Catch me if you can: Trade mis-invoicing and capital flight from Ethiopia

Adugna Lemi
University of Massachusetts Boston
Department of Economics
100 Morrissey Blvd.
Boston, MA 02125
Email: Adugna.lemi@umb.edu

Abstract

As developing countries struggle to catch the train of globalization ensuing negative effects are often dwarfed in the midst of ebullient reporting. Trade mis-invoicing, a major contributor to capital flight, is one of such consequences, which is seemingly negligible, but significant for an African country like Ethiopia. With increased globalization comes increased opportunities to manipulate export and import invoices as a vehicle to move capital unrecorded and hence illegally out of a country. This paper presents the extent of trade mis-invoicing and the resulting capital flight for the case of Ethiopia. Using commodity group level trade flows between Ethiopia and its trading partners as well as disaggregated CIF-FOB ratios, this paper sheds light on commodity groups and trading partners that contribute to trade mis-invoicing in a significant way. Results show that previous estimates of trade mis-invoicing from Ethiopia were underestimated due to exclusion of major trading partners (like China and India) and use of a fixed CIF-FOB ratio that doesn't reflect variation across commodity groups. Results also show, for trade with advanced countries alone, trade mis-invoicing costed Ethiopia $6-36 billion dollars between 2008 and 2016. For trade with emerging trading partners (including China and India) Ethiopia lost $15-78 billion to trade mis-invoicing during the same period. A handful of commodity groups (vegetables, hides and skins, machineries, and transport equipment) contribute to trade mis-invoicing in a significant way. Results also show that India, United Arab Emirates (UAE), Finland, New Zealand, China (Hong Kong), Ireland, Australia, the U.S, Japan, and Czech Republic are the top trading partners with the highest trade mis-invoicing share in total trade with Ethiopia.

I. Introduction

Trade mis-invoicing is not a new phenomenon although its impacts and implications only grew faster in recent years as previously marginalized countries increased their engagement in global trade and investment. Previous studies document the prevalence and extent of trade mis-invoicing (Naya and Morgan, 1969; Yeats, 1990; Beja, 2007; Berger and Nitsch, 2008) without going into 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 misinvoicing (Buehn and Eichler, 2011; Geda and Yimer, 2016; Bahmani-Oskooee and Goswami, 2003; Fisman and Wei, 2004; Fismand and Wei, 2007; Farzanegan, 2008, Ndikumana and Boyce, 2010; Ndikumana, et. al, 2015). The welfare implication of trade mis-invoicing is also another strand in the literature although empirical tests of the theoretical implications of mis-invoicing on welfare are very limited.

In those studies that use African countries as a case study the motivation is to estimate the magnitude of trade mis-invoicing as part of overall capital flight 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 in the case of Africa, where there is limited information on individual countries. 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 where sufficient data is available.

The focus of the present study is to estimate trade mis-invoicing for Ethiopia between 2008 and 2016. As an improvement over previous studies, the present study looks into previously ignored or assumed away dimensions of trade mis-invoicing including major trading partners often excluded from such estimation, estimated cost insurance and freight values (CIF-FOB ratio), and commodity groups. As such the present study zooms in trade mis-invoicing activities in Ethiopia to highlight on the commodities and countries involved in this practice. 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 country and commodity groups, estimates of trade mis-invoicing is disaggregated into their export and import components. The specific questions I ask in this study are: Was there systematic discrepancies in trade flow data between Ethiopia and its trading partners? Which commodity groups and partner countries are susceptible to this practice? How much does non-advanced trading partners contribute to trade mis-invoicing in Ethiopia? I investigate this question both

by country and by commodity group to get to the bottom of the issue and to relate the findings to local anecdotes. The findings in this study will be compared to previous studies to highlight how much trade mis-invoicing numbers are underestimated for Ethiopia.

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

II. Literature Review

As noted above, there may be positive or negative welfare implication for a country experiencing significant level of trade mis-invoicing. The focus of the burgeoning literature on this issue is on the motives and deterrents behind this practice. Illicit capital outflow from developing countries in general and from Africa in particular is estimated to be in tens of billions (Kar and Spanjers, 2015; Global Financial Integrity, 2017). Ethiopia is not an exception within African countries, in fact, trade mis-invoicing account for one of the largest share of capital flight in Ethiopia compared to other African countries (Ndukmana and Boyce, 2010; Spanjers and Salamon, 2017).

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 absolutely 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 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, to gain from black market premium, and to have the opportunity to save in a convertible currency in a foreign bank (i.e. capital flight). These possible explanations provide an insight into whether the gain (it could be in local or foreign currency) from mis-invoicing stay in the country or leave through the back doors. The implication is paramount for policy-makers to cope with the fast changing and integrated world. In the paragraphs that follows specific motivations and their implications are discussed.

Motivations of Trade Mis-invoicing

Why does a trader mis-invoice import and export transactions? The motivations behind this practice often portrayed as negative for a country (UNCTAD, 2016), although there

are cases where this practice may end up helping a country positively through positive welfare effect in the form of capital inflow or allocation of resources free of regulatory barriers. The debate on whether trade mis-invoicing result in positive or negative welfare effect is not yet settled (Buehn and Eichler, 2011). The purpose of the present study is, however, not to contribute to this debate rather it is to highlight on the magnitude and motivations/determinants of trade mis-invoicing.

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 key factors in developing countries in Africa in influencing both the decision to engage in and the amount of trade mis-invoicing (Buehn and Eichler, 2011). UNCTAD (2016), based on 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 are driven by profit maximization through tax evasion. This can be done through under-invoicing of exports and imports to minimize tax liabilities. It is expected that in a country where trade barriers (tariffs, quotas, etc.) are discouragingly high, this motive to be the main driving force to result in trade mis-invoicing (for empirical evidence see Bhagwati, 1964; McDonald, 1985; Epaphra, 2015; Fisman and

Wei, 2004; Buehn, et. al, 2011). In the reverse case, where there is incentive for exports (export subsidies) and intermediate input imports (import tariff exemptions), firms tend to over-invoice(overstate) exports and imports to maximize profit. This may seem rare, but it may happen in countries where promotion of trade in taking the center stage. In countries like Ethiopia where the tariff rates are significantly high for some products (up to 200% tariff on some automobiles) and where there is tax on some commodities (for instance, 6.5% tax on coffee exports (see Minten, et. al. (2014)) firms 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.

Motives to circumvent exchange and customs controls – this mechanism is to hide foreign currency from official channels so as to take advantage of the prevailing Black Market Premium (BMP) or to hoard cash in foreign currency in a foreign account (hence engage in capital flight). Under such motives, it is expected that traders engage in import over-invoicing (so that they obtain undeserving foreign currency from the authority that controls currency) and export under-invoicing (so that they can hide some of their export earnings). This ill-obtained foreign currency can be used 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, it is believed that 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) and between 2000 and 2009 Ethiopia had lost over $ 11 billion due to trade mis-invoicing (Kar and Freitas, 2011). Trade mis-invoicing is suspected to be one of the channels through which this illicit capital outflow occurs. In fact, Ndikumana and Boyce (2010) estimated that trade mis-invoicing account for 60% of capital flight in Ethiopia between 1970 and 2004; of the $11 billion capital flight in Kar and Freitas (2011), it is reported that over $7 billion was due to trade mis-invoicing.

Motives to minimize the 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 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. The effect of administrative burden is therefore under-invoicing of both exports and imports.

Another motive that much the focus of previous studies is the motive to being in foreign

currency stashed in a foreign country. The reason is to bring money previously illegally sent abroad into the country for investment purposes. This is often done through export over-invoicing. This is a practice to launder an illegal money back into the country through illegal 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 believed to be good for a country's economic growth. It is, however, comes through illegality means and may end up being spend on activities not that helpful for the country. As we discuss the practice of trade mis-invoicing in Ethiopia, this motivation was driving part of the mis-invoicing at least before 2010.

As to which of these motives are important and prevalent in a country like Ethiopia is an empirical question. To reach to the bottom of this issue, one need to use disaggregated data by commodity and trading partners to pinpoint to the conditions facilitating one motive over the other by each commodity and partner. The net effect of these motives varies by partner country, year, 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 where it is 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.

Estimates of Capital Flight and Trade Misinvocing 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 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 didn't report estimates for the mis-invoicing component separately.

Ndikumana and Boyce (2010) report that during the period 1970-2004 Ethiopia has lost $17 billion to capital flight and $10 billon (60% of capital flight) of that was record through positive trade mis-invoicing (capital inflow). This is such a long period of time and it covers periods when the country experienced regime change, and moved from strict exchange control (1970-1990) and a bit more relaxed exchange control system (1991-2004) that may explain inflow of capital through trade mis-invoicing. However, this trend has reversed itself in the subsequent decades as trade mis-invoicing, in fact, contributed to capital outflow. Results from Kar and Freitas (2011) confirm this reversal, in that between 2000 and 2009, Ethiopia 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. Clearly, this is a confirmation that as the country expanded its trade engagement with the rest of the world, trade mis-invoicing grew with it. Kar and Spanjers (2015) breaks 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) was over $19 billion and export over-invoicing (capital inflow) was 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 is often ignored as insignificant or unimportant. As the above estimates indicates, though, this is not the case for Ethiopia.

Table 1. Estimates of Capital flight from Ethiopia

1970-2004[a]		2005-2014[b] (% of total trade)		2004-2013[C] (in billion USD)		2000-2009[d] (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; [b] Spanjers and Salamon, 2017; [c] Kar and Spanjers, 2015; [d] Kar and Freitas, 2011.

In the present study provides similar results expanded to cover other trading partners and commodity groups for recent years.

III. Data and Methodology

To arrive at the desired capital flight numbers due to trade mis-invoicing, I need data on exports and imports as reported by Ethiopia (as a reporter) and associated exports and imports by Ethiopia's trading partners (mirror trade data). I have extracted these trade flow values from UN COMTRADE using the World Bank's WITS tool by two-digit commodity groups. UN's COMTRADE database is the only source that provides data at such 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 only from advanced countries excluding these emerging economies. Needless to say, this approach underestimates trade mis-invoicing numbers. The justification to exclude 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 in early 2000s and even before (for the case of India). For recent years, statistical reporting from such countries are believed to be high quality and comparable to those of advanced countries. I argue that such countries should be included in estimating trade mis-invoicing for African countries. As such the

present study report results both for advanced countries (as in previous studies) and for major trading partners (including emerging economies that are major trading partners of Ethiopia) for purpose of comparison.

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 form COMTRADE data, various years.

The other dataset needed to comparable trade flows between two trading partners is transport and insurance costs associated with import. That is, the cost insurance freight to free on board (CIF-FOB) ratios that I use to convert exports of a country into its

mirror flow of imports by a country's trading partners. To compare exports (reported by Ethiopia) to imports (reported by Ethiopia's trading partners), I need to convert free on board (F.O.B.) export values into their import equivalents using cost, insurance and freight (C.I.F, i.e. transport and insurance costs of trade between Ethiopia and its trading partners) values. Similarly, I need to convert exports that Ethiopia's trading partners reported into its Ethiopia's import equivalents using CIF values.

Previous studies use fixed proportions of exports (10% or 5%) as approximation for CIF values. Unlike previous studies, the present study will use OECD's *estimated* values of CIF-FOB value (Miao and Fortanier, 2016). Use of fixed proportion may underestimate or overestimate trade mis-invoicing depending on the commodities and how far a country is from its trading partners. Estimated values of CIF-FOB values take into account distance, volume of trade and other factors to arrive at a better approximation of this ratio. Specifically, their approach uses a gravity model with a list of independent variables identified as relevant in previous studies, including the geographical 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 values of 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.*

The CIF-FOB values computed from the IMF's direction of trade has been criticized as inconsistent (Ndikumana and Boyce, 2010; Ndikumana, et. al, 2015; UNCTAD, 2016; CEPII, 2008; Miao and Fortanier, 2016). The other option is to use fixed values for CIF_FOB as in UNCTAD (2016). Reports from Global Financial Integrity (GFI) and other studies (Ndikumana and Boyce, 2010) have used ten percent (or five percent) of F.O.B value of exports to approximate CIF values. However, the alternative fixed values proposed by UNCTAD and other studies is not perfect either since it assumes fixed CIF values for all trading partners and all commodity groups. OECD and CEPII attempt to estimate country and commodity specific CIF values to highly the significant variation across commodities and trading partners.

Recently, Miao and Fortanier (2016)'s 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. In this study, I opt for the OECD data (as reported in Miao and Fortanier (2016) to convert export values of a country to equivalent import values (as reported by a partner country) over time by commodity groups. Since it uses trade partner-commodity-specific CIF-FOB values over time, 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).

The other complication is whether to use CIF-FOB values estimated from trade flow data reported by a country or its trading partners. Figures 1 and 2 below plots estimated CIF-FOB ratios from Ethiopia and its trading partners. As is clear from the figures, there are variations in the average values of the ratios. The data estimated from partner countries concentrate around 0.09 whereas those estimated from Ethiopia vary widely. Figure 1 plots average CIF-FOB ratio for the period between 2008 and 2016; whereas Figure 2 plots estimates for 2014[1] (the latest year data on CIF-FOB ratio is available). In this study, I used CIF-FOB ratio (CIF-FOB_repo) obtained from Ethiopia's trade flow data to compute values of Ethiopia's imports from partners exports. Similarly, I used CIF-FOB ratio (CIF-FOB_part) obtained from partners' trade flow data to compute values of partners' imports from Ethiopia's exports. This is justifiable since estimates of CI-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

[1] 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.

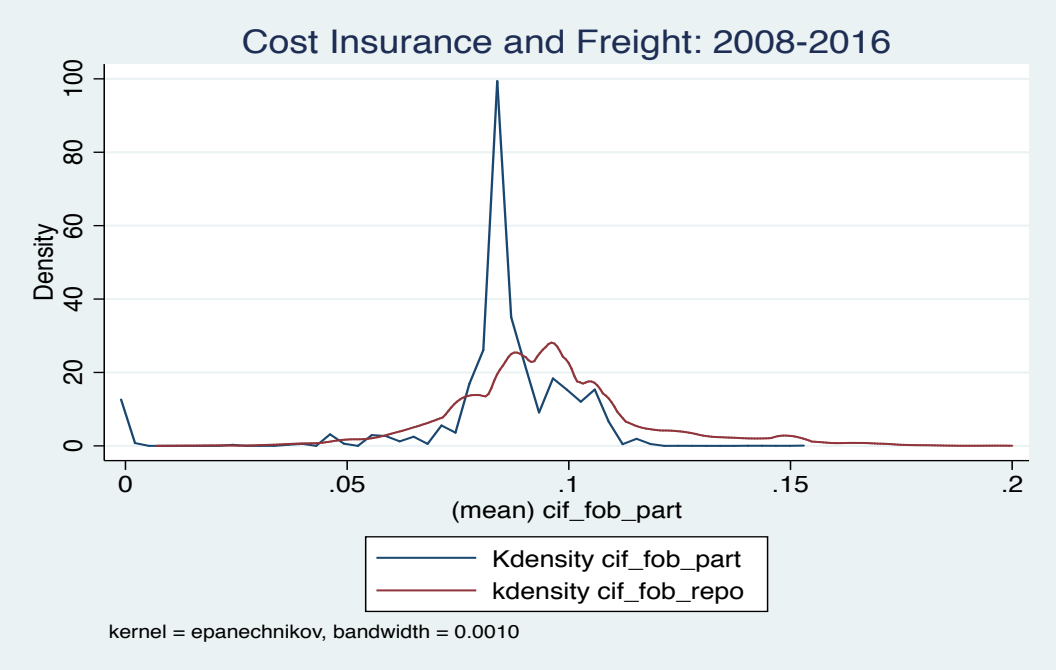
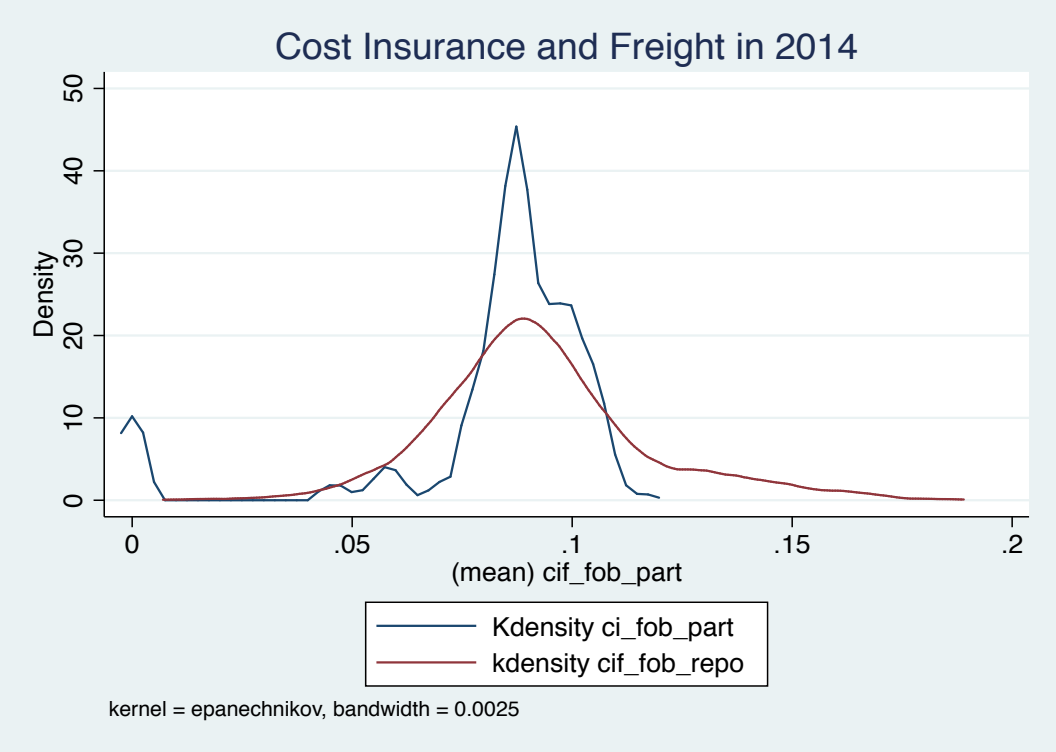


Figure 2. Kernel density of average cost insurance and freight estimates from data reported by Ethiopia and its partners 2014



Methodology

There is no as much 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 adopt the standard estimation technique that compares exports of a country to its trading partners' imports and vise-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 commodity level (UNCTAD, 2016; Beja, 2006; Buehn and Eichler, 2011).

The estimation formula 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 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 cost of insurance and freight, CIF). Similarly, imports of E from P should be the same as exports of P to E (plus CIF). In practice, however, these equalities don't hold 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) over time (t). CIF-FOB values are reported as fraction of exports at CIF values. In the formula below, I added the CIF-FOB fraction of exports to export values to generate equivalence import values.

For export mis-invoicing by exports from E, I compute the following:

$\boldsymbol{DX^{c}_{EP,t} = M^{c}_{PE,t} - (1 + CIF) * X^{c}_{EP,t}}$, labelled as differences in exports (exportdiff) in the data.

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:

$\boldsymbol{DM^{c}_{EP,t} = M^{c}_{EP,t} - (1 + CIF) * X^{c}_{PE,t}}$, labelled as differences in imports (importdiff) in the data.

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).

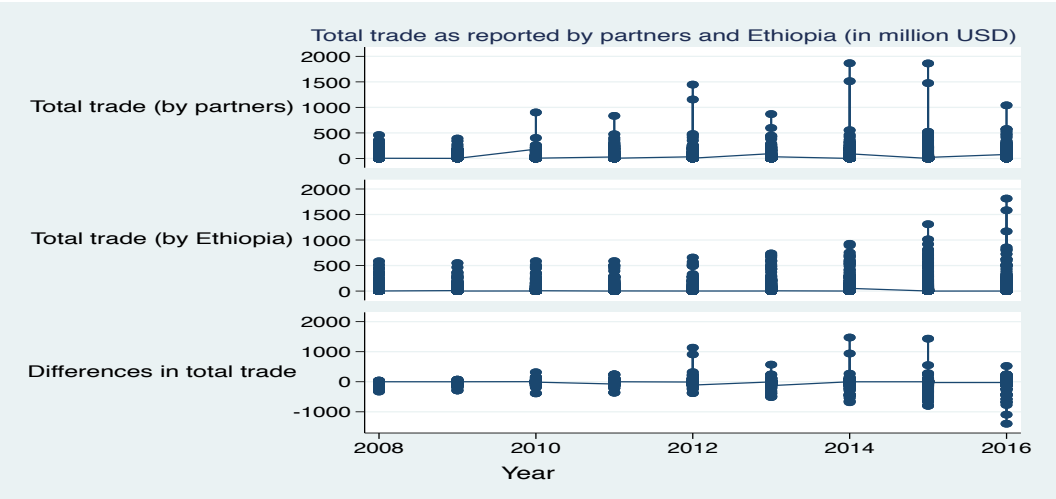
Export over-invoicing and import under-invoicing result in capital inflow, not capital flight, as such some studies (Global Financial Integrity, 2016) exclude these values from capital flight estimation. As we will discuss below though, these values are not insignificant.

Total trade mis-invoicing is also computed 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, then I regroup the values to highlight the commodities and partners by the sign and magnitude of the difference computed above.

IV. Results and Discussion

Before getting into details of trade mis-invoicing and its components, Figure 3 below compares trade flows that Ethiopia and its trading partners reported. Differences in total trade flows is hundreds of millions, especially since 2012. In 2012, 2014 and 2015, Ethiopia's trading partners reported more trade than what Ethiopia reported. In 2016, Ethiopia reported more trade flow than that of its trading partners. The last five years has driven much of the differences in trade flows between Ethiopia and its trading partners.

Figure 3. Total trade differences as reported by partners and Ethiopia



Figures that follow give us details on the components of this trade flow differences. Tables 4-7 in appendix provide details on the alternative ways of measuring trade mis-ivoicing (and its components) over time (Table 4) and trade mis-invoicing (and its components) by major commodity groups and trading partners (Tables 5-7).

Table 3 presents estimates of export, import, and trade mis-inovicing using three different estimates for CIF-FOB ratios for advanced countries as well as for emerging trading partners of Ethiopia. Table 4 in appendix provides similar estimates for all countries, and major trading partners over time. To compare results with previous studies, I computed trade mis-invoicing not just with estimated values of CIF-FOB ratio but also using 10% and 5% of exports at FOB values to generate import values. There is no difference in the direction (sign) of mis-invoicing using all three estimates of CIF-FOB ratios, but there is significant difference in magnitude[2]. In all the 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 for major trading partners (see Table 4).

The results in the table confirm that exports are over-invoiced and imports are under-invoiced. The results that use 10% and 5% for CIF-FOB ratio overestimate over-invoicing of exports and under-invoicing of exports since both overstate estimated values of partners countries imports (for export mis-invoicing) and Ethiopia's imports from partner countries (for import under-invoicing).

[2]Similar estimates for all countries and for major trading partners (including India and China) confirm the same finding. Tables are not reported here, but are available up on request.

Table 3. Trade mis-invoicing computed using three different estimates of CIF-FOB ratios for advanced countries (in million USD)

Year	Exports	Exports (10%)	Exports (5%)	Imports	Imports (10%)	Imports (5%)	Trade	Trade (10%)	Trade (5%)
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**
	For emerging trading partners (Brazil, China, Egypt, India, Mexico, Poland, Russia, South Africa, Thailand, and Turkey)								
Year	Exports	Exports (10%)	Exports (5%)	Imports	Imports (10%)	Imports (5%)	Trade	Trade (10%)	Trade (5%)
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**

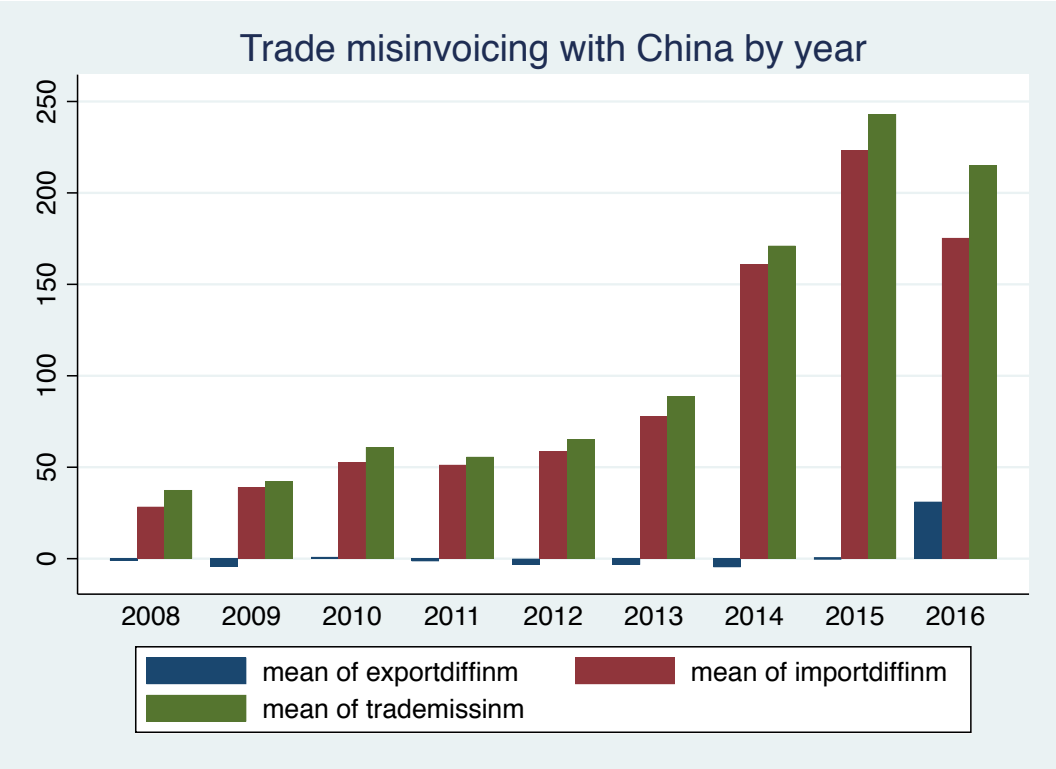
Results in the above table shows that, Ethiopia has lost $6-36 billion to trade mis-invoicing between 2008 and 2016. Import under-invoicing contributes entirely to this, that is, import over-invoicing contribute $10-40 billion to this capital flight. The lower panel of the table reports results for emerging trading partners of Ethiopia that are often not included in the estimation of capital flight or trade mis-invoicing. Just these countries alone add $15-78 billion to trade mis-invoicing number more than double the estimate for advanced countries. For these countries, import over-invoicing contribute $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. But I believe that since this capital inflow comes through illegal means and don't come through official channel to benefit the country but the traders that brought this money through illegal means.

Trade mis-invoicing estimates for transactions with US and China

Are there differences in trade mis-invoicing across countries? Two figures below show estimates for the two top trading partners of Ethiopia, China (Figure 4), and the U.S (Figure 5). The major component of trade mis-invoicing between China and Ethiopia is import under-invoicing, that contributed for over $200 million in 2015, it declined to around $180 million in 2016.

Figure 4: Ethiopia's Trade misinvoicing with China: 2008-2016



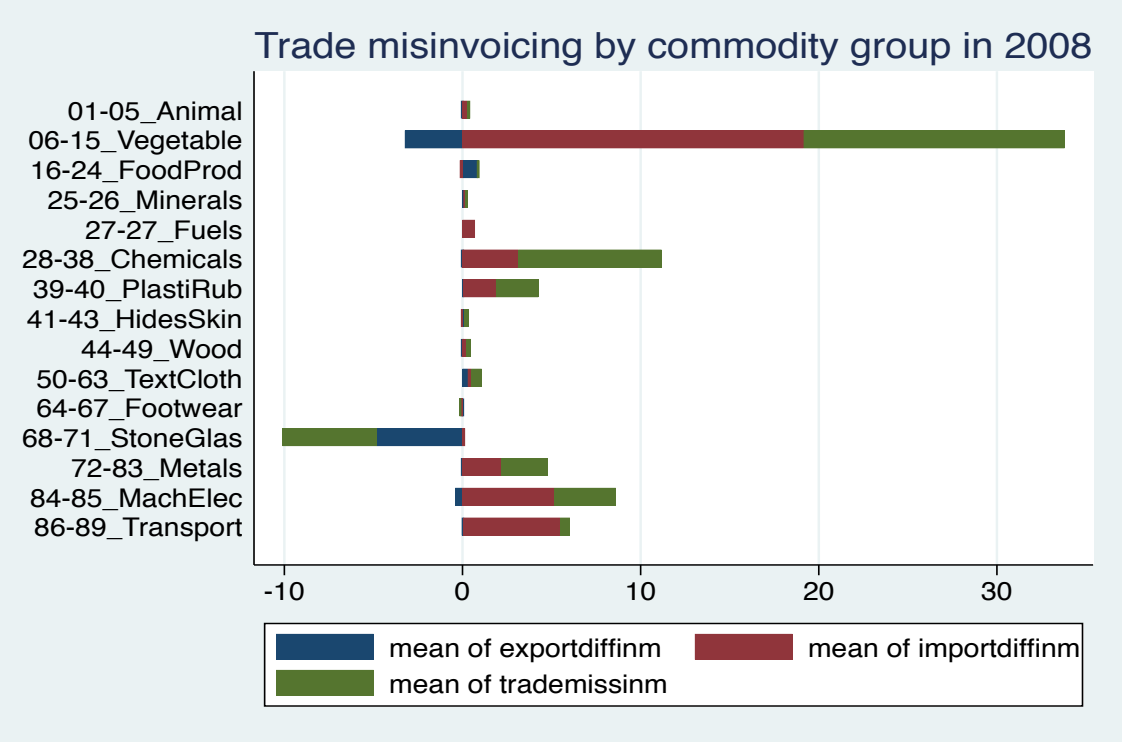
Comparable number for U.S is not as high, in fact, trade misinvoicing of Ethiopia with the U.S is about one fourth of what it was in China in 2015. In 2016, trade misinvoicing with the U.S jumped to $100 million, which is about half of what it was in China. There may be trade diversion from China to the U.S as the country expand factories to target the U.S market to take advantage of the Africa Growth Opportunity Act signed between selected African countries and the U.S government.

Figure 5. Ethiopia's Trade mis-invoicing with the U.S: 2008-2016

Trade mis-invoicing by commodity group

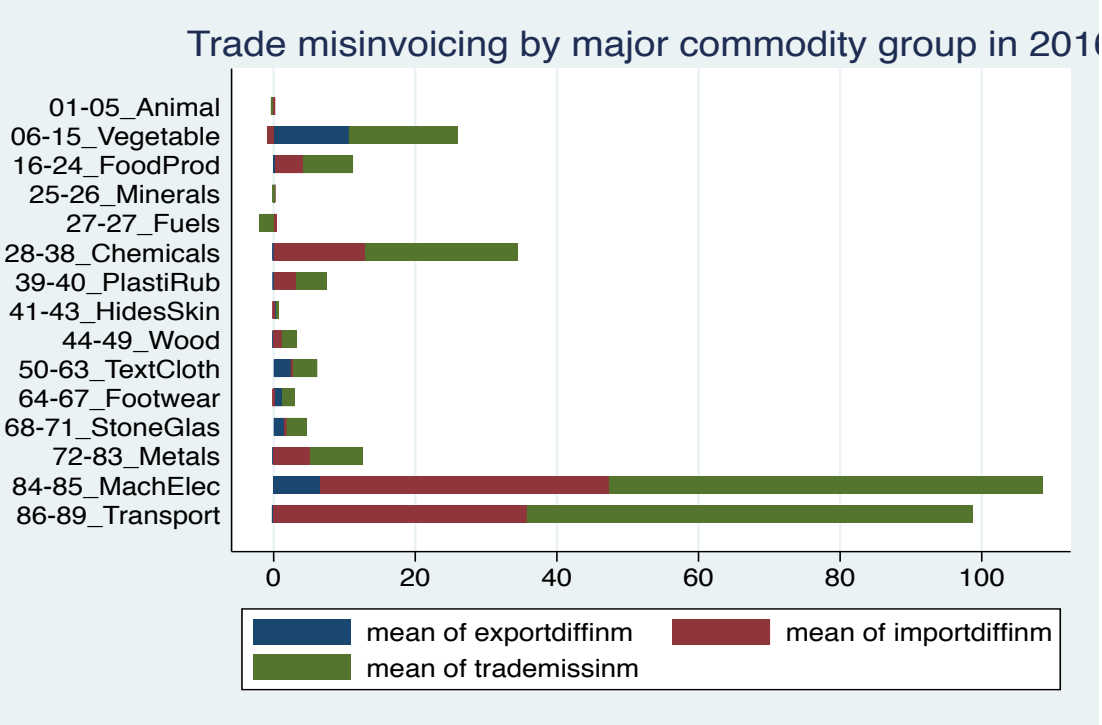
In 2008 a handful of commodities contribute to trade misinvoicing for both export and import misinvoicing. Trade in vegetables, chemicals, mechines, and transport equiments are the top commodities that contribute to import under-invoicing. Trade in stones and glass (to some extent vegetables) is major driver of export over-invoicing (see Figure 6).

Figure 6. Trade misinvoicing by commodity group in 2008.



In 2016, export over-invoicing almost disappeard (Figure 7), almost all commodity groups contribute to capital flight through both import over-invoicing and export under-invoicing, with machinaries and transport equipments being major contributors to both import over-invoicing and export under-invoicing. As the country engage in major infrastructure expansion, import in machinaries and transport equipments expanded in recent years and as a result end up being major contributors to trade misinvoicing.

Figure 7. Trade misinvoicing by commodity group in 2016

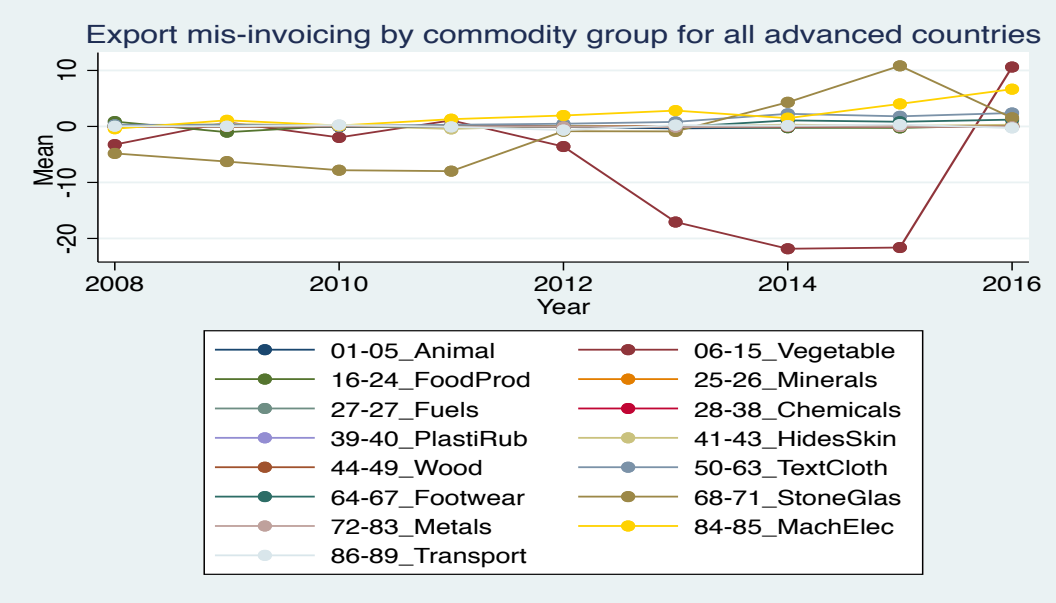


Figures 8-13 report misinvoicing over time by commodity group; export misinvocing and import misincing for trade with advanced countries are reported in Figures 8 and 9. The last four figures provides similar details for China (Figures 10 and 11) and the U.S (Figures 12 and 13). In almost all these figures, the key commodities that contribute to the large surge in trade misinvoicing in recent years are the same commodity groups discussed above, that is, trade in vegetables, chemicals, machininaries, and trasport equiments. There is, however, slight varations as we zoom in the details by year, country and direction of trade (exports or imports).

Figure 8 reveals that for advanced countries, Ethiopia's exports of hides and skins and vegetables contribute to export misinvocing. Both products were responsible for export

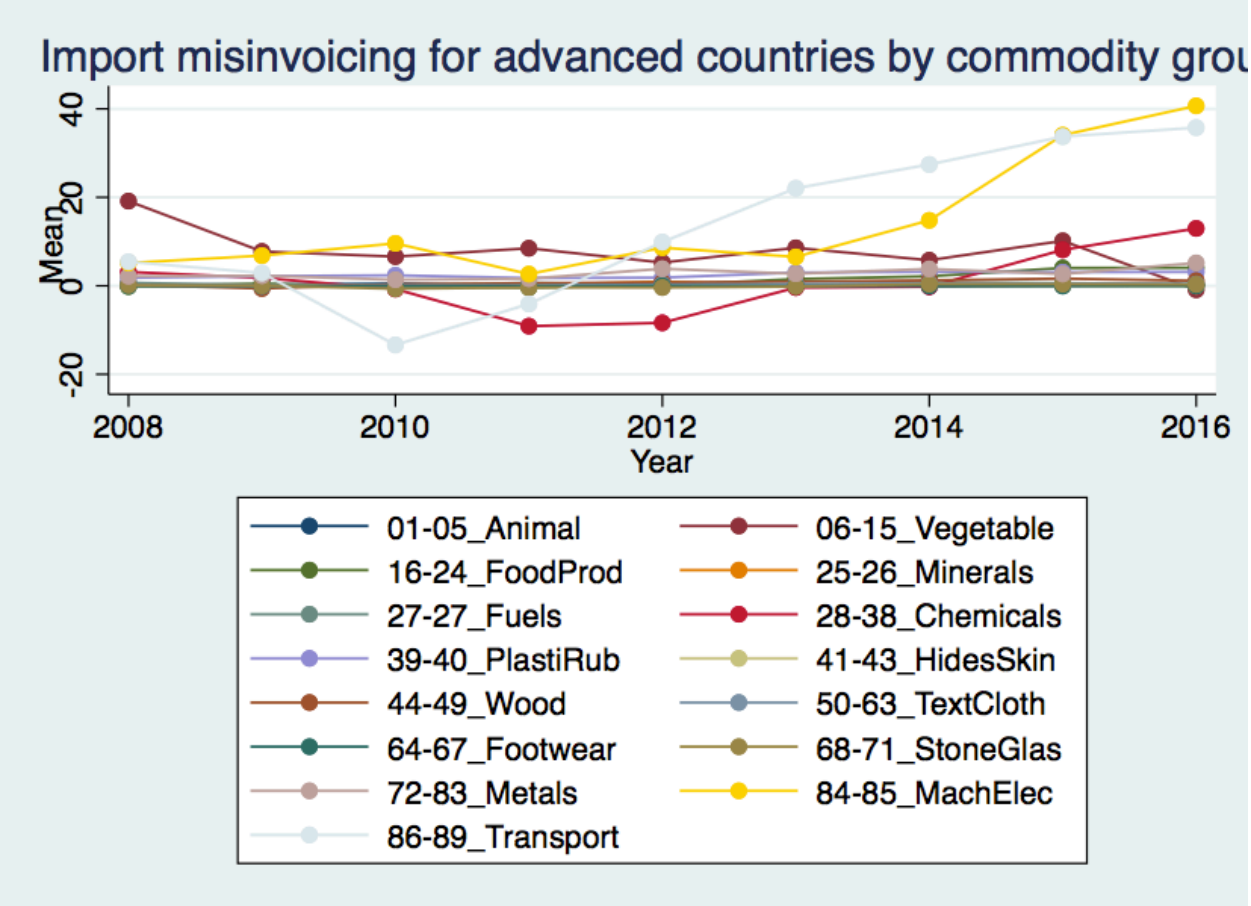
over-invocing but during different time periods, hides and skins were over-invoicing between 2008 and 2012, where as trade in vegetables (this includes cut flowers and chat (stimulat leaf mostly sold to middle eastern countries)) were over-invoiced between 2012 and 2015.

Figure 8. Export misinvoicing by commodity group over time: Advanced countries



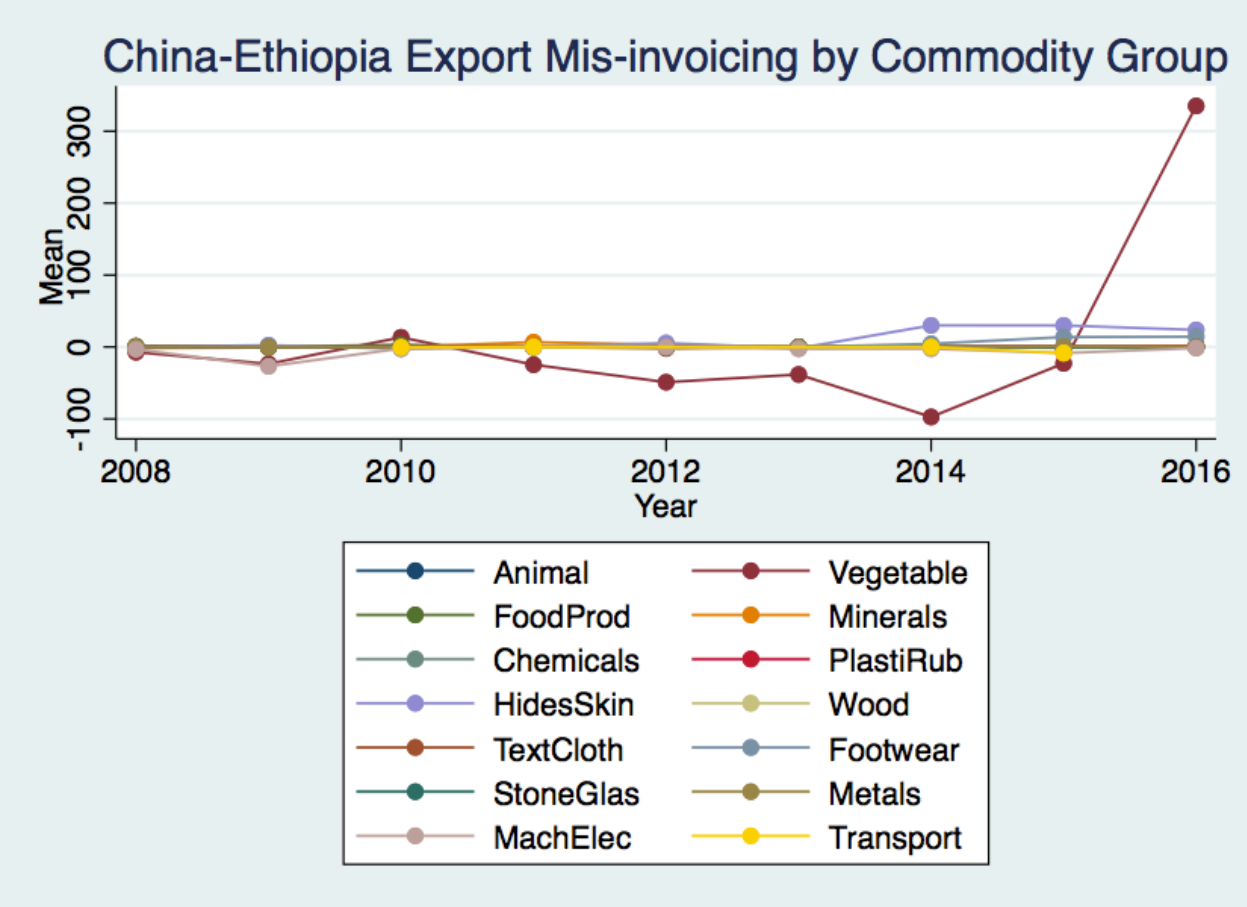
For imports, trade in machninaries, tranpsort equiments and chemicals are major contributors to import misivocing. With the exception of a couple of years between 2010 and 2012, imports of all three products were over-invoiced (Figure 9). The last three years were particularly important as the country expanded imports of these good as it expands infrastructure development.

Figure 9. Import misinvoicing by commodity group over time: Advanced countries



Similar results can be observed for trade with China. Figure 10 shows that exports of vegetables, footwear, and textile products are responsible for export misinvoicing. Until 2013, exports of vegetables were under-invoiced, however, for the following two years (2014 and 2015), vegetables exports were over-invoiced. Textile and clothing products were consistently under-invoiced from 2008 to 2016. One suspecion is that mostly Chinese firms located in Ethiopa are the ones exporting texilte and clothing products to China and they tend to underestimate exports to underestimate profits of their opertation in Ethiopia to evade taxation.

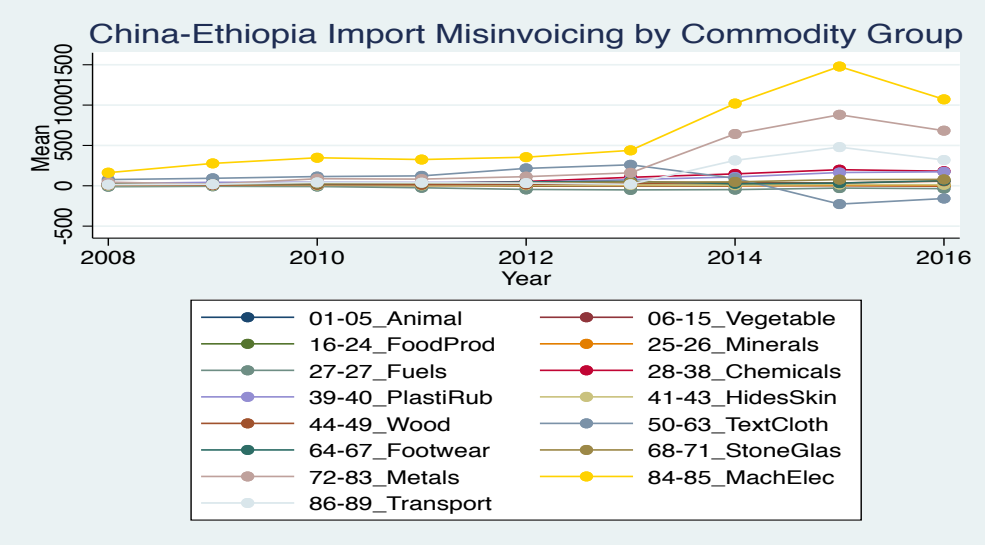
Figure 10. Export misinvoicing by commodity group over time: China



With the exception of textile products, imports of all other products from China were over-invoiced (Figure 11). Imports of machineries, transport equipment, and plastic and rubber products contribute significantly to import over-invoicing. As Ethiopia intensifies expansion of infrastructure development, it looked east towards China for the supply and construction of these infrastructures sourcing most inputs from China.

Import over-invoicing followed the trend and imports took advantage of this expansion in trade to hid their ill-obtained foreign currency in China through this mechanism.

Figure 11. Import misinvoicing by commodity group over time: China



For exports, the case of the U.S is similar to that of China in that three products are resposnible for export misinvoicing: Vegetables, footwears and textile products with more or less similar trends (Figure 12). Similarly import misinvoicing is driven by imports of machinaries and transport equipment.

Figure 12. Export misinvoicing by commodity group over time: U.S

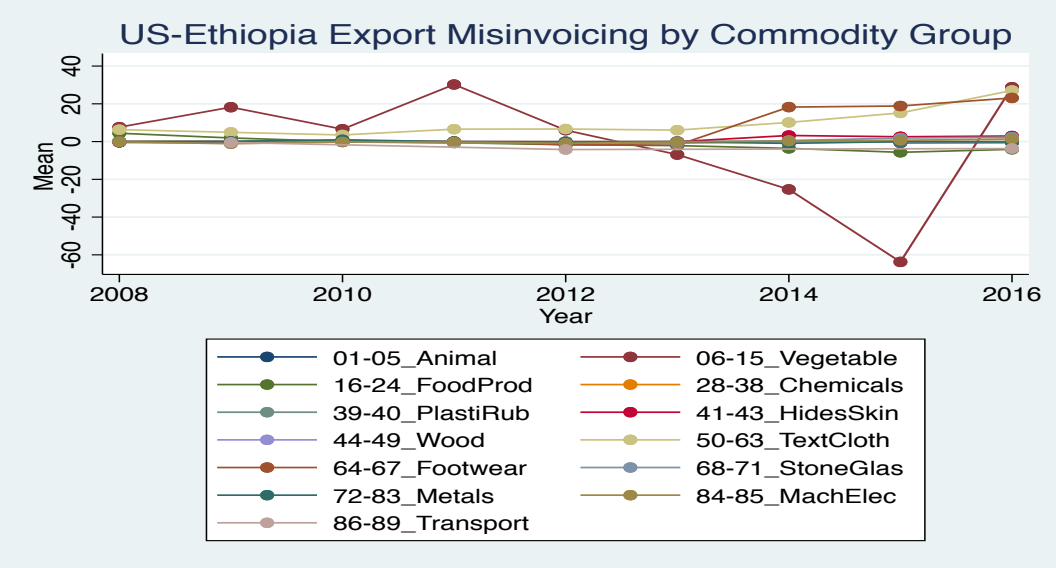
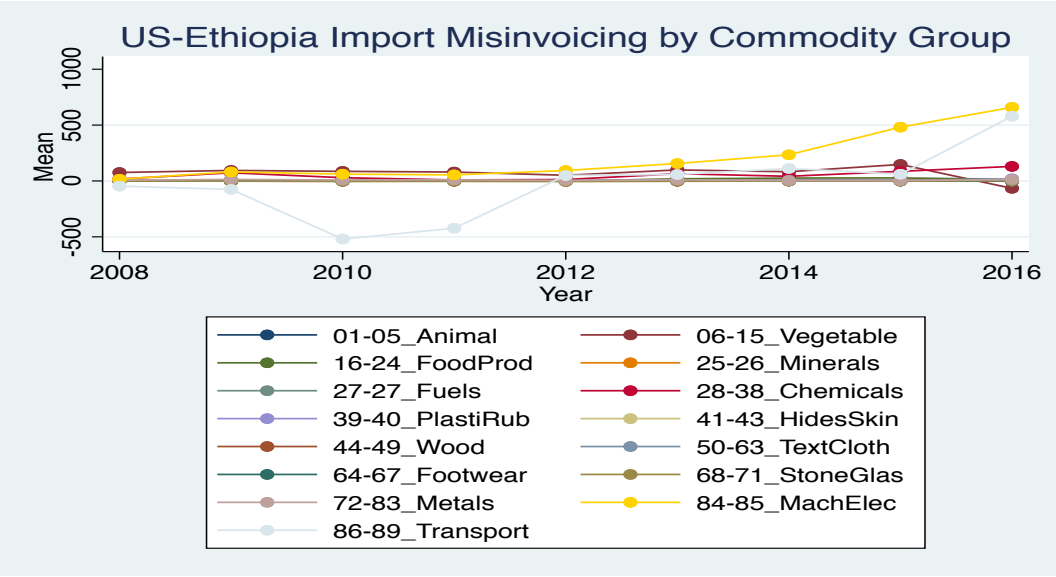


Figure 13. Import misinvoicing by commodity group over time: U.S



Figures 14-17 provides scatter plot 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 U.S, 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 export there has been movement by trading partners between 2008 and 2016. In 2008, Ethiopia's exports to Switzerland, Japan, and the U.S were over-invoiced (to the left of the 45-degree line), whereas in 2016, all these three countries changed sides to the right side of the 45-degree line suggesting export under-invoicing. It is not clear why there is such significant shift from export over-invoicing to export under-invoicing between 2008 and 2016.

In connection with partner countries that contribute to trade mis-inviocing, 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 importance of these commodities in affecting trade mis-invoicing. Percentage share of export mis-invoicing was the highest for exports to Austria, Czech Republic, Estonia, Ireland, Luxembourg, Slovak Republic, and Switzerland. These are small European economies with which Ethiopia has small market share and it is expected that even small (absolute magnitude wise) mis-invoicing shows up as a big 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 machineries.

Overall, trade mis-invoicing in vegetables is recorded with Singapore (over-invoicing) and Brazil (under-invoicing). For food products, trade with India, United Arab Emirates, and Czech Republic had the highest percentage share and recorded the highest export under-invoicing. For trade in chemical products, Finland, Czech Republic, and New Zealand had the highest percentage share. For trade in machineries, China (Hong Kong), Ireland, and Australia and the top three countries with the highest share of trade mis-invoicing. The U.S 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, Czech Republic, and Japan. Czech Republic comes up a lot on this list for almost all products. Once need to study further the trade relation with the country further to get to the root of the problem.

V. Conclusions and Implications

The aim of this study was to present estimates of Ethiopia's trade mis-invoicing disaggregated by commodity groups and trading partners. Unlike previous studies, the present study used estimated values of transport and insurance costs to convert a country's exports to its partner countries equivalent import values. Estimates reported

in this study also includes countries excluded from previous studies but major trading partners of Ethiopia (like China and India), especially in recent years.

The result of this study shows that if we consider only advanced countries, trade mis-invoicing costs Ethiopia $6-36 billion dollars between 2008 and 2016. This does include numbers form major trading partners of Ethiopia not included in this estimation. Trade with emerging trading partners of Ethiopia (often excluded from such estimation) add $15-78 billion to trade mis-invoicing between 2008 and 2016.

A handful of commodity groups contribute to trade mis-invoicing in a significant way. For exports, vegetables, hides and skins, and machineries are major contributors; for imports, transport equipment, machineries, and, to some extent, chemicals are major contributors.

Trading partners which has the highest percentage share of trade mis-invoicing compared to overall trade includes: India, United Arab Emirates (UAE), Finland, New Zealand, China (Hong Kong), Ireland, Australia, the U.S, Australia, Japan, and Czech Republic. Some of these countries are not on the list of advanced economies (India, UAE, and China), however, these countries contribute to mis-invoicing and hence to capital flight in a major way.

References

Bahmani-Oskooee, M. and Goswami, G. G. (2003). Smuggling as Another Cause of Failure of the PPP. Journal of Economic Development, 28 (2), 23-38.

Baker, R., Clough, C., Kar, D., LeBlanc, B. and Simmons, J. (2014). Hiding in Plain Sight: Trade Misinvoicing and the Impact of Revenue Loss in Ghana, Kenya, Mozambique, Tanzania, and Uganda: 2002-2011. Washington DC: Global Financial Integrity.

Barnett, R. C. (2003). Smuggling, Non-fundamental Uncertainty, and Parallel Market Exchange Rate Volatility. Canadian Journal of Economics, 36 (3), 701-727.

Beja, E. (2006). Was capital fleeing Southeast Asia? Estimates from Indonesia, Malaysia, the Philippines, and Thailand. Asia Pacific Business Review, 12 (3), 261-283.

Beja, E. (2007). Brothers in Distress: Revolving Capital Flows of Indonesia, Malaysia, and Thailand. Journal of Asian Economics, 18 (6), 904-914.

Berger, H. and Nitsch, V. (2012). Gotcha! A Profile of Smuggling in International Trade. In C. Costa Storti and P. De Grauwe (Eds.), Illicit Trade and the Global Economy (pp. 49-72): CESifo Seminar Series. Cambridge and London: MIT Press.

Bhagwati, J. N. (1964). On the Under-invoicing of Imports. Bulletin of the Oxford University, Institute of Economics and Statistics, 26, 389-397.

Biswas, A. K. and Marjit , S. (2005). Mis-invoicing and Trade Policy. The Journal of Policy Reform, 8 (3), 189-205.

Buehn, A. and Eichler, S. (2011). Trade Misinvoicing: The Dark Side of World Trade. World Economy, 34 (8), 1263-1287.

Chang, P. H., Claessens, S., & Cumby, R. E. (1997). Conceptual and methodological issues in the measurement of capital flight. International Journal of Finance & Economics, 2(2), 101-119.

Dicken, P. (2007). Global shift: mapping the changing contours of the world economy. New York: Guilford Press.

Dignam, A. J. and Galanis, M. (2009). The globalization of corporate governance.

Epaphra, M. (2015). Tax Rates and Tax Evasion: Evidence from Missing Imports in Tanzania. International Journal of Economics and Finance, 7 (2), 122-137.

Fisman, R. and Wei, S.-J. (2004). Tax Rates and Tax Evasion: Evidence from 'Missing Imports' in China. Journal of Political Economy, 112 (2), 471-496.

Fisman, R. and Wei, S.-J. (2007). The Smuggling of Art, and the Art of Smuggling: Uncovering the Illicit Trade in Cultural Property and Antiques. NBER Working Paper, No. 13446.

Hüfner, K., Metzger, M. and Reichenstein, B. (2000). Challenges for international

organizations in the 21st century : essays in honour of Klaus Hüfner. New York: St. Martin's Press.

IMF. (2016). Regional Economic Outlook: Sub-Saharan Africa – Time for a Policy Reset (Vol. April 2016). Washington, DC: IMF.

Jha, R. and Truong, D. N. (2014). Trade Misinvoicing and Macroeconomic Outcomes in India. The Australian National University, Australia South Asia Research Centre, ASARC Working Papers.

Kar, D. (2010). The Drivers and Dynamics of Illicit Financial Flows from India: 1948-2008. Washington DC: Global Financial Integrity (November).

Kar, D. and Cartwright-Smith, D. (2010). Illicit financial flows from Africa: Hidden resource for development. Washington DC: Global Financial Integrity.

Kar, D., & Freitas, S. (2011). Illicit financial flows from developing countries over the decade ending 2009 (Vol. 100). Washington, DC: Global Financial Integrity.

Kar, D., & Spanjers, J. (2015). Illicit Financial Flows from Developing Countries: 2004-2013. Global Financial Integrity.

Kar, D. and LeBlanc, B. (2013). Illicit Financial Flows from Developing Countries: 2002-2011. Washington DC: Global Financial Integrity.

Kar, D. and Spanjers, J. (2014). Illicit Financial Flows from Developing Countries: 2003-2012.Washington, DC: Global Financial Integrity (December).

Lanz, R. and Miroudot, S. (2011). Intra-Firm Trade: Patterns, Determinants and Policy Implications. OECD Publishing, OECD Trade Policy Working Papers: 114.

Lessard, D. R. and Williamson, J. (Eds.). (1987). Capital Flight and Third World Debt. Washington, DC: Institute for International Economics.

McDonald, D. C. (1985). Trade Data Discrepancies and the Incentive to Smuggle: An Empirical Analysis. International Monetary Fund Staff Papers, 32 (4), 668-692.

Minten, B., Tamru, S., Kuma, T., & Nyarko, Y. (2014). Structure and performance of Ethiopia s coffee export sector (Vol. 66). Intl Food Policy Res Inst.

Miao, Guannan and Fortanier, Fabienne. (2016). Estimating Cif-Fob Margins On International Merchandise Trade Flows, OECD Working paper, STD/CSSP/WPTGS (2016)8

Naya, S. and Morgan, T. (1969). The Accuracy of International Trade Data: The Case of Southeast Asian Countries. Journal of the American Statistical Association, 64 (326), 452-467.

Ndikumana, L. and Boyce, J. K. (2010). Measurement of capital flight: Methodology and results for sub-Saharan African countries. African Development Review, 22 (4), 471-481.

Ndikumana, L., Boyce, J. K. and Ndiaye, A. S. (2015). Capital flight from Africa: Measurement and drivers. In S. I. Ajayi and L. Ndikumana (Eds.), Capital Flight from Africa: Causes, Effects and Policy Issues (pp. 15-54). Oxford: Oxford University Press.

Patnaik, I., Sen Gupta, A. and Shah, A. (2012). Determinants of Trade Misinvoicing. Open Economies Review, 23 (5), 891-910.

Spanjers, Joseph and Matthew Salamon (2017). "Illicit Financial Flows to and from Developing Countries: 2005-2014." Global Financial Integrity. http://www.gfintegrity.org/report/illicit-financial-flows-to-and-from-developingcountries-2005-2014/

Yeats, A. J. (1990). On the Accuracy of Economic Observations: Do Sub-Saharan Trade StatisticsMean Anything? World Bank Economic Review, 4 (2), 135-156.

UNCTAD. (2016). Trade Misinvoicing in Primary Commodities in Developing Countries: The cases of Chile, Côte d'Ivoire, Nigeria, South Africa and Zambia (UNCTAD/SUC/2016/2)

Appedix:

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

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

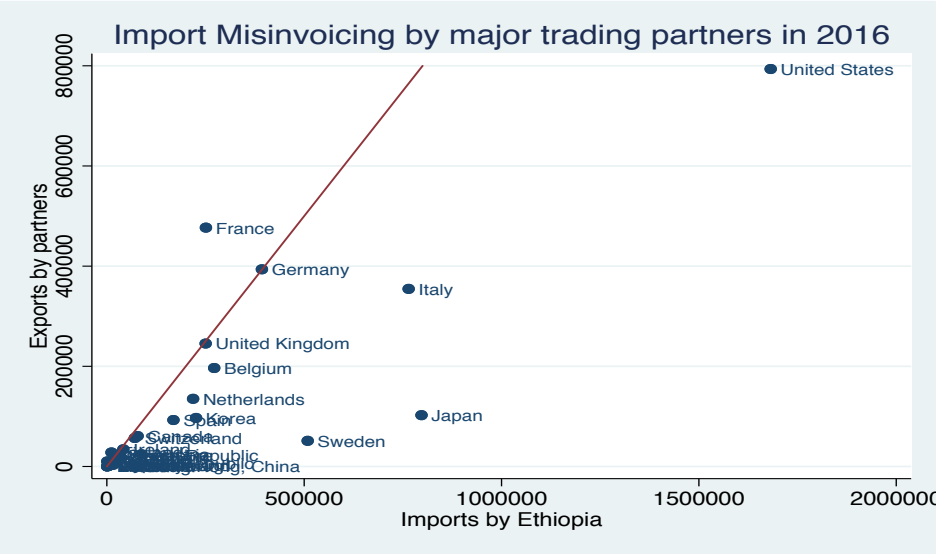


Figure 16: Scatter plots of Ethiopia's exports and partners imports: 2008

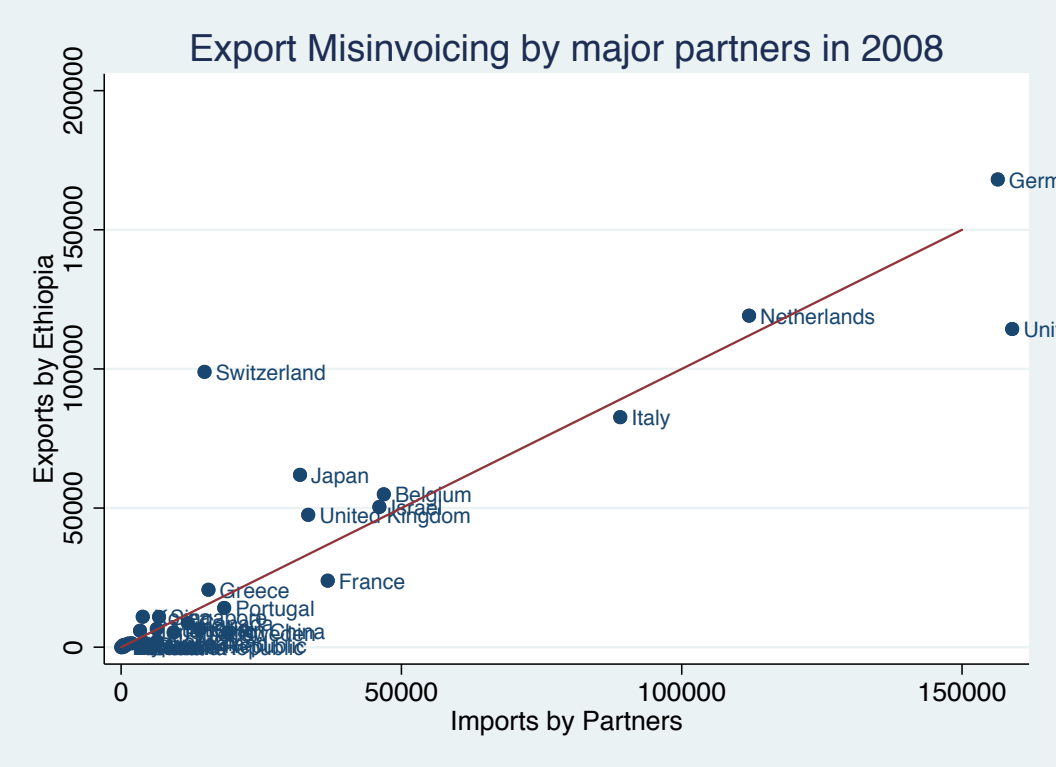


Figure 17: Scatter plots of Ethiopia's exports and partners imports: 2016

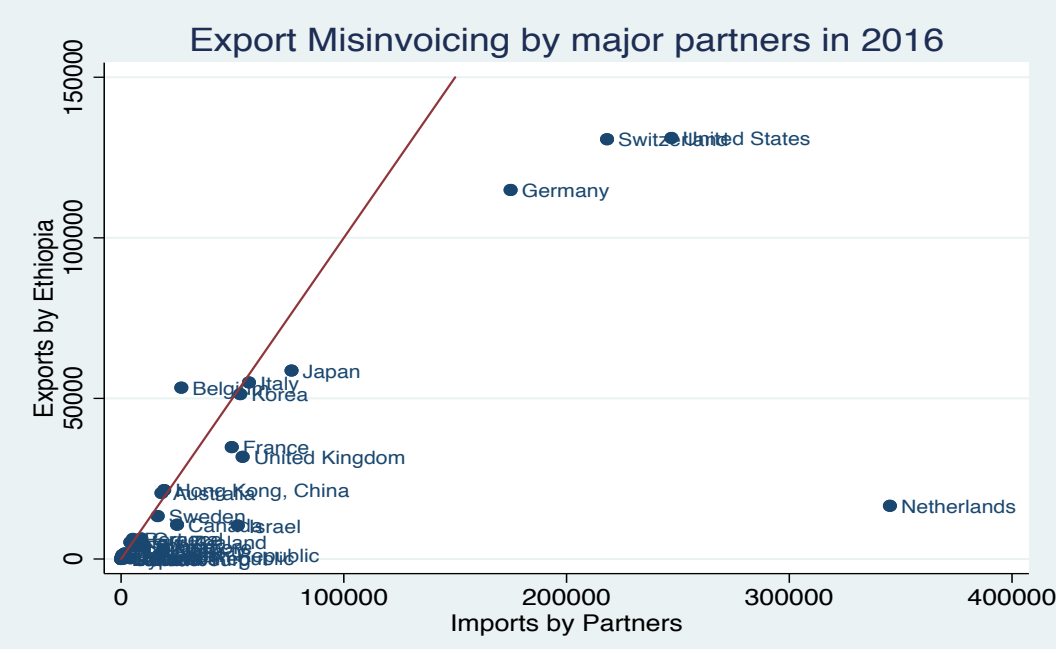


Table 4. Export, Import, and total trade mis-invoicing at three different CIF-FOB ratios (estimated, 10% and 5% CIF values)

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
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 misinvoicng 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	
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 misinvoicng as a percent of total imports by major commodity groups for major trading partners between 2008 and 2016

Country	Vegetable	FoodProd	Chemicals	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
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 misinvoicng 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					
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