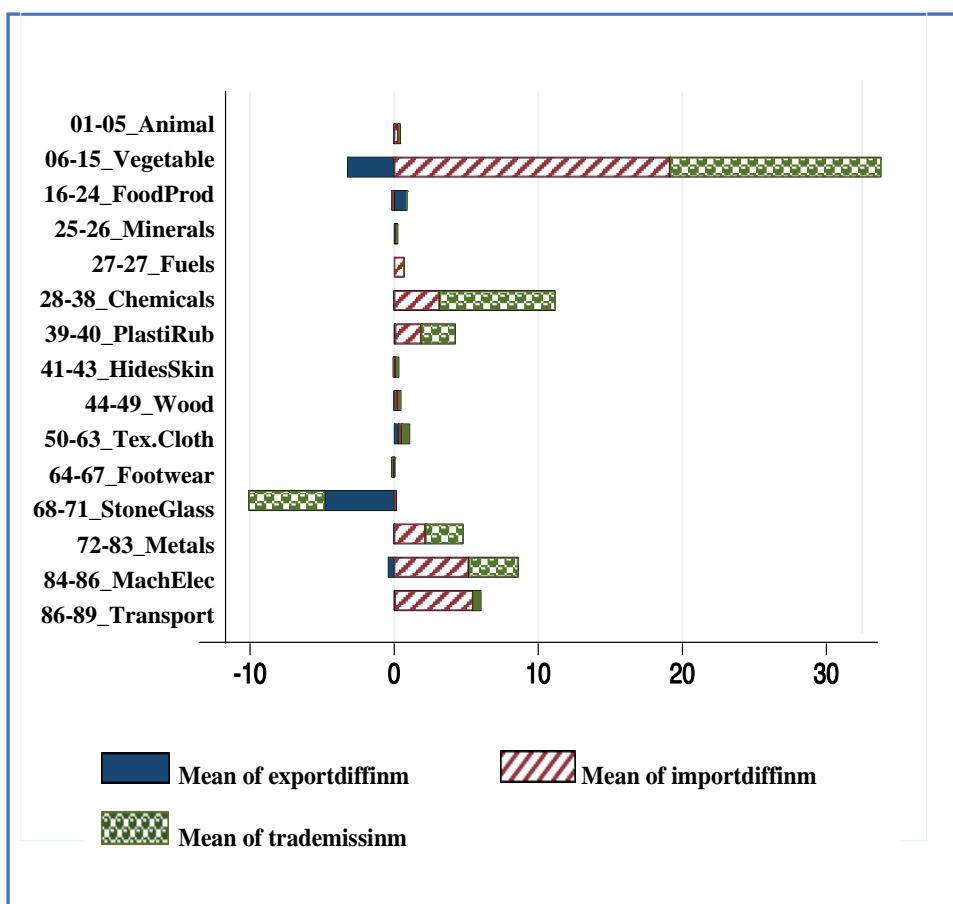
Figure 5: Trade mis-invoicing estimates for Ethiopia-U.S. trade flow (in millions): 2008-2016



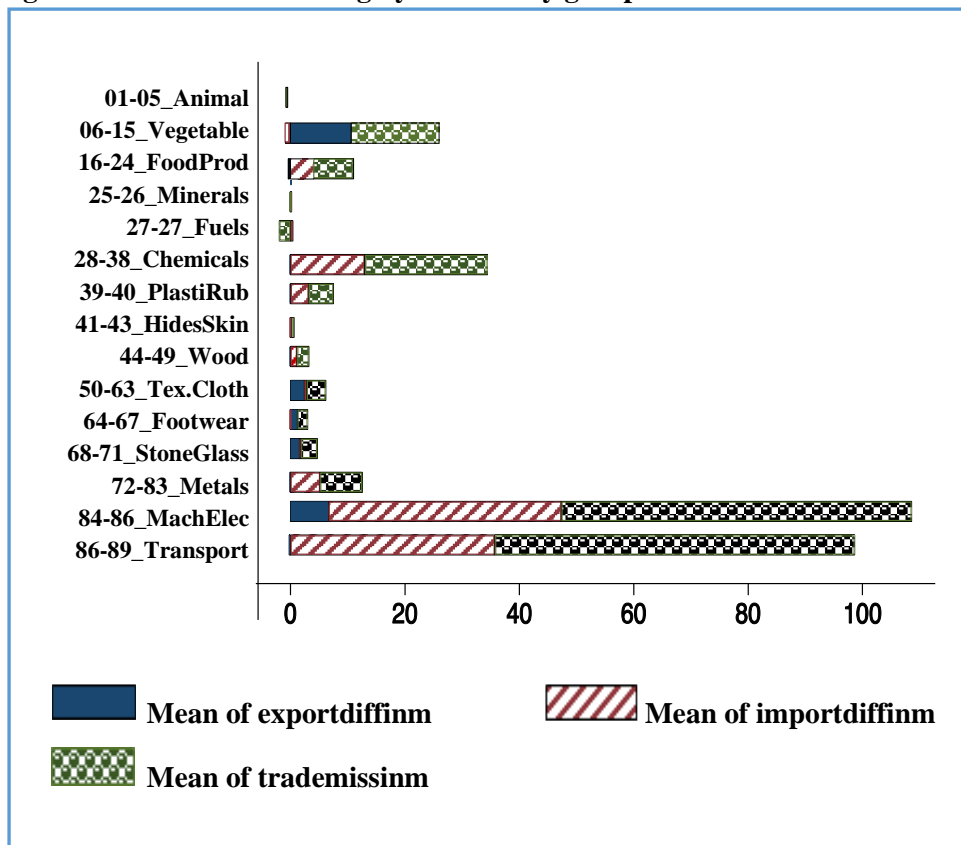
4.1 Trade mis-invoicing by commodity groups

In 2008, a handful of commodities contributed to trade mis-invoicing for both exports and imports. Transactions in vegetables, chemicals, machines, and transport requirements were the top commodities that contributed to import over-invoicing. Transactions in stones & glasses, and, to some extent, vegetables were significant drivers of export over-invoicing (see Figure 6).

Figure 6: Trade mis-invoicing by commodity groups in 2008



In 2016, export over-invoicing almost disappeared (see Figure 7). The majority of the commodities that contributed to capital flight through both import over-invoicing and export under-invoicing were in machinery and transport equipment commodity groups. As the country engages in major infrastructure expansion, imports of different types of machinery and transport equipment expanded in recent years and ended up being one of the significant contributors to trade mis-invoicing.

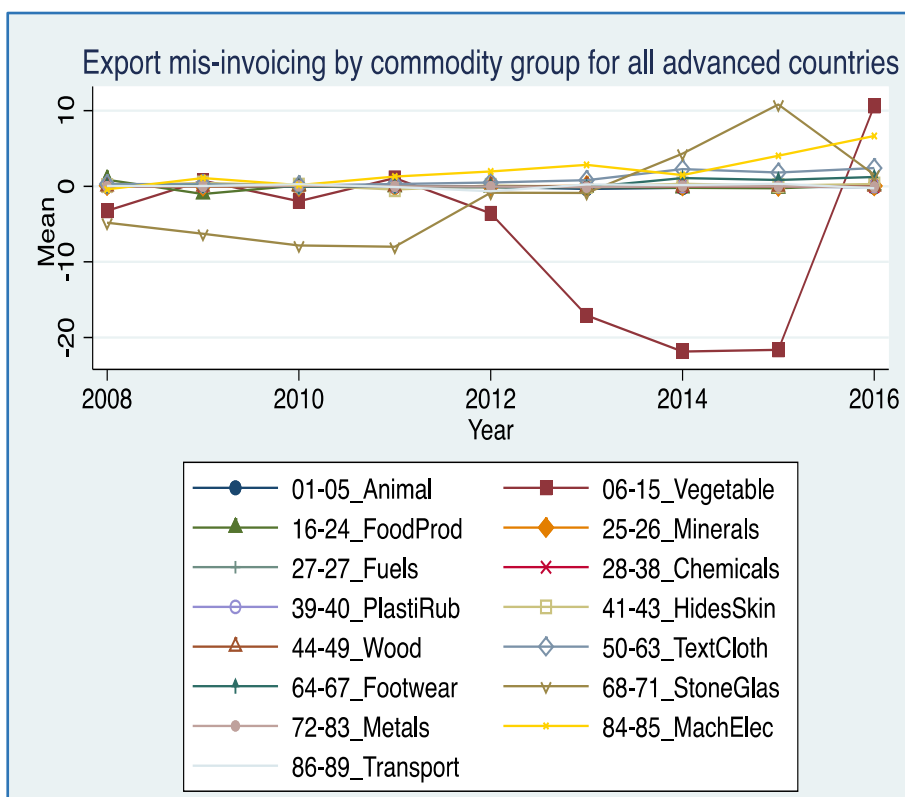
Figure 7: Trade mis-invoicing by commodity groups in 2016

Figures 8-13 report trade mis-invoicing over time, and by commodity groups, for trade with advanced countries (Figures 8 and 9), China (Figures 10 and 11), and the US (Figures 12 and 13). In almost all these figures, the same commodity groups that contributed to a significant surge in trade mis-invoicing in recent past as discussed above. That is, vegetables, chemicals, machinery, and transport equipment. There is, however, slight variations across commodity groups as we zoom in the details by year, country, and direction of the trade (exports or imports).

Figure 8 reveals that for advanced countries, Ethiopia's exports of machineries, stones & glasses, and vegetables have contributed to the largest share of the mis-invoicing. Vegetable, stones & glasses exports were responsible for export over-invoicing but at different time periods. More specifically, exports of vegetables (this includes cut flowers and chat- a stimulant leaf mostly sold to

middle eastern countries) were responsible for over-invoiced between 2012 and 2015. Exports of machineries and stones & glasses (in recent years) were responsible for export under-invoicing.

Figure 8: Export mis-invoicing by commodity groups for Advanced countries: 2008-16



For imports, trade in machinery, transport equipment, and chemicals are significant contributors to import mis-invoicing. Except for a couple of years between 2009 and 2013, imports of all three products were over-invoiced (Figure 9). The last three years were particularly important as the country expanded imports of these goods as it expands infrastructure development.

Figure 9: Import mis-invoicing by commodity groups for Advanced countries: 2008-16

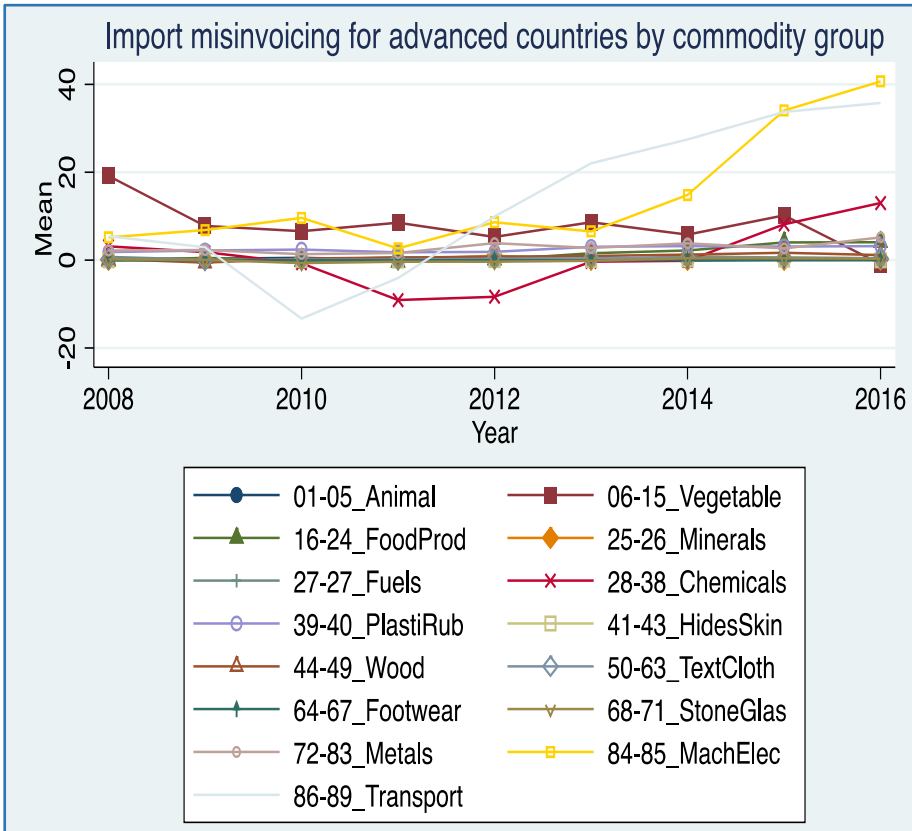
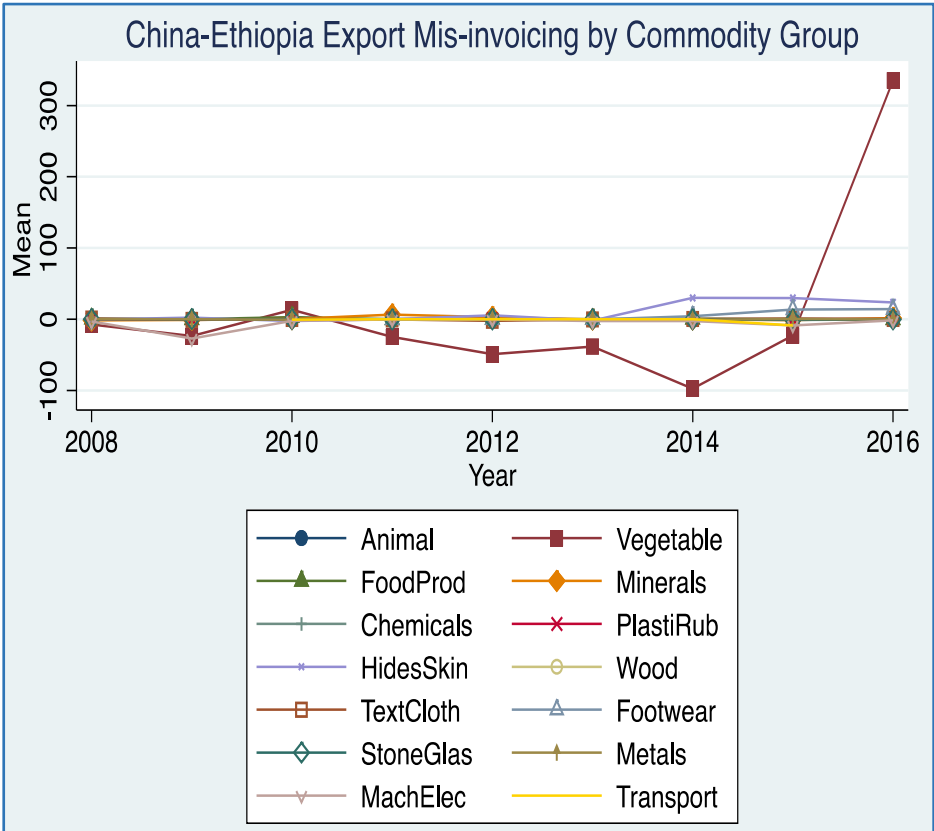


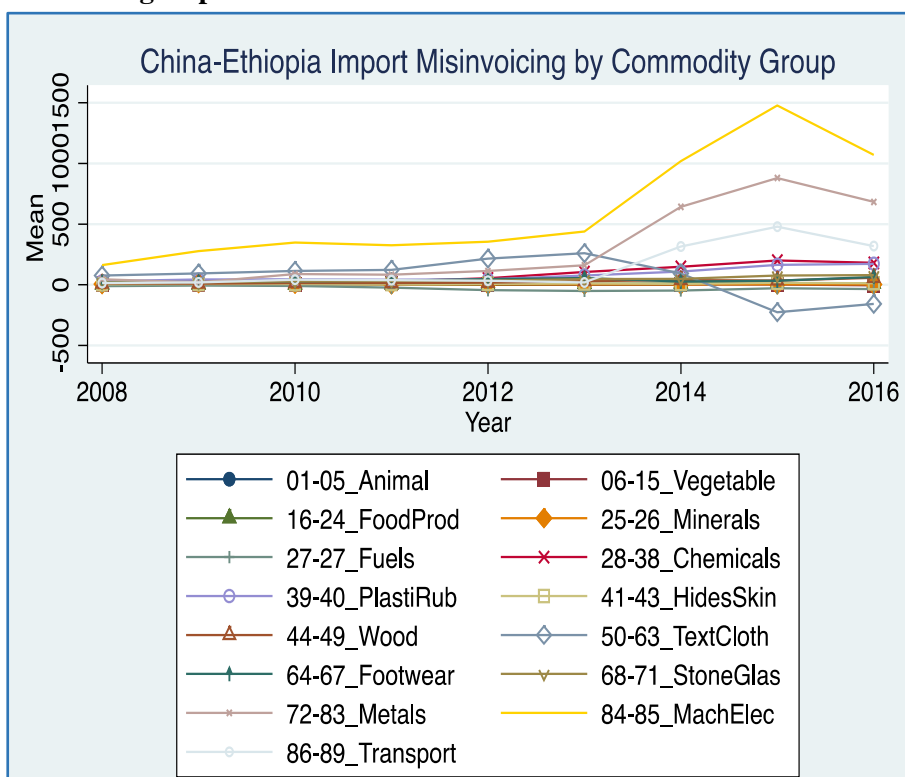
Figure 10 depicts a similar phenomenon for trade with China; that is, exports of vegetables, footwear, and hides and skins are responsible for export mis-invoicing. Until 2015, exports of vegetables were over-invoiced; however, there was reversal of this trend in 2016. All the other commodity groups show insignificant amount of export mis-invoicing.

Figure 10: Export mis-invoicing of China-Ethiopia trade flow by commodity groups



Except for textile products in the last three years, imports of all other products from China were over-invoiced (Figure 11). Imports of machinery, transport equipment, and metal products contributed significantly to import over-invoicing. As noted above, when Ethiopia intensifies the expansion of infrastructure development, it looked east for the supply of construction materials sourcing most inputs from China. These import over-invoicing followed this trend and took advantage of this trade expansion to hide their ill-obtained foreign currency in China through import over-invoicing.

Figure 11: Import mis-invoicing of China-Ethiopia trade flow by commodity groups



The case of the US is somewhat similar to that of China. Figures 12 and 13 below depict similar graphs for Ethiopia exports and imports mis-invoicing, respectively. For exports, three products were responsible for export mis-invoicing: Vegetables, footwear, and textile products (Figure 12). Exports of vegetables were initially under-invoiced until 2013, then over-invoiced until the end of 2015. All other commodity groups contributed little to trade mis-invoicing. Similarly, imports of machinery, transport equipment, and, to some extent chemicals drove most of the import mis-invoicing between Ethiopia and the US. Except for transport equipments (between 2008 and 2012), all three commodity groups contributed to import under-invoicing. However, the magnitude of mis-invoicing both for exports and imports were much lower than the case of China.

Figure 12: Export mis-invoicing of Ethiopia-U.S. trade flow by commodity groups

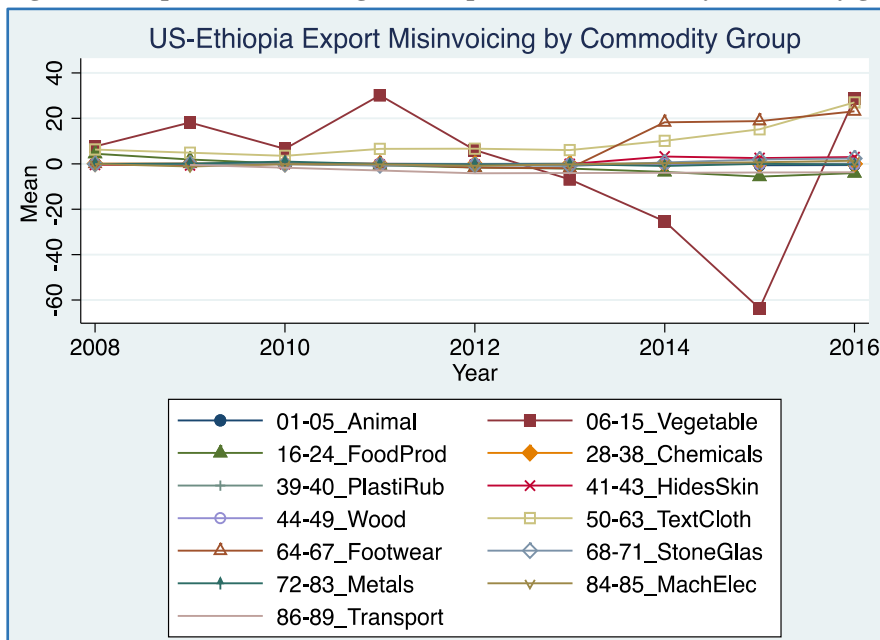
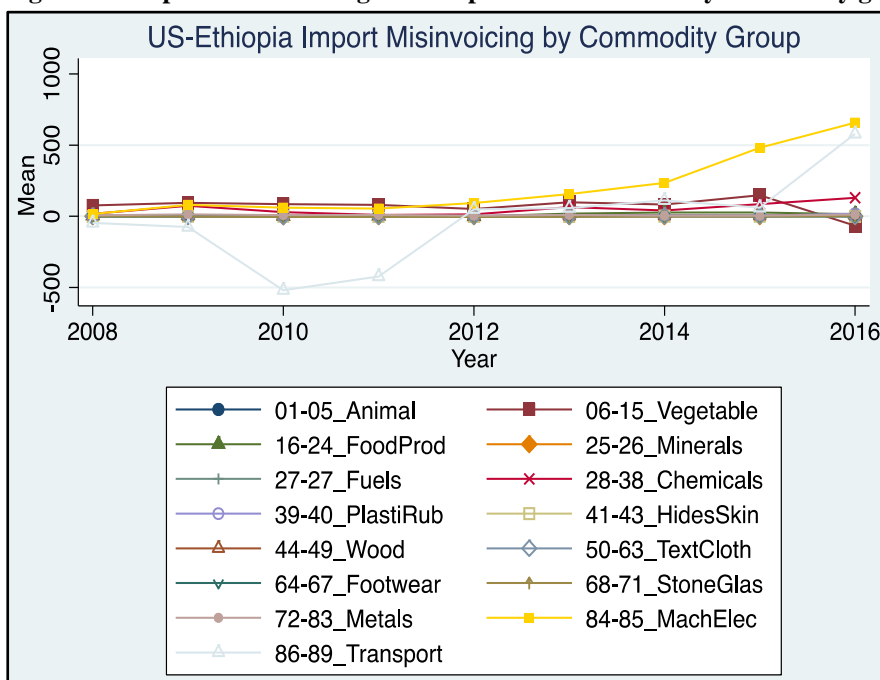


Figure 13: Import mis-invoicing of Ethiopia-U.S. trade flow by commodity groups



Figures 14-17 in the appendix depict scatter plots of export, import, and trade mis-invoicing for major trading partners of Ethiopia. These figures highlight the countries with which Ethiopia had recorded under-invoicing or over-invoicing of exports and imports. For instance, Figure 14 (with a 45-degree line) shows that countries to the right of the 45-degree line reported exports that are lower than the import amount reported by Ethiopia, which implies import over-invoicing in 2008. These countries include the US, Italy, Japan, Germany, and France. In 2016, not much had changed except that France moved to the other side of the 45-degree line suggesting import under-invoicing, and Germany moved closer to the 45-degree line (Figure 15).

For Ethiopia's exports, there have been movements by trading partners between 2008 and 2016. In 2008, Ethiopia's exports to Switzerland, Japan, and the US were over-invoiced (to the left of the 45-degree line), whereas, in 2016, all these three countries changed sides to the right of the 45-degree line suggesting export under-invoicing. It is not clear why there has been such a significant shift from export over-invoicing to export under-invoicing between 2008 and 2016 for these countries.

In connection with partner countries that have contributed to trade mis-invoicing, Tables 5-7 provide percentage share of export, import, and trade mis-invoicing to exports, imports, and total trade, respectively, for major commodity groups. Six commodity groups are selected based on results from previous graphs that show the importance of these commodities in affecting trade mis-invoicing. The percentage share of export mis-invoicing was the highest for exports to Austria, the Czech Republic, Estonia, Ireland, Luxembourg, Slovak Republic, and Switzerland. These are small European economies with which Ethiopia has a small market share, and for these countries, even smaller (in absolute magnitude) mis-invoicing shows up as a large percentage change. China has the highest percentage share of mis-invoicing for exports in vegetables and transport equipment. Germany, the third major trading partner of Ethiopia, recorded the highest export mis-invoicing for food and machinery.

Overall, Ethiopia had significant trade mis-invoicing record in vegetables with Singapore (over-invoicing) and Brazil (under-invoicing). For food products, trade with India, the United Arab Emirates, and the Czech Republic had the highest percentage share and recorded the highest export under-invoicing. For trade in chemical products, Finland, the Czech Republic, and New Zealand had the highest percentage share. For trade in machinery, China (Hong Kong),

Ireland, and Australia were the top three countries with the highest share of trade mis-invoicing. The US comes second on the list of countries responsible for trade mis-invoicing as a result of trade in transport equipment. The other countries on the top of the list are Australia, the Czech Republic, and Japan. The Czech Republic comes up a lot on this list for almost all products. One needs to study the trade relationship with the country further to get to the root of the problem.

5. Conclusions and Implications

This study aimed to present estimates of Ethiopia's trade mis-invoicing disaggregated by commodity groups, trading partners, and over time. Unlike previous studies that have used fixed CIF-FOB ratios, the present study used estimated values of CIF- FOB ratios to convert a country's exports to its equivalent import values from partner countries. Estimates reported in this study also include countries often excluded in similar previous studies, despite being major trading partners of Ethiopia (like China and India), especially in recent years.

The results of this study show that, if we consider only advanced countries, trade mis-invoicing costs Ethiopia \$6-36 billion between 2008 and 2016. If we include trade with emerging trading partners of Ethiopia (often excluded from such estimation), this alone adds \$15-78 billion to trade mis-invoicing estimates between 2008 and 2016. If we just take the sum of the lowest estimates of trade mis-invoicing, Ethiopia had lost over \$20 billion (6 billion + 15 billion) due to trade mis-invoicing with both advanced and emerging economies. A handful of commodity groups contributed to trade mis-invoicing in a significant way. For exports, vegetables, and machinery were major contributors; for imports, transport equipment, machinery, and, to some extent, chemicals were major contributors.

Trading partners, which have a significant percentage share of trade mis-invoicing compared to overall trade, include India, United Arab Emirates (UAE), Finland, New Zealand, China (Hong Kong), Ireland, Australia, the US, Australia, Japan, and the Czech Republic. Some of these countries are not on the list of advanced economies (India, UAE, and China); however, these countries contributed to mis-invoicing and hence to capital flight in a significant way.

Authorities in Ethiopia should look into these countries and commodity groups that have contributed to trade mis-invoicing in a major way to close the loopholes that these traders have used to mis-invoice trade. There is a need to further study the channels through which these commodity groups are traded and what special loophole exists with the trading partners that tops the list of largest mis-invoicing. Custom authorities in the country should also ensure that the pricing system they use for tariff and tax purposes are up to date to mitigate mis-invoicing of these commodity groups and trading partners. Finally, government watch dog groups should also take a stock of traders involved in exports and imports of the top commodities suspected of mis-invoicing to see if they are taking advantage of some hidden regulation that result in trade mis-invoicing.

Future research should focus on fine tuning such studies to provide even more refined insight for policy-makers. This may include micro-level analysis of the commodity groups suspected of having the largest trade mis-invoicing. Similarly, individual partner countries should be scrutinized to pin point to a special agreement or pact that Ethiopia signed which may inadvertently encourage trade mis-invoicing.

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Appendix

Figure 14: Scatter plots of Ethiopia's imports and partners exports: 2008

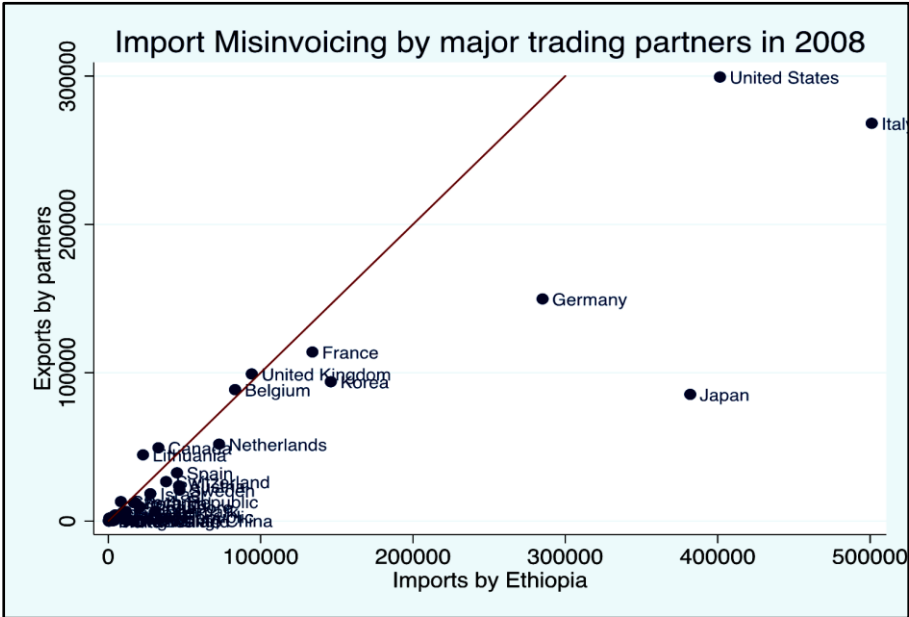


Figure 15: Scatter plots of Ethiopia's imports and partners exports: 2016

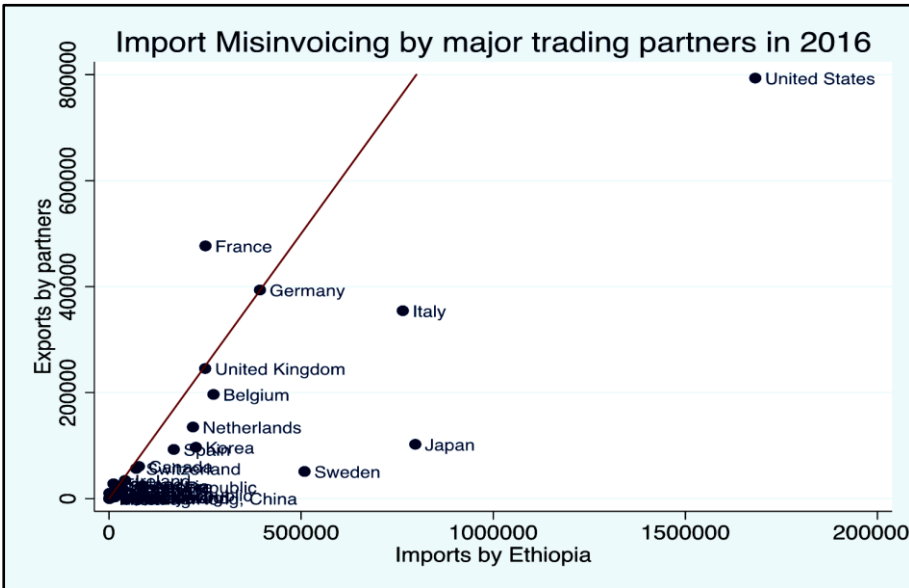


Figure 16: Scatter plots of Ethiopia's exports and partners imports: 2008

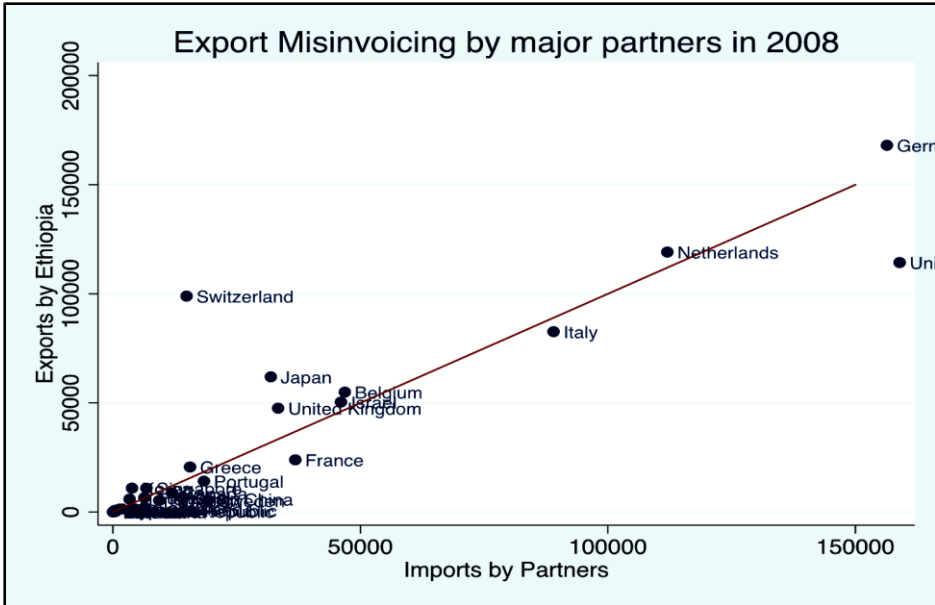


Figure 17: Scatter plots of Ethiopia's exports and partners imports: 2016

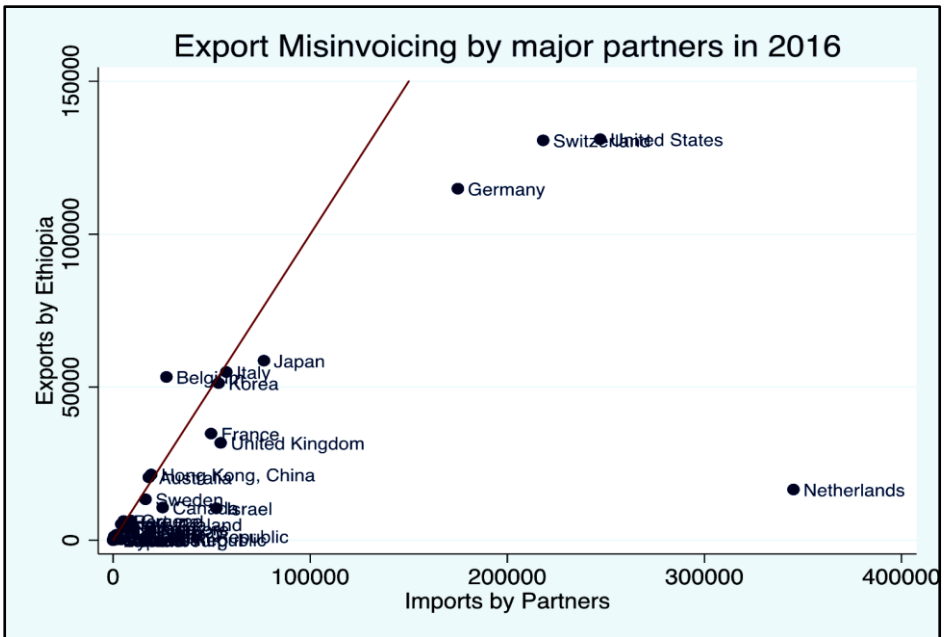


Table 4: Export, Import, and total trade mis-invoicing at three different CIF-FOB ratios (estimated, 10% and 5% CIF values)

All Countries	Exports			Imports			Trade		
Year	Diff. Exports	Diff. Export (10%)	Diff. Export (5%)	Diff. Imports	Diff. Imports (10%)	Diff. Imports (5%)	Diff. Trade	Diff. Trade (10%)	Diff. Trade (5%)
2008	-77.37	-437.4	-159.3	2017.05	13437.83	14126.3	856.08	11712.49	12610.43
2009	-49.99	-706.72	-430.89	2111.77	12043.27	12801.33	1188.31	10133.66	11085.49
2010	-324.19	-1991.14	-1613.1	2137.55	12077.27	12943.35	1079.25	8476.97	9602.09
2011	-142.3	-1548.24	-1108.55	2209.62	11689.18	12650.01	1253.68	10085.79	11348.94
2012	-213.01	-1620.48	-1133.05	3039.54	14526.12	15760.8	1502.3	11674.1	13268.52
2013	-785.96	-4223.35	-3618.8	3945.22	19423.49	20716.69	2220.92	14506.94	16277.33
2014	-888.84	-3790.34	-3108.31	5856.12	31419.79	33031.44	3571.15	26945.56	29114.63
2015	-703.92	-2758.28	-2113.93	8296.98	37676.82	39455.13	6459.6	33609.74	35930.21
2016	1017.21	4461.63	4722.92	7982.62	35857.99	37563.93	7529.8	38866.36	40750.82
Total	-2168.37	-12614.32	-8563.01	37596.46	188151.76	199048.98	25661.09	166011.61	179988.46

All Countries	Exports			Imports			Trade		
Year	Diff. Exports	Diff. Export (10%)	Diff. Export (5%)	Diff. Imports	Diff. Imports (10%)	Diff. Imports (5%)	Diff. Trade	Diff. Trade (10%)	Diff. Trade (5%)
Major Trading Partners									
2008	-186.89	-786.32	-561.34	1309.86	5709.16	6320.27	738.81	4970.15	5749.89
2009	-104.33	-683.98	-463.2	1527.1	7039.51	7721.38	948.07	5982.78	6831.12
2010	-229.39	-1700.16	-1386.71	1428.8	6659.25	7424.9	963.67	4550.33	5536.42
2011	-103.18	-1224.23	-861.67	1345.42	5582.46	6407.23	1038.15	4948.72	6035.85
2012	-144.15	-579.48	-225.38	2013.88	5729.53	6821.63	1194.39	4579.22	5949.28
2013	-546.95	-2262.56	-1831.04	2988.41	10606.07	11731.93	1711.75	8003.76	9482.58
2014	-597.97	-2470.19	-1954.17	4825.13	16626.84	18057.4	2965.61	13655.65	15539.61
2015	-382.2	-1431.71	-953.01	6961.08	26019.69	27589.56	5989.87	24046.56	26038.63
2016	1044.3	4162.27	4343.58	6826.33	25973.39	27508.83	6810.35	29276.35	30934.9
Total	-1250.77	-6976.35	-3892.93	29226	109945.91	119583.14	22360.66	100013.5	112098.28

Table 5: Average export mis-invoicing as a percent of total exports by major commodity groups for major trading partners between 2008 and 2016

Country	Vegetable	FoodProd	Chemicals	Metals	MachElec	Transport
Australia	-3.20	-30.07	93.42	57.65	1559.15	92.89
Austria	216293.73	5.47e+06	1197.80	2849.02	6951.53	501.46
Belgium	73.06	34997.10	743.94	109.83	226.02	172.84
Brazil	125.98			-45.33	-53.98	
Canada	71.64	381.81	122.71	9118.94	383.35	29.09
China	409.59	54.66	42.79	60.67	-101.27	2275.90
Cyprus	2664.20					
Czech Republic	3430.45	801.25	3314.01	1168.78	18.93	-87.87
Denmark	43.66	29.54			730.97	2995.51
Egypt	0.55	-22.21	213.55	648.48	387.30	-35.05
Estonia	2711.76					
Finland	72.54	47.94	3791.68	204.91	114.23	451.93
France	33.22	838.66	32185.88	-24.45	32.35	1762.03
Germany	-23.83	437.99	-36.56	-39.16	1827.66	203.12
Greece	16.08	20.11			-73.18	-108.38
Hong Kong, China	-83.40	18339.03	519.59	198.08	135.73	
Iceland	13.67	-108.18			-107.35	
India	-6.08	3131.15	10.86	-10.76	179.98	38.77
Ireland	15940.41		981.39	-64.78	844.87	55436.50
Israel	22.01	124.41	-12.58	73.39	-72.96	
Italy	-12.45	984.95	3251.07	395.32	499.73	22.39
Japan	-12.25	20215.59		-93.42	29.56	3661.40
Korea	1.19	2406.33	-0.12	-85.38	184.36	
Latvia	-29.83					
Lithuania	113.77					
Luxembourg	19301.99				-80.18	
Malta	-46.95	3276.61		-77.77		
Netherlands	61.61	-74.47	1144.82	450.93	31985.48	699.38
New Zealand	9.20	1325.43	-32.85	-96.12	268.56	2250.16
Norway	181.65	15912.93	-13.24	-90.08	-89.81	-18.31
Portugal	-12.08					
Russia	42.42				-54.57	

Country	Vegetable	FoodProd	Chemicals	Metals	MachElec	Transport
Singapore	-89.47		442.67	5938.03	69296.95	292204.03
Slovak Republic	66506.21			2776.90	982.18	
Slovenia	70.04					
South Africa	-18.05	946.75	36.61	-84.80	0.64	-58.28
Spain	-2.85	151.48	-75.51	-32.30	1932.07	-65.05
Sweden	34.38	56.71	-4.28	-107.15	12606.05	8989.62
Switzerland	1524.37	5136.81	528.93	84.52	27639.55	115957.53
Thailand	-52.26		916.24	1926.76	684.83	
Turkey	19.24	-72.50	-50.13	7619.01	-44.55	2006.93
United Arab Emirates	-40.94	-57.76	62.10	-93.50	-100.75	-94.20
United Kingdom	-29.54	169.73	898.98	-64.35	2940.06	1563.07
United States	5.92	83.72	31.54	37.13	76.78	-101.33

Table 6: Average import mis-invoicing as a percent of total imports by major commodity groups for major trading partners between 2008 and 2016

Country	Vegetable	FoodProd	Chemical	Metals	MachElec	Transport
Australia	-1219.45	67.34	85.02	94.77	70.65	-89.10
Austria		18.39	-117.08	-19.09	-102.41	-1345.30
Belgium	-106.86	-106.25	-494.41	9.33	15.58	-485.02
Brazil	84.69	61.99	-50.80	28.51	57.09	52.12
Canada	-25.13	71.52	54.12	-7.86	25.20	-3278.51
China	35.04	50.85	45.60	38.25	37.31	29.81
Cyprus		72.32	24.24	-62.88	30.71	
Czech Republic	-9646.80	-145.72	71.99	-319.76	28.28	-332.77
Denmark	32.98	28.29	77.15	41.29	-14.25	-727.27
Egypt	44.32	34.68	-20.19	53.59	-23.31	6.41
Estonia			-5.61	66.70	-58.16	-1594.75
Finland			95.69	85.43	23.65	-1162.56
France	63.33	-39.27	-252.50	63.38	26.93	-78.01
Germany	11.02	-19.41	28.60	28.27	20.35	31.97
Greece	33.53	14.48	14.46	10.98	-45.55	78.70
Hong Kong, China		81.70	100.00	32.68	77.40	100.00
Iceland					98.94	
India	69.35	81.42	7.50	32.15	39.10	36.68
Ireland	79.09	-2265.17	0.91	-131.70	74.58	-656.19
Israel	13.27	-1.37	52.99	20.22	6.54	-90.27
Italy	92.86	42.10	67.37	26.69	7.10	45.23
Japan			48.50	45.93	75.41	82.64
Korea	2.54	20.09	-27.56	63.63	50.19	47.53
Latvia	45.96	-53.32	96.31		-697.84	
Lithuania			-160.47	65.50	-818.50	-15057.01
Luxembourg				38.82	-4508.21	-176.54
Malta		99.34		-640.13	-537.45	
Netherlands	15.56	7.54	53.78	23.00	-68.52	-396.83
New Zealand	16.09		43.92	72.28	65.55	100.00
Norway		-1998.80	91.51	-17.68	-37.88	-1128.40
Portugal	17.67	10.94	-219.14	43.19	-0.89	-513.83

Country	Vegetable	FoodProd	Chemical	Metals	MachElec	Transport
Russia	-508.32	67.83	-665.88	41.88	-918.43	-466.76
Singapore	-450.56	-4891.20	57.35	27.01	16.38	-1580.43
Slovak Republic			-1733.14	-214.64	-24.33	-392.90
Slovenia			-372.13	-701.64	36.94	81.04
South Africa	-32.00	38.36	18.42	47.38	-0.58	40.09
Spain	-15.73	27.38	31.43	23.66	13.12	16.01
Sweden	5.56	80.08	39.85	51.44	55.33	47.37
Switzerland	99.46	17.96	-10.75	-27.06	38.12	-73.93
Thailand	37.94	62.83	39.29	18.96	55.46	83.76
Turkey	42.06	38.60	11.56	17.85	19.07	14.87
United Arab Emirates	81.42	61.32	50.88	45.29	76.93	29.30
United Kingdom	45.67	25.97	10.57	24.80	-66.40	-106.12
United States	32.01	47.29	82.14	70.47	68.40	-306.10

Table 7: Average trade mis-invoicing as a percent of total trade by major commodity groups for major trading partners between 2008 and 2016

Country	Vegetable	FoodProd	Chemicals	Metals	MachElec	Transport
Australia	-27.83	17.14	1499.68	16408.79	505.66	6154.15
Austria		89.03	-33.60	1644.49	8.28	-293.89
Belgium	6.56	-4.13	-43.81	143.21	113.40	-50.42
Brazil	236.73			75.81	378.88	
Canada	19.44	19.50	305.75	22.57	115.04	80.92
China	1.75	116.62	103.18	78.63	67.36	82.61
Cyprus						
Czech Republic	79.41	529.65	4627.12	-39.21	147.36	1007.79
Denmark	100.49	35.43			-2.93	13.86
Egypt	34.94	198.06	-15.43	315.59	49.20	191.64
Estonia						
Finland			17650.41	2019.16	118.84	333.29
France	34.49	-15.90	-56.10	263.83	51.31	-20.99
Germany	-32.59	-5.36	62.66	48.61	35.65	53.38
Greece	-20.19	40.00	27.57		6.40	
Hong Kong, China			221.76	-35.56	11632.35	
Iceland						
India	152.65	2896.42	22.60	66.74	84.46	-36.21
Ireland	42.09		15.53	16121.80	598.44	0.30
Israel	-32.79	95.47	326.85	294.26	25.28	
Italy	180.09	154.00	589.63	44.89	10.68	162.27
Japan			128.92	172.63	329.18	975.87
Korea	0.72	131.96	85.52	684.75	121.56	
Latvia						
Lithuania						
Luxembourg					-64.80	
Malta						
Netherlands	-206.15	54.75	382.51	51.85	15.51	-73.68
New Zealand	10.59		1552.18	3286.10	282.82	
Norway		69.18		1184.15	65.55	-110.94
Portugal	-23.06					

Country	Vegetable	FoodProd	Chemicals	Metals	MachElec	Transport
Russia	81.32				97.36	
Singapore	-622.02		19.82	-64.76	73.06	29.75
Slovak Republic				-39.28	-13.58	
Slovenia					145.22	
South Africa	-19.94	141.38	42.87	131.15	4.47	82.52
Spain	-27.03	153.60	53.23	80.80	31.23	144.52
Sweden	-15.98	93.00	94.65	570.47	269.85	234.94
Switzerland	40.53	5.96	-1.09	1838.50	102.83	54.63
Thailand	95.50		69.96	434.12	139.23	
Turkey	-0.80	312.84	41.15	31.63	42.72	21.56
United Arab Emirates	4.27	552.74	511.34	304.11	284.68	510.28
United Kingdom	-48.66	12.47	21.92	75.31	-24.59	-16.82
United States	35.13	193.47	1080.66	301.97	413.17	1904.79

