Trade Misinvoicing in Primary Commodities in Developing Countries:

The cases of Chile, Côte d'Ivoire, Nigeria, South Africa and Zambia

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Note

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1. Introduction

Trade in primary commodities is a key driver of growth in many developing countries. However, for the commodity-led growth to be sustainable and more generally for globalization to be more inclusive, it is important to ensure that producing countries are able to capture their legitimate share of the gains from international trade in terms of foreign exchange earnings and fiscal revenue collected from customs and other trade levies. At the same time, features of the regulatory environment, notably tariffs, customs, export subsidies, exchange controls, coupled with imperfect monitoring and poor enforcement of regulations, may create incentives for trade misinvoicing by agents seeking to maximize profits and other gains such as access to foreign exchange out of control of the regulating authority, thus undermining developing countries' gains from commodity trade.

Trade misinvoicing is a long-standing concern in the economics profession since the seminal work by Jagdish Bhagwati in the 1960s (Bhagwati, 1964, 1967). This work in turn drew on an even older strand of literature concerned with the consistency of partner data on international trade dating back from the 19th century (see Ferraris (1885) as cited in Morgenstern (1963, Chap. IX)). Comparison of bilateral trade statistics is based on the simple principle proposed by Ferraris (1885) that the value of exports of a country A to a country B as reported by country A should agree with the value of country B's imports from country A as reported by country B. Normal discrepancies should represent the cost of freight, insurance and duties. In practice, however, two possible scenarios may arise (Bhagwati, 1967). The first is the situation where comparison of partner data reveals discrepancies in the "perverse" direction; i.e., where the value of a country's c.i.f. import is less than the value of the corresponding f.o.b. exports of its trading partner. Such 'perverse' discrepancies suggest either overinvoiced exports or underinvoiced imports or both (Bhagwati, 1967, p. 69). The second scenario is when there are "excessive normal" discrepancies, where the difference is in the right direction but exceeds reasonable values of the costs of freight, insurance and duties. These situations provide *prima facie* indication of either underinvoicing of exports or overinvoicing of imports. The literature on trade misinvoicing provides evidence on these potential scenarios through partner data comparisons. This study uses this well-established concept of trade misinvoicing and follows this long-standing line of inquiry with an application to the case of commodity dependent developing countries.

This study specifically aims to contribute to research and policy debates by providing empirical evidence on the magnitude of trade misinvoicing in the particular case of primary commodity exports from a sample comprising four resource-dependent developing countries (Chile, Côte d'Ivoire, and Zambia) and a more diversified resource-rich middle-income country (South Africa). It covers a representative sample of products in the three main categories of primary commodities: oil and gas; minerals, ores and metals (copper, gold, iron ore, silver and platinum[1]); and agricultural commodities (cocoa). Two copper exporters (Chile and Zambia) are selected to compare and contrast patterns and trends of copper misinvoicing.

The work on trade misinvoicing has been based on publicly available data on international trade compiled from government sources by major international institutions such as the IMF and the United Nations Statistics Division. The IMF's Direction of Trade Statistics offers data that enable to estimate trade misinvoicing at the aggregate level, which has been integrated in the estimation of capital flight from developing countries dating back from the 1970s (Bhagwati et al., 1974). This line of inquiry gained momentum since the 1980s in the context of the debt crisis (Lessard and Williamson, 1987), and since then it has taken prominence in both the academic literature and the policy arena (see, among others, Ndikumana et al. (2015), Beja (2006); (Beja, 2007), Patnaik and Vasudevan (2000); more references are given in Section 2.1). The analysis of trade misinvoicing at the disaggregated level; i.e., at the sector and product levels, and by trading partner, has generated growing interest, which is motivated by two major factors. First is the presumption that some products may be more prone to trade misinvoicing than others based on their idiosyncratic characteristics. Second, there may be variations among trading partners with

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[1] Note that UN Comtrade classifies silver, platinum and other metals of the platinum group into one category (SITC code 681).

regard to transparency and enforcement of trade recording rules that may generate differences in trade misinvoicing across partners.

This study describes in detail the process of using UN Comtrade data to identify major products and leading partners that will be the focus of the analysis based on the established statistical methodology for estimation of export misinvoicing at the product and partner levels. In the case of Nigeria, which exports oil and gas while also relying on imported oil products, the study also investigates the extent of oil import misinvoicing.

The data show heavy concentration of exports both by product and by partner. With the exception of South Africa, the export baskets of the countries in this sample exhibit a heavy dependence on two to three primary commodities. These stylized facts illustrate the relevance and appropriateness of the sample of countries selected for this study.

The results from the analysis show substantial levels of trade misinvoicing in all five countries covered by the study, but the patterns vary substantially across countries, products and trading partners. Some interesting patterns and contrasts emerge. At the product level, while trade in copper exhibits large amounts of export overinvoicing in Chile, the results for Zambia show substantial export underinvoicing. In particular, while Zambia's data shows that Switzerland is the top buyer of its copper (51 percent), no copper imports from Zambia appear in Switzerland's trade data. The case of gold exports from South Africa is also strikingly peculiar. Imports of non-monetary gold reported by trading partners vastly exceed exports recorded by South Africa. Monetary gold exports are recorded as "unallocated" in terms of destination in the government records. However, while non-monetary gold and monetary gold are reported separately in national trade statistics, the two series are inexplicably merged starting in 2011. Trade in iron ore from South Africa exhibits export underinvoicing. Exports of oil from Nigeria and silver and platinum from South Africa show mixed results – both underinvoicing and overinvoicing. At the partner level, the Netherlands also presents a peculiar case, where Nigerian oil registered as exported to the Netherlands cannot be traced in the Netherlands' bilateral trade data. In contrast Germany's trade of all products with all the countries in the sample exhibits export underinvoicing. The results generally show a close correlation between export concentration by destination and the extent of trade misinvoicing.

The next section provides a review of the literature on the main mechanisms and motivations of trade misinvoicing. Section 3 describes the method of compilation of the data and presents some stylized facts. Section 4 presents the methodology used for estimation of trade misinvoicing. The results by country, product and partner are presented in section 5. Section 6 concludes with a summary of the results and some policy recommendations.

2. Mechanisms and motives for trade misinvoicing

2.1   Trade misinvoicing in the literature

The empirical economics literature has documented substantial discrepancies in bilateral trade data starting as back as in the 19th century (see Ferraris (1885), cited by Morgenstern (1963)), forming the basis for the analysis of trade misinvoicing since the 1960s. Bhagwati (1964) pointed out substantial import misinvoicing in the case of Turkey. Naya and Morgan (1969) provided similar evidence of export misinvoicing in the case of South-East Asian countries.

Interest in the issue of trade misinvoicing increased in the 1980s in the context of research on capital flight, drawing on earlier work by Jagdish Bhagwati (Bhagwati, 1967; Bhagwati et al., 1974). The practice was identified as a major mechanism through which developing countries lose valuable capital (Bhagwati (1967); Bhagwati et al. (1974); Lessard and Williamson (1987)). Indeed, the empirical literature has established that trade misinvoicing represents a substantial share of total capital flight from developing and emerging economies. The study by Ndikumana et al. (2015) provides evidence for African countries, (Beja, 2006, 2007) for Asian countries, and Jha and Truong (2014) and Kar (2010) for India. And a number of other studies cover broad samples of countries from all developing regions (Kar and Cartwright-Smith,

2010; Kar and LeBlanc, 2013; Kar and Spanjers, 2014). The significance of trade misinvoicing has drawn attention to the issue of tax evasion by transnational corporations (TNCs) and their role in fuelling the outflow of unrecorded capital from developing countries. This study contributes to this line of inquiry by documenting the extent of trade misinvoicing in primary commodities, a sector that is dominated by TNCs.

Most recent studies, as those cited above, have investigated trade misinvoicing primarily as a mechanism of capital flight at the aggregate/national level. Analysis at the disaggregated level such as the one undertaken in this study is especially important for developing countries that depend on exports of primary commodities. Analysis at the partner and product levels can help uncover the extent as well as direction of trade misinvoicing in primary commodity exports, which is essential information for designing policies to curb trade misinvoicing and associated capital flight.

2.2   *Motives for trade misinvoicing*

A review of the literature reveals three main categories of motives for exporting and importing firms to engage in trade misinvoicing (Buehn and Eichler, 2011; Patnaik et al., 2012): (i) financial motives; (ii) circumventing exchange and customs controls; and (iii) minimizing the administrative burden.

The financial motive is driven by a trader's bid to maximize profit by avoiding tariffs and/or taking advantage of export subsidies. Jadgdish Bhagwati pointed out that "The presence of tariffs and subsidies on international trade transactions generally creates immediately an incentive to overinvoice or underinvoice the value of the transactions" (Bhagwati, 1967, p. 67). Bhagwati (1964) found that products facing high tariffs experienced substantial import underinvoicing relative to products facing low tariffs. McDonald (1985) found a positive correlation between trade misinvoicing and export taxes in trade between developing and developed countries. Epaphra (2015) confirmed this finding in the case of the United Republic of Tanzania, where the extent of import misinvoicing is higher for products facing higher tax rates. Fisman and Wei (2004) found a close correlation between import tax rates and the extent of "missing imports", suggesting under-reporting of imports as well as possible misreporting of products to take advantage of differences in tax rates across products. Similarly, Yeats (1990) found that the extent of trade misinvoicing varies across product categories, which may be an indication of the role of differential treatment of products in terms of quotas and tariffs. Buehn and EichBuehn and Eichler (2011) present further evidence of a positive link between trade misinvoicing and quotas and tariffs.

Firms may also engage in trade misinvoicing to take advantage of tax incentives aimed at promoting exports. In such contexts, exporting firms seek to maximize profits by overinvoicing their exports. From the exporter's perspective, overinvoicing of exports is beneficial if the gains from extra subsidies exceed the costs of acquiring foreign exchange on the black market that the exporter must surrender to the authorities. Thus there are incentives for overinvoicing if the subsidy rate is sufficiently greater than the black market premium on foreign exchange (Bhagwati, 1967, p. 67). A recent paper by Kellenberg and Levinson (2016) finds that tariff evasion is one of the factors that may lead firms to 'intentionally misreport' trade data.

The second motive for trade misinvoicing is to circumvent currency controls. In this case, the existence of exchange rate distortions and foreign exchange controls creates a black market premium that traders will seek to exploit to their advantage. Thus traders engage in import overinvoicing and export underinvoicing to generate extra foreign exchange to be used to purchase domestic goods with a premium. Empirical evidence of a correlation between the black market premium and import overinvoicing can be found in Bahmani-Oskooee and Goswami (2003), Barnett (2003), and Biswas and Marjit (2005).

Finally, trade misinvoicing may reflect smuggling of imports and exports, driven by the motive to circumvent bureaucratic hurdles, including lengthy paperwork and delays in administrative authorizations and controls, in order to speed up execution and settlement of transactions. This practice is likely to be more prevalent in countries with low administrative capacity and/or high levels of corruption in the public sector. In such a context, firms engage in smuggling to avoid red tape, while smuggling is also encouraged

and facilitated by corrupt public officials in charge of trade and customs regulations. The literature provides some empirical evidence of a positive correlation between corruption and trade misinvoicing for high-value goods (Fisman and Wei, 2007), a relationship confirmed in the case of larger sets of export products (Berger and Nitsch, 2012).

In practice trade misinvoicing, in general, takes place simultaneously with correctly recorded and licit trade. In fact firms may engage in both legal and illegal trade so that the former helps disguise the latter. This makes it difficult for authorities and statistical analysts to detect misinvoicing where trade volumes are high. Thus, to gain a more accurate picture, the analysis of trade misinvoicing requires using disaggregated data enabling transactions to be tracked at both product and partner levels.

2.3   The case of primary commodity exports from developing countries

The above discussion suggests that trade misinvoicing in primary commodities is an important topic for research and policy purposes. As mentioned earlier, there is some evidence in the literature to indicate that trade misinvoicing may vary by product category based on product characteristics. For instance, high-value, low-weight products, such as gold, diamonds and other precious commodities, may be more vulnerable to smuggling. Similarly products not governed by a standardized international pricing regime are more subject to misinvoicing, as are goods produced through highly informal production practices, such as artisanal mining.

There are also other features of primary commodities that make them more prone to trade misinvoicing. The first is that governments have a high degree of discretionary control in the management of the natural resource sector. This provides considerable economic and political power to officials in charge of managing the sector, which opens up avenues for rent-seeking. Second, large TNCs in extractive industries have substantial financial and market power which enables them to exert pressure on host governments in order to circumvent government controls and regulations. Moreover, the complex organization of TNCs makes it hard for governments in resource-rich developing countries to monitor their operations. Most of these TNCs are large conglomerates that have branches and affiliates located in several countries. This facilitates exports through intra-company trade as well as profit shifting through transfer pricing. Intra-firm trade constitutes a large, albeit varying, share of trade in developed economies.[2] This increases the incentives for export underinvoicing to minimize tax liabilities and earn extra foreign exchange outside of the control of the regulatory authority. Export overinvoicing may also be important in the presence of substantial tax incentives aimed at encouraging export-oriented activities.

Finally, extractive industries may be exposed to trade misinvoicing due to the large volumes of exports involved. The fact that many natural-resource-rich developing countries have limited regulatory and administrative capacity to manage and monitor such large and complex trade volumes increases the likelihood of trade misinvoicing.

2.4   Trade misinvoicing vs. other interpretations of 'perverse' and 'excessive normal' discrepancies in trade statistics?

It is possible that 'excessive normal' discrepancies and 'perverse' discrepancies in partner trade statistics could reflect phenomena other than trade misinvoicing as pointed out in the early literature in this area (Bhagwati, 1967; Morgenstern, 1963). These factors may be related to imperfections in the methodology and the recording of imports and exports at the origin and destination. First, with regard to methodology, a key challenge is the measurement of the actual costs of transport, insurance and other fees related to the shipment of merchandises, which must be taken into account to make partner data on imports comparable with exports. This information is not readily available in trade statistics databases for most countries; only few countries publish both c.i.f. and f.o.b. values in the IMF's Direction of Trade Statistics.

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[2] The increase in intra-firm trade in the context of globalization has been documented since the 1990s. See, among others, Dicken (2007); Dignam and Galanis (2009); Hüfner et al. (2000); Lanz and Miroudot (2011).

The tradition in the literature has been to use 10 per cent of the f.o.b. value of the goods as the cost of insurance, transport and other costs incurred until the goods are delivered to the importer. In practice, however, the actual costs vary across trading partner pairs, by product, and over time. If the estimated 'perverse' discrepancies or 'excessive normal' discrepancies are relatively small, one can infer that they may be due to the fact that the estimate of 10 per cent for c.i.f.is either too low or too high. This argument is difficult to make when the estimated discrepancies are sufficiently large. In fact, looking at the data for the few countries that publish imports both in c.i.f. and f.o.b. values, the c.i.f. ratio is reasonably close to 10 per cent on average.[3] For South Africa and Zimbabwe, the only two African countries that report such data, the averages c.i.f. ratio over 1980-2014 is 11 per cent and 13 per cent, respectively. From a practical perspective, then, the use of the 10 per cent estimate for c.i.f. provides a reasonable solution to the problem of data availability on the true costs of transport and insurance.

The second potential source of 'perverse' or excessive 'normal' discrepancies is the fact that imports may be recorded with lags, creating mismatches in mirror values of bilateral imports and exports. This problem is more likely to arise when there are large year-to-year variations in imports and exports, and if the lags are also variable in length. While the issue is likely to be relevant in high frequency data (quarterly and monthly), it is not likely to be as significant in annual data. It is likely that this year's imports which are not reported but carried over next year will be more or less compensated by last year's imports which carried over to this year. As a result, at the aggregate level, lags in recording of imports will have minimal effects on estimated statistical discrepancies in annual import and export series.

A third issue relates to the classification of products. Excessive normal and perverse discrepancies may arise due to inconsistent classification of products across partners and over time. Products may be misclassified either by error or deliberately. Deliberate misclassification by operators could be motivated by reduction of transport costs or duties (which may vary by product) or by secrecy motives (in the case of sensitive products such as gold). The substantial progress made over time in the refinement and expansion of the classification system (SITC, HS), and the various global efforts to harmonize data compilation suggest that abnormal discrepancies due to misclassification should decline over time. Any persistence of misclassification would imply either a deliberate choice (in which case one would wonder about the motive) or severe technical deficiencies. Improvements in transparency in international trade hinges on progress in not only fine tuning classification systems but also systematic use of agreed upon classification conventions by all concerned parties.

The fourth possible source of abnormal discrepancies could arise from inconsistent recording of the origin and destination of products. An example would be the case of a product exported by country A to country C but that either transits or is purchased by a buyer in country B. Estimates of discrepancies in bilateral trade data would be misleading if country A records the product as exported to country B whereas C records it as imported from A. However, the comparison between country A's data on its total exports to all its partner's data on imports from A will not be affected by these errors given that country A is recorded only once as origin of the exported product. It follows that the effects of such inconsistencies on the estimates of total misinvoicing at the national level, which are incorporated in the estimation of capital flight is likely to be negligible. The partner by partner estimates of trade misinvoicing, in contrast, require more scrutiny to trace incidences of such mis-recording of destination and origin of exports and imports.

3. Data sources and highlights

3.1   Data sources and data compilation procedure

This study covers the key primary commodity groups, notably oil and gas; minerals, ores and metals; and agricultural commodities. The sample includes four resource-dependent developing countries – Chile,

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[3] The c.i.f. ratio is derived by dividing imports c.i.f. by imports f.o.b. as published in the IMF's Direction of Trade Statistics. For comparison, the ratios for the few other developing countries with available data are: Brazil (7 per cent), Dominican Republic (15 per cent, Mexico (5 per cent), Papua New Guinea (11 per cent), Paraguay (12 per cent), and Peru (16 per cent).

Côte d'Ivoire, Nigeria and Zambia – and a more diversified yet resource-rich economy, South Africa. The data are from the UN Comtrade database, which is publicly available at http://Comtrade.un.org/data/. UN Comtrade has the unique advantage of containing export and import data by product disaggregated up to the 4-digit SITC level.

The compilation of the time series used for estimation of export misinvoicing involves the five steps described below. A similar process is used to compile data for estimating import misinvoicing.

- Step 1: To determine the main export commodities, exports of all commodities to the world (as trading partner) are extracted.[4] The leading products are determined using each product's share in cumulative exports over the period reported in UN Comtrade.[5] In this study, the average shares over the period 2010–2014 were used to determine the leading export products.

- Step 2: The next step is to determine the leading partners based on average shares in cumulative exports over the investigation period. The aim is to assemble a sample of trading partners that represents a high proportion of the concerned country's total exports, preferably over 90 per cent. Only the partners with a meaningful length of time series are included in the sample.

- Step 3: Next, export series for the identified products to the identified leading trading partners are extracted.

- Step 4: Import data by the identified leading partners are then extracted. These series will be compared to the country's exports to estimate export misinvoicing.

- Step 5: The last step is to organize the data so as to compare exporter data and partner data for the computation of trade misinvoicing. This requires generating a panel that combines exporter data and partner data.

The study uses data from the UN Comtrade Database over the 1990–2014 period for Chile, 1995–2014 for Côte d'Ivoire and Zambia, and 2000–2014 for South Africa. In the case of Nigeria, due to the absence of data for 2004 and 2005, the results are presented for two sub-periods, 1996–2003 and 2006–2014.

Using the process described above, the following products were identified for the sample countries using the 3-digit SITC classification system:

- Chile: the copper group comprising processed copper [682] and copper ores and concentrates, copper mattes and cement [283].

- Côte d'Ivoire: cocoa [072].

- Nigeria: the oil and gas group [33] comprising: crude petroleum oils, oils from bitumen materials [333]; natural gas, whether or not liquefied [343]; petroleum oils or bituminous minerals > 70 per cent oil [334].

- South Africa: silver, platinum, other metals of the platinum group [681]; iron ore and concentrates [281]; gold, non-monetary (excluding gold ores and concentrates) [971].

- Zambia: Copper [682]

The next subsection presents highlights from the data, before proceeding to statistical estimation of trade misinvoicing in the subsequent section.

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[4] Note that for imports, "the world" does not appear in UN Comtrade as a trading partner (importer). Therefore estimates for the annual total imports are obtained as the sum of imports by all individual partners.
[5] If the product (or products) to be investigated is (are) pre-determined, this first step is not needed. In that case, the process will start with step 2.

3.2   Highlights from the data

The data exhibits heavy concentration of exports in a few primary commodities for the countries in this sample. Table 1 presents the shares of the top primary commodities exported as a percentage of total merchandise exports over the entire period. In the case of Nigeria, oil and gas and related products make up 92 per cent of total merchandise exports. In Zambia and Chile, copper alone constitutes 66 per cent and 54 per cent of total merchandise exports, respectively. South Africa has a substantially more diversified export basket, where the top export product group (the silver, platinum, and other metals of the platinum group) represents only 9 per cent of total merchandise exports. Moreover, the top 10 products account for only 52 per cent of South Africa's total exports. Côte d'Ivoire's export basket is relatively less concentrated than that of the other developing countries in the sample, although it is still heavily dominated by cocoa, which accounts for 32 per cent of its total exports.

The concentration in export commodities is compounded by concentration in export destination by trading partner. Indeed, in some cases, one trading partner accounts for more than half of some countries' total exports of a particular primary commodity. For example, about 62 per cent of South Africa's iron ore, its second most important export commodity, in value, goes to one partner, China. In the case of Zambia, 51 per cent of its leading export commodity, copper, is exported to Switzerland, although Switzerland's data do not show any copper imports from Zambia most probably reflecting the fact that Switzerland serves as a transit platform to copper-trading commodity trading companies. This pattern of concentration is evident also in the other countries in the sample, though to a lesser extent.

In the case of South Africa, the data for gold exports show major discrepancies between the values reported by South Africa (recorded exports to partners) and the values reported by its trading partners (as gold imports from South Africa). According to South Africa's data in COMTRADE, the top partner, India, accounts for only 4.6 per cent of its total gold exports. However, India's data show a share of 35 per cent. This peculiar situation was further investigated by examining gold exports data as reported by South African customs services, which are publicly available on the website of the Department of Trade and Industry (DTI). The Government data does not show the destination of monetary gold exports, which are recorded as "unallocated". Another peculiar feature of the reporting of gold exports is inconsistency of the split between monetary gold and non-monetary gold. From 2011, the monetary gold category is blank and it appears that the two are combined under the heading of non-monetary gold exports. Comtrade does not report monetary gold exports from South Africa. These inconsistencies call for caution in the interpretation of the results from the standard trade misinvoicing algorithm for gold exports from South Africa. This is discussed further in the next section where the estimation results are presented.

The strong concentration of exports in a few products and destinations exposes resource-rich developing countries to adverse effects of demand and price shocks in international commodity markets. This was illustrated during the global economic crisis when primary commodity exporters suffered a deeper growth contraction than their resource-scarce counterparts. The recent decline in commodities prices, especially of oil, has translated into relatively larger downward revisions of growth forecasts for resource-dependent economies compared to non-resource-dependent economies.[6]

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[6] In the case of sub-Saharan African countries, see *IMF (2016) Regional Economic Outlook: Sub-Saharan Africa – Time for a Policy Reset (April 2016 edition).*

Table 1. Shares of top export commodities of sample countries in their total exports (per cent) [SITC codes are given in brackets]

Country	Top product	Top 3 products	Top 5 products	Top 10 products	Top product	Top 2nd product	Top 3rd product
Chile	53.7	59.8	67.7	76.4	[682] Copper	[283] Copper ores and concentrates; copper mattes, cement *(Share = 20.5% of total exports)*	[057] Fruits and nuts (excl. oil nuts), fresh or dried
Côte d'Ivoire	31.8	54.0	65.9	81.2	[072] Cocoa	[334] Petroleum oils or bituminous minerals > 70% oil *(Share = 13.2% of total exports)*	[333] Petroleum oils, oils from bitumen materials, crude
Nigeria	78.8	92.4	94.6	97.3	[333] Petroleum oils, oils from bitumen materials, crude	[343] Natural gas, whether or not liquefied *(Share = 8.6% of total exports)*	[334] Petroleum oils or bituminous minerals > 70% oil
South Africa	9.1	23.6	34.7	52.0	[681] Silver, platinum, other metals of the platinum group	[281] Iron ore and concentrates *(Share = 7.9% of total exports)*	[971] Gold, non-monetary (excl. gold ores and concentrates)
Zambia	66.2	71.4	75.5	82.7	[682] Copper	[121] Tobacco, unmanufactured; tobacco refuse *(Share = 2.6% of total exports)*	[522] Inorganic chemical elements, oxides & halogen salts

Source: Author's calculations using UN Comtrade Database.

Note: Shares are calculated as the ratio of exports to total exports over the period 1995–2014. The data for South Africa cover a shorter period (2000–2014). For Nigeria the data start in 1996 and there are no data for 2004 and 2005.

Table 2. Shares of sample countries' top trading partners (export destination) in their total exports (per cent)

	Chile: copper [682]	Cote d'Ivoire: cocoa	Nigeria: oil	South Africa: iron ore	South Africa: silver and platinum	South Africa: gold (SA data)	South Africa: gold (partner data)	Zambia: copper [682]
Top partner	25.7	31.3	29.8	61.7	33.9	4.6	34.6	51.3
Top 3 partners	46.5	58.9	49.5	79.8	71.9	7.5	65.4	74.9
Top 5 partners	61.1	69.7	60.7	86.7	91.6	8.8	86.1	82.7
Top 10 partners	83.2	84.3	77.8	95.4	99.5	9.2	97.5	91.3
Top 15 partners	91.6	93.5	85.8	98.9	99.8	9.3	99.4	95.4

Source: Author's calculations using data from UN Comtrade Database.

4. Methodology for estimating trade misinvoicing

Trade between two countries A and B is said to exhibit *prima facie* indication of trade misinvoicing when the value of exports from country A to its trading partner country B, as reported by country A, is significantly different from the value of imports by country B from country A, as reported in country B's data. Conventionally, exports are recorded according to their free on board value (f.o.b), while the reported value of imports includes the cost of insurance and freight (c.i.f.). Applying the Ferraris principle, under normal circumstances, the export values reported by country A would differ from the import values reported by country B by an amount representing the cost of freight and insurance. Thus, the following equality would hold:

Country B's imports from country A = Country A's exports to country B + freight and insurance **(1)**

In practice, however, trade data often reveal substantial differences between the amount on the left and that on the right of the above equation. Two sets of scenarios may arise as identified in the literature since the 1960s (Bhagwati, 1967). The first scenario is when the difference between imports and exports is in the 'perverse' direction; that is, imports as reported by the importer are less than exports (plus freight and insurance) as reported by the exporter. This is interpreted as *prima facie* indication of underinvoicing of imports or overinvoicing of exports or both (Bhagwati, 1967, p. 69). In the second scenario, the difference is in the 'normal' direction but the data exhibits 'excess normal' discrepancies. In other words, imports are greater than exports by an amount that is significantly bigger than reasonable costs of freight and insurance. In this situation, there is prima facie indication of export underinvoicing or import overinvoicing or both.

In the case of import underinvoicing, there are two possible cases. The first is technical smuggling, where the value of imports is deliberately underestimated, possibly to avoid import duties and other official levies. The second case is pure smuggling, whereby some of the imported goods are simply not recorded at all at entry into the country. Empirically, it is difficult to distinguish between these two scenarios by looking at the aggregate trade data. Moreover, it is important to note that, unlike unrecorded exports, imports that are smuggled into the country do not amount to a net loss to the country, given that the goods are consumed in the country. However, these imports must be paid for; therefore they must have a counterpart in terms of use of foreign exchange, even though the transactions are not traceable in the country's official balance-of-payments statistics. Import smuggling reduces the estimated amount of capital flight from the country, while import overinvoicing increases it. A detailed discussion of import misinvoicing in the context of estimation of capital flight can be found in Ndikumana et al. (2015) and Ndikumana and Boyce (2010).

The literature on capital flight and trade misinvoicing has thus far used aggregate national imports and exports in the computation of trade misinvoicing. This study estimates trade misinvoicing at the product level and by partner. The focus is on export misinvoicing, except for Nigeria where also oil import misinvoicing are also estimated.

For country *i*, product *k*, and partner *j* at time *t*, export misinvoicing (noted as *DX* henceforth) is calculated as follows:

$$DX_{ij,t}^{k} = M_{ji,t}^{k} - \beta * X_{ij,t}^{k} \qquad\qquad (2)$$

Where M_{ji} represents imports by country *j* from country *i* according to country *j*'s data, X_{ij} is exports by country *i* to country *j* as reported by country *i*, and β is the freight and insurance factor. This factor is expected to vary across countries especially when taking into account the distance to export markets as well as product-specific and market-specific factors affecting transport costs and insurance. However, due to lack of country-specific data, a value of 1.1 is used following the practice in the literature (Baker et al., 2014; Ndikumana and Boyce, 2010; Ndikumana et al., 2015), a practice dating back to the 1960s and 1970s (Bhagwati, 1964, 1967; Bhagwati et al., 1974).

A positive value of *DX* in a given year provides *prima facie* indication of export underinvoicing; a negative value implies export overinvoicing. Following the discussion in section 2 on the motives for trade misinvoicing, export underinvoicing is the most expected scenario, reflecting the incentives of exporting firms to stash foreign exchange abroad to settle transactions or to pay for smuggled goods, or to avoid foreign exchange controls or administrative bottlenecks. However, export overinvoicing may also occur, which, among others, may reflect an attempt by firms to benefit from tax incentives which are often established to promote strategic activities and programs such as export-oriented industrialization. It is therefore not possible to predict the sign of *DX a priori*.

Similarly, for a country *i*, product *k*, and partner *j*, import misinvoicing (labeled *DM*) in a year *t* is measured as follows:

$$DM_{ij,t}^{k} = M_{ij,t}^{k} - \beta * X_{ji,t}^{k} \qquad\qquad (3)$$

where M_{ij} is the value of imports by country *i* from country *j* as reported by country *i*, X_{ji} is the value of exports by country *j* to country *i* as reported by country *j*, and β is the freight and insurance factor, which is assumed to be 1.1 as indicated above.

A positive value for *DM* represents import overinvoicing, which may be motivated by a desire to secure extra foreign exchange to buy goods and investment assets abroad or take advantage of a favourable black market premium to buy goods on domestic markets. A negative *DM* implies import underinvoicing, reflecting technical smuggling or pure smuggling, or a combination of the two.

Total export misinvoicing and import misinvoicing are calculated by replacing country *k* with the rest of the world in the above equations. Total trade misinvoicing may also be calculated by considering trade misinvoicing relative to a group of countries, such as developed economies as the benchmark, and then scaling up the obtained value by the inverse of the share of this group of countries in country *i*'s total exports and imports, respectively. This is commonly used in the literature under the presumption that trade data are of better quality in developed countries than in developing countries. This would minimize biases in the trade misinvoicing estimates that may arise from poor quality data.

The analysis in this study focuses on export misinvoicing, given that, in general, most developing countries that are primary commodity exporters do not import the same products in significant amounts. One exception is oil, where oil- and gas-producing developing countries may not have sufficient local refining industries and therefore must import refined oil. This is the case for Nigeria, for example. For this reason, the paper presents results both oil export misinvoicing and oil import misinvoicing in Nigeria.

To enable comparability over time and across countries, the estimates are converted into real values by deflating nominal values using the United States gross domestic product (GDP) deflator with 2014 as the base year. The series for the GDP deflator are obtained from the IMF's International Financial Statistics.

5. Results by country

This section presents and discusses the estimated amount of trade misinvoicing by country and product. A table summarizing the results for the main trading partners to illustrate patterns and disparities in export underinvoicing and overinvoicing is presented in annex table A1. The section starts with copper exports, showing the contrasts between Chile and Zambia.

5.1 Chile: Copper export misinvoicing

The results for Chile cover the period 1990–2014 for two sub-products of the copper group (see table 3). The partners selected in the analysis are determined following the methodology described in section 2. However, Switzerland is also included in the sample for comparison purposes, as its trade with the other countries in the sample exhibits large discrepancies. The sample of leading trading partners considered accounts for 91.4 per cent of Chile's total copper exports, with 90.8 per cent of total exports of copper ores and concentrates (SITC 283) and 84.4 per cent of copper products in the non-ferrous metals category (SITC 682). The leading trading partners are China, which accounts for 23.7 per cent of Chile's total copper exports over the period, followed by Japan (13 per cent) and the United States (8 per cent).

The results show excessive negative discrepancies, suggesting export overinvoicing for all trading partners except France, Germany and Spain. Whereas trade with Germany exhibits substantial export underinvoicing worth $9.4 billion in net terms, the values are small for France and Spain. The following are some noteworthy results by trading partner:

- Trade with the Netherlands presents a peculiar situation with the largest estimate of export overinvoicing of $16 billion, even though the country accounts for a relatively small share (5.3 per cent) of Chile's total exports of copper products [SITC 682]. This means that the bulk of Chile's copper exports to the Netherlands are not reported in the Netherlands' trade data even though they are reported in Chile's trade data. The evidence points to a need to establish a mechanism for better tracking the effective destination of Chile's copper exports.

- Chile's leading trading partners also exhibit large overinvoicing of copper exports. In the case of China, there is both export underinvoicing for the refined copper products [SITC 682] worth $3.4 billion, and export overinvoicing for copper ores [SITC 283] worth $4.2 billion, resulting in net overinvoicing for the two products combined amounting to $791 million.

- Chile's trade with Japan, the second leading trading partner, exhibits large overinvoicing of copper exports for both sub-groups: $4.1 billion [SITC 282] and $1.8 billion [SITC 682], respectively, with total export overinvoicing of $5.9 billion.

The cumulative amount of copper export misinvoicing for the sample of Chile's major trading partners tracks the trend of total misinvoicing with all partners or the rest of the world as illustrated in figure 1. The results also show that the absolute value of copper export misinvoicing has increased in tandem with total copper exports.

One of the possible reasons for the extremely large "perverse" (negative) and "excessive normal" (positive) discrepancies in partner by partner data may be inconsistencies in the recording of the actual destination of exports. So, in the case of The Netherlands, the products may be purchased by a buyer registered in The Netherlands while they are actually offloaded and registered as imports in another country. However, so long as Chile's copper exports are registered as imports in only one country, the aggregate values should not be affected. Thus large estimated discrepancies with respect to the rest of the world suggest export misinvoicing.

Figure 1. Copper misinvoicing in Chile (Millions of constant 2014 dollars)
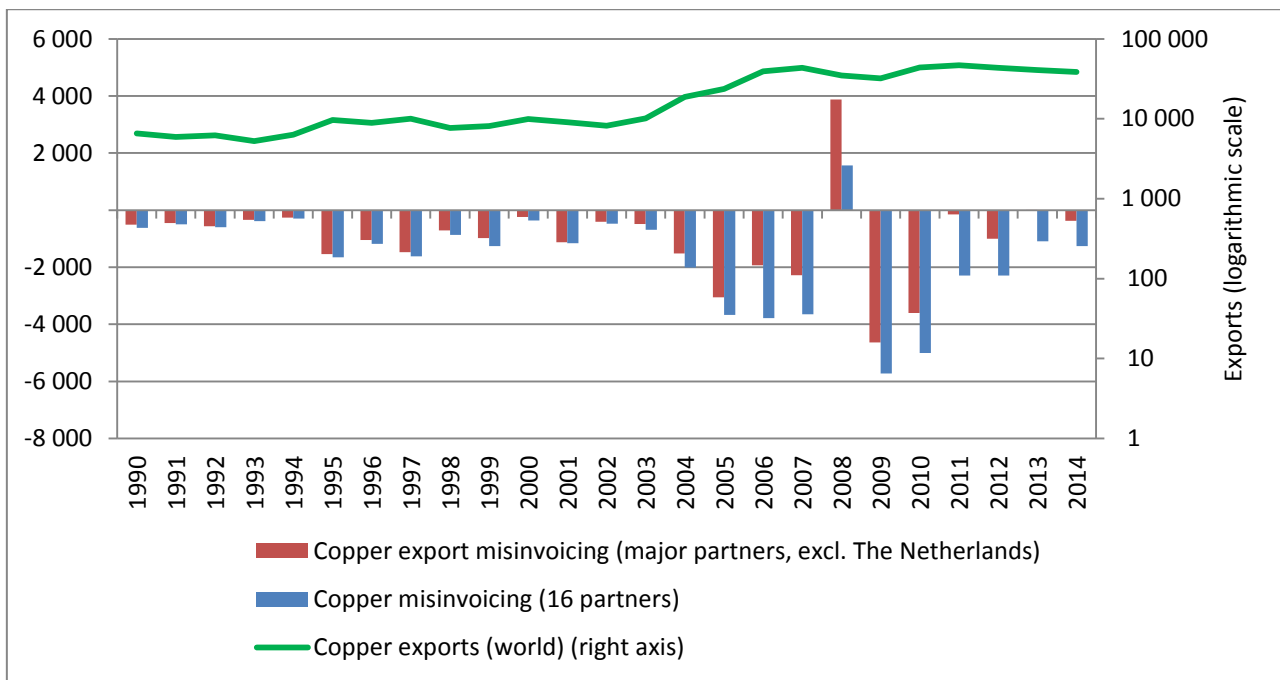
Source: Author's computation using UN Comtrade data.

Table 3. Chile: Copper export misinvoicing (millions of constant 2014 dollars) and partners' shares in copper exports (per cent), 1990–2014

Country	Export misinvoicing			Partner's share in copper exports (per cent)		
	Copper ores and concentrates [283]	Copper products [682]	Total [282 + 628]	Copper ores and concentrates [283]	Copper products [682]	Total [282 + 682]
Belgium		-3 151.3	-3 151.3		1.4	0.9
Brazil	-1 154.3	-1 732.1	-2 886.4	6.6	5.8	6.1
Canada	-193.4	-807.1	-1 000.5	0.8	1.7	1.4
China	-4 173.3	3 382.3	-791.0	23.1	24.0	23.7
France		147.7	147.7		6.3	4.1
Germany	-1 001.8	10 405.6	9 403.8	5.1	1.7	6.8
India	-2 959.4	-75.4	-3 034.9	10.7	0.2	3.9
Italy		-2 272.2	-2 272.2		8.6	5.6
Japan	-4 139.3	-1 796.4	-5 935.7	31.8	3.0	13.0
Mexico	-90.4	-651.7	-742.1	0.3	2.2	1.5
Netherlands		-16 085.4	-16 085.4		5.3	3.4
Rep. of Korea	-375.2	-1 723.5	-2 098.6	8.0	7.9	7.9
Spain	1 260.2	-339.6	920.6	3.9	1.2	2.1
Switzerland	-168.0	-706.8	-874.7	0.1	0.2	0.2
United Kingdom		-5 502.3	-5 502.3	0.0	2.6	2.6
United States	67.3	-7 059.4	-6 992.1	0.4	12.2	8.1
World	-17 130.9	-27 247.8	-44 378.0	100	100.0	100.0
Major partners	-12 927.7	-27 967.7	-40 895.0	90.8	84.4	91.4
Excluding The Netherlands: World		-11 162.4	-28 293.3			

Source: Author's computation using UN Comtrade data

5.2   *Zambia: Copper export misinvoicing*

The results for Zambia (see table 4 and figure 2), a country that is also heavily dependent on copper exports, differ drastically from those of Chile. In contrast to widespread export overinvoicing in Chile, Zambia's results show copper export underinvoicing, with the notable exceptions of trade with the United Kingdom which exhibits substantial export overinvoicing of $31.8 billion and $4.4 billion. Trade with Singapore, South Africa and the United Republic of Tanzania also exhibits export overinvoicing, albeit a relatively smaller proportion compared to Switzerland.

Copper exports to Switzerland present a strikingly peculiar case, where no copper imports are recorded in Switzerland at all. Excluding Switzerland, Zambia recorded systematic export underinvoicing starting in 2005, with a cumulative $12 billion in export underinvoicing with its major trading partners over the 1995–2014 period, and $14.5 billion relative to the rest of the world (all the trading partners). The peculiar feature of trade with Switzerland deserves to be explored further, especially at a more disaggregated, company level. It is possible that exports are recorded as destined to an importer in Switzerland when the ultimate importer does not reside there, as would be the case with transit trade. Therefore, it would be important to investigate the effective destination of Zambian copper marked as exported to Switzerland that is not recorded in this country.

For China, the second leading trading partner, the results indicate export underinvoicing with a total of $5.6 billion, representing 61 percent of total exports to this partner. The results for trade with Italy show

$2 billion of copper export underinvoicing compared to only $16 million of exports reported in Zambia's data. The respective values for trade with the Republic of Korea are $3.9 billion in export underinvoicing and $358 million of declared exports. It appears that a large fraction of the copper exports to these countries are not recorded in Zambia's official statistics. This raises the important question of why Zambia would record a transit destination rather than the final destination. The other question is why the actual destination of the products is not registered in Zambia's records, and if such a practice generates any gains to the buyer who is on the books in Zambia's records. Knowing the full information on the transactions at all the nodes of trade from Zambia to the final destination is essential for asserting whether Zambia is getting the fair share of the value of its copper exports.

There was a notable switch in destinations of copper exports in 2004. Up to that year, South Africa and the United Kingdom were the two most important trading partners. However, as illustrated in figure 3, from 2005 to 2006, their combined share of Zambia's total copper exports fell from 44.9 per cent to 8.7 per cent. Since then, China has taken over as the dominant trading partner, with its share rising from 9.4 per cent in 2003 to 55 per cent in 2006, and peaking at 63 per cent in 2011. Switzerland's share has also tapered off in the context of China's emergence.

Table 4. Zambia: Copper exports and misinvoicing (Millions of constant 2004 dollars) and partners' shares in copper exports (per cent), 1995–2014

| Partner	Copper exports and misinvoicing		Partners' share in Zambia's total copper exports
	Exports	**Export misinvoicing**	
China	9 225.9	5 644.5	16.4
Egypt	1 069.3	1 180.8	1.9
India	547.6	691.8	1.0
Italy	15.7	2 036.5	0.0
Japan	767.6	168.7	1.4
Rep. of Korea	357.6	3 923.5	0.6
Malaysia	516.2	73.0	0.9
Saudi Arabia	1 217.6	2 939.2	2.2
Singapore	538.6	-272.1	1.0
South Africa	3 061.9	-1 516.0	5.4
Switzerland	28 877.7		51.3
Thailand	1 338.0	839.6	2.4
United Arab Emirates	1 143.9	1 290.2	2.0
United Rep. of Tanzania	638.9	-585.0	1.1
United Kingdom	4 091.3	-4 360.4	7.3
Partners	53 407.8		94.8
World	56 335.3		100.0
Excluding Switzerland			
Partners	24 530.9	12 054.3	
World	27 458.4	14 469.8	

Source: Author's computation using UN Comtrade data.

Figure 2. Zambia: Copper export misinvoicing (Millions of constant 2014 dollars), 1995–2014
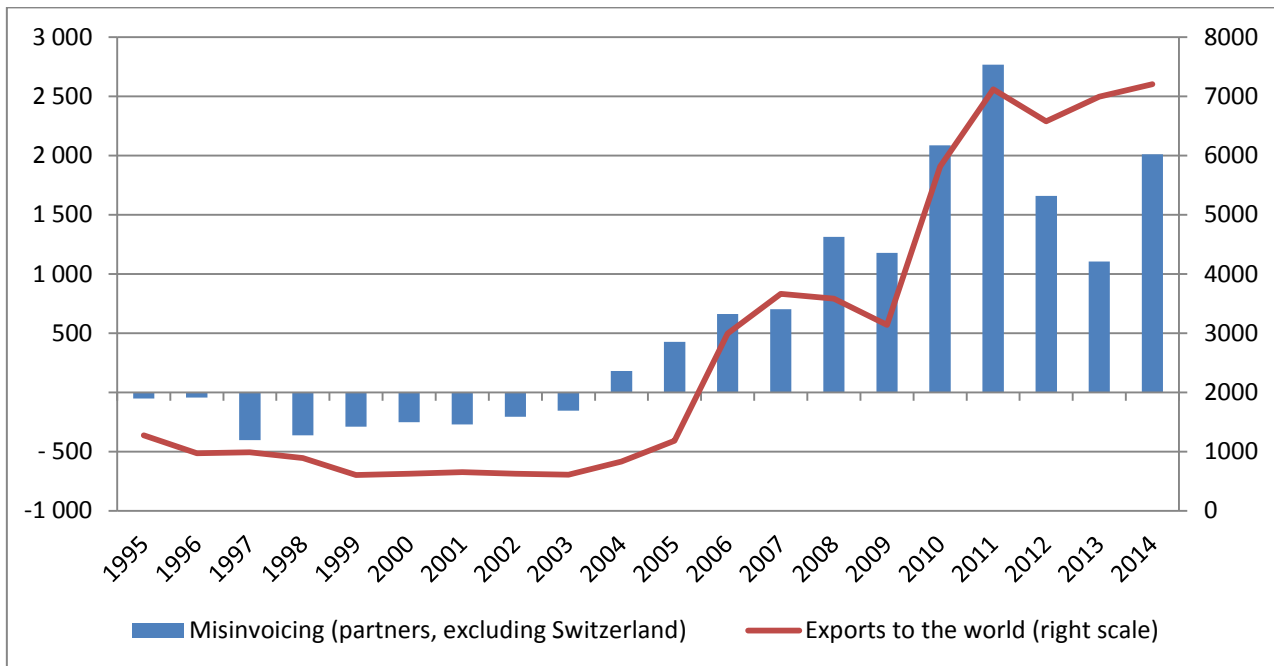
Source: Author's computation using UN Comtrade data.

Figure 3. Partners' shares in Zambia's total copper exports, 1995–2015 (Per cent)
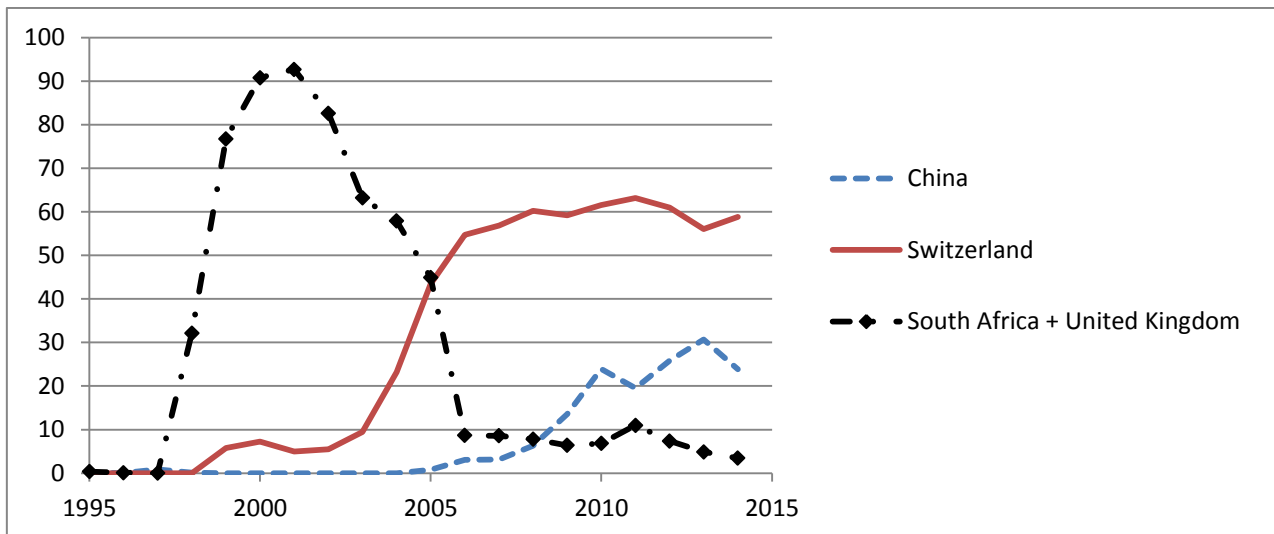
Source: Author's computation using UN Comtrade data.

5.3   *Nigeria: Oil export misinvoicing*

There are no data on imports and exports for Nigeria in the UN Comtrade database for the years 2004 and 2005. Therefore, the results for Nigeria are divided into two sub-periods, 1996–2003 and 2006–2014 (table 5 and figure 4).

The results from the analysis by trading partner show that trade with 5 out of the 17 major trading partners exhibits export underinvoicing, while with the others it shows export overinvoicing. The largest amount of underinvoicing is in trade with the United States ($69.7 billion) and Germany ($23.9 billion). Trade with Italy and the Netherlands exhibits very high levels of export overinvoicing, with a total of $25.1 billion and $20.5 billion respectively. This practice is also observed in Nigeria's trade with Brazil, Canada, France, Ghana, India, the Republic of Korea and South Africa. Excluding Italy and the Netherlands, total oil

export underinvoicing with Nigeria's major trading partners amounted to $51.9 billion over the 1996-2014 period.

The results for oil trade with Switzerland are striking and in sharp contrast with those of copper trade between Switzerland and Zambia. The results show that a substantial amount of oil exports to Switzerland is not recorded in Nigeria, or that the exported quantities or values are highly undervalued. In the case of Zambia, the situation was reversed: copper exports headed to Switzerland do not appear in Switzerland's trade data.

Figure 4. Nigeria: Oil exports and export misinvoicing, 1996–2014 (Millions of constant 2014 dollars)
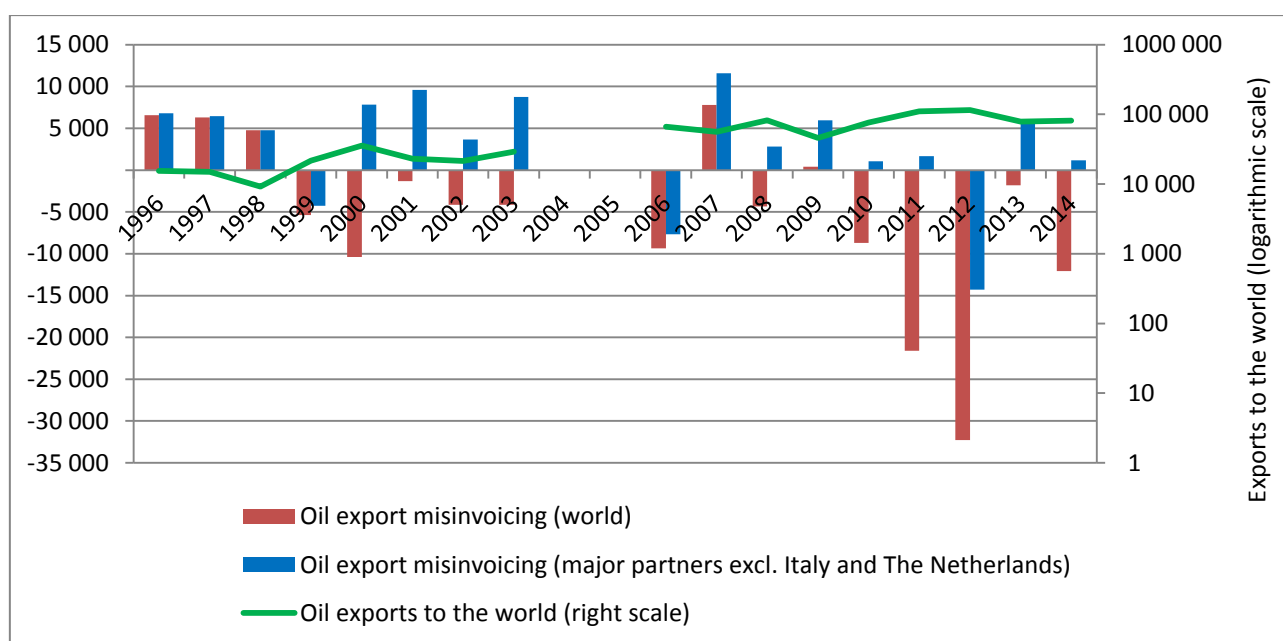
Source: Author's computation using UN Comtrade data.

Table 5. Nigeria: Oil export misinvoicing by trading partner (Millions of constant 2014 $) and partners' share in Nigeria's total oil exports (Per cent), 1996–2014

Partner	Oil export misinvoicing			Partner's share in Nigeria's total oil exports		
	1996–2003	2006–2014	1996–2014 (excl. 2004 and 2005)	1996–2004	2006–2014	1996–2014
Brazil	-398.9	-3 485.4	-3 884.3	4.6	8.3	6.6
Canada	-1 348.7	-6 994.1	-8 342.7	1.8	2.4	2.1
China	-16.0	-4 703.9	-4 719.9	0.5	1.3	0.9
Côte d'Ivoire	-550.9	-611.3	-1 162.1	3.2	2.6	2.9
France	-1 994.6	-10 719.9	-12 714.6	6.3	4.8	5.5
Germany	3 324.6	20 585.0	23 909.7	1.3	1.3	1.3
Ghana	-552.8	-5 248.6	-5 801.4	1.8	1.2	1.4
India	-10 286.1	1518.2	-8 767.9	9.2	11.9	10.6
Italy	-5 137.4	-19 985.0	-25 122.4	4.6	3.9	4.2
Rep. of Korea	-214.4	-2 429.1	-2 643.6	2.1	0.5	1.2
Netherlands	-2 425.0	-18 108.1	-20 533.0	2.9	5.3	4.2
Portugal	398.0	-1 191.5	-793.5	3.0	1.4	2.1
South Africa	-533.5	-3 588.1	-4 121.6	0.9	3.7	2.4

Partner	Oil export misinvoicing			Partner's share in Nigeria's total oil exports		
	1996–2003	2006–2014	1996–2014 (excl. 2004 and 2005)	1996–2004	2006–2014	1996–2014
Spain	982.4	-106.6	875.8	7.7	5.5	6.5
Switzerland	2 935.2	3 971.9	6 907.1	0.0	0.1	0.0
United Kingdom	483.3	2 899.4	3 382.7	0.2	2.3	1.3
United States	51 298.5	18 456.0	69 755.0	19.9	29.4	24.9
Partners	35 963.8	-29 740.0	6 223.4	69.9	85.7	78.3
World	-7 800.6	-81 902.0	-89 702.5	100	100	100
Without Italy and the Netherlands						
Major partners	43 526.2	8 352.6	51 878.8	62.4	76.6	69.9
World	-238.2	-43 808.9	-44 047.0	92.5	90.8	91.6

Source: Author's computation using UN Comtrade data.

5.4   Nigeria: Oil import misinvoicing

While Nigeria is a leading producer and exporter of oil, it also depends on oil imports due to its limited domestic refinery capacity. This study, therefore, also investigates the extent of oil import misinvoicing in Nigeria. The results are presented in table 6 and figure 5.

The results show systematic and substantial import underinvoicing in Nigeria. Cumulative oil import underinvoicing amounted to $45.6 billion over the 1996–2014 period. Underinvoicing was significantly higher during the 2006–2014 period compared with the 1996–2003 period. While the cumulative amount of unrecorded oil imports was $3.4 billion in the earlier period, it was $42.2 billion in the second period.

Analysis at the partner level also reveals noteworthy patterns over time and by different partners. The results set the Netherlands apart from other trading partners, in that its trade with Nigeria exhibited very large oil import underinvoicing of $24 billion over the period. Most of this misinvoicing occurred in the 2006–2014 period ($23.7 billion).

Table 7 summarizes the results for oil export and oil import misinvoicing vis-à-vis the leading partners. When comparing Nigeria's oil exports to, and imports from, the Netherlands, the peculiarity of oil trade with the Netherlands stands out even more. On the export side, it appears that the bulk of oil exported by Nigeria to the Netherlands is not recorded there. On the import side, most of oil exported by the Netherlands to Nigeria is not recorded at its stated destination either. Trade between the two countries has generated cumulative trade misinvoicing amounting to $44.6 billion over the 1996–2014 period. This deserves close scrutiny to investigate the factors behind these 'perverse' discrepancies so as to inform the country's strategy to stem the practice of trade misinvoicing.

The results in tables 5-7 also show substantial and simultaneous oil export underinvoicing and oil import overinvoicing in trade with Germany, Spain and Switzerland. Net export and import misinvoicing is positive in trade with Germany, Spain, Switzerland, the United Kingdom and the United States. In these cases, trade misinvoicing implies net capital outflows from Nigeria. In the case of trade with the United States, the cumulative unrecorded outflows amount to a staggering $66.8 billion. Germany and Switzerland follow with $24.1 billion and $7.3 billion, respectively. An investigation into the mechanisms and direction of oil export misinvoicing as a channel for capital flight should focus on these major outlets of oil exports from Nigeria. Underinvoicing of oil imports also deserves attention, as it is even more prevalent than oil export misinvoicing, occurring with 12 out of Nigeria's 17 major trading partners.

Table 6. Nigeria: Oil import misinvoicing (Millions of constant 2014 dollars) and partners' share in Nigeria's oil imports (Per cent), 1996–2014

Partner	Oil import misinvoicing			Partner's share in Nigeria's oil imports		
	1996–2003	2006–2014	1996–2014	1996–2003	2006–2014	1996–2014
Brazil	-500.9	-3 022.5	-3 523.4	1.8	0.8	1.3
Canada	-7.5	-32.8	-40.3	0.2	0.0	0.1
China	-82.5	185.8	103.3	0.6	3.1	1.9
Côte d'Ivoire	-555.0	-5 810.2	-6 365.2	3.9	1.7	2.7
France	-775.4	-4 069.2	-4 844.6	8.0	7.9	8.0
Germany	38.4	156.2	194.6	11.8	2.8	7.0
Ghana	-32.0	84.0	52.0	0.0	0.4	0.2
India	-45.9	-259.3	-305.2	0.1	3.5	1.9
Italy	-155.7	-424.9	-580.7	4.2	5.1	4.7
Netherlands	-454.0	-23 685.4	-24 139.4	6.9	6.5	6.7
Portugal	-36.1	-312.4	-348.5	1.0	0.6	0.8
Rep. of Korea	17.3	-166.4	-149.1	1.2	0.1	0.6
South Africa	-120.8	-373.6	-494.4	0.4	0.9	0.6
Spain	-523.1	978.4	455.2	6.8	2.7	4.7
Switzerland	52.4	304.3	356.7	3.6	4.2	3.9
United Kingdom	-193.3	-2 829.0	-3 022.3	10.2	4.2	7.0
United States	-96.9	-2 855.9	-2952.8	12.4	16.3	14.5
Partners	-3 471.1	-42 132.7	-45 603.9	83.3	54.6	55.5

Note: The average share excludes 2002. There is a large drop in the share in 2003 due to a large increase in imports (from $143.8 million in 2002 to $2.3 billion in 2003).
Source: Author's computation using UN Comtrade data.

Figure 5. Nigeria: Oil imports and import misinvoicing (Millions of constant 2014 dollars), 1996–2014
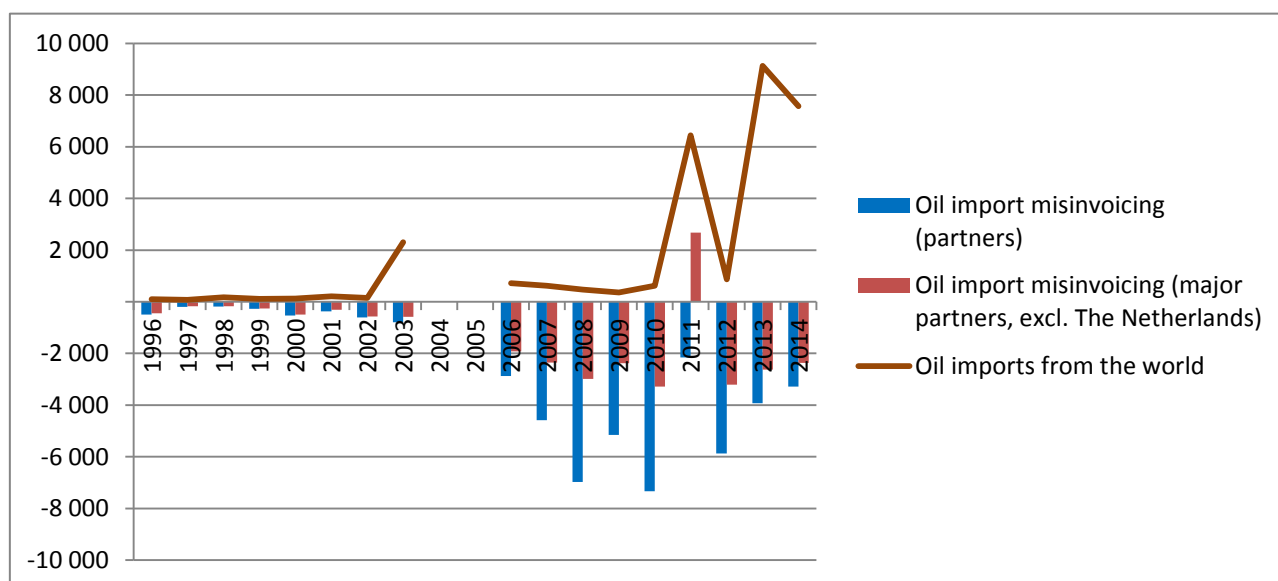
Source: Author's computation using UN Comtrade data.

Table 7. Nigeria: Net oil export and import misinvoicing, 1996-2014 (Millions of constant 2014 dollars)

Partner	Oil export misinvoicing plus oil import misinvoicing		
	1996–2003	2006–2014	Total 1996–2014
Brazil	-899.8	-6 507.9	-7 407.7
Canada	-1 356.2	-7 026.8	-8 383.0
China	-98.5	-4 518.1	-4 616.6
Côte d'Ivoire	-1 105.9	-6 421.4	-7 527.3
France	-2 770.0	-14 789.1	-17 559.1
Germany	3 363.0	20 741.3	24 104.3
Ghana	-584.8	-5 332.6	-5 749.4
India	-10 332.0	1 258.9	-9 073.1
Italy	-5 293.1	-20 409.9	-25 703.1
Netherlands	-2 879.0	-41 793.4	-44 672.4
Portugal	361.8	-1 503.9	-1 142.0
Rep. of Korea	-197.2	-2 595.5	-2 792.7
South Africa	-654.3	-3 961.7	-4 616.0
Spain	459.3	871.8	1 331.1
Switzerland	2 987.6	4 276.2	7 263.9
United Kingdom	290.0	70.4	360.4
United States	51 201.7	15 600.6	66 802.2
Total	32 524.7	-71 957.2	-39 432.5
Excluding The Netherlands	35 403.7	-30 163.7	5 239.9

Source: Author's computation using UN Comtrade data.

5.5   *Côte d'Ivoire: Cocoa export misinvoicing*

Cocoa exports by Côte d'Ivoire exhibit heavy geographical concentration, with the top two partners accounting for nearly 50 per cent of the country's total exports: the Netherlands with 31.3 per cent and the United States with 18.3 per cent.

The trade misinvoicing estimates (table 8 and figure 6) show systematic cocoa export underinvoicing, occurring in trade with 10 partners over the period 1995–2014. However, the aggregate results are heavily influenced by Germany and the Netherlands. Trade with the Netherlands generates a cumulative amount of $4.9 billion in export overinvoicing, or $248 million per year. Spain is the only other trading partner in the sample where trade with Côte d'Ivoire exhibits export overinvoicing, though the value is relatively small (an annual average of $2 million). If the Netherlands were excluded, the results would show overall export underinvoicing for the sample in every year, and the cumulative amount of export underinvoicing for the sample over the period 1995–2014 would more than double, amounting to $8.7 billion.

The results indicate that 29 per cent of cocoa exports from Côte d'Ivoire to the Netherlands are not recorded in the Netherlands' books. It would be worth investigating trade records in Côte d'Ivoire and the Netherlands to identify whether it is a problem of recording of destination of exports. It is possible that exports may be recorded as destined to an importer in the Netherlands who in fact does not reside there, in which case the shipment would not be registered in the Netherlands' trade statistics, as in the case of transit trade.

Trade with Germany exhibits the opposite pattern than trade with The Netherlands. The results suggest substantial export underinvoicing with the largest cumulative amount of $4.5 billion or $182.5 million per year. While Côte d'Ivoire's data show total exports of $3.6 billion, in Germany's books, imports of cocoa

from Côte d'Ivoire totalled $8.6 billion over the 20-year period. Once again the results raise the question of recording of the destination of cocoa exports in Côte d'Ivoire as well as recording of origin in Germany's data. Trade with France also exhibits a relatively large amount of cocoa export underinvoicing. The cumulative amount of $1.4 billion represents 28 per cent of Côte d'Ivoire's exports of cocoa to France over the period.

The United States is the second largest importer of cocoa from Côte d'Ivoire, but, contrary to the Netherlands, Germany and France, the results show relatively little evidence of export misinvoicing. Over the 20-year period, cocoa trade between the United States and Côte d'Ivoire generated $492 million of export underinvoicing, representing 4.8 per cent of total cocoa exports to the United States.

Table 8. Côte d'Ivoire: Cocoa exports and export misinvoicing (Millions of constant 2014 dollars) and Partners' share in Côte d'Ivoire's total exports (Per cent), 1995-2014

Partner	Cocoa exports	Cocoa export misinvoicing	Share in exports (Per cent)
Belgium	2 313.8	290.3	4.2
Canada	705.8	1 249.0	1.3
China	220.4	56.0	0.4
France	5 123.2	1 451.4	9.3
Germany	3 643.5	4 563.2	6.6
Italy	1 712.7	237.2	3.1
Malaysia	1 053.4	12.5	1.9
Netherlands	17 198.9	-4 971.9	31.3
Spain	1 608.3	-42.6	2.9
Switzerland	17.3	234.8	0.0
United States	10 088.5	492.3	18.3
United Kingdom	1 637.2	198.1	3.0
Total	45 323.1	3 770.4	82.4

Source: Author's computation using UN Comtrade data.

Figure 6. Côte d'Ivoire: Cocoa exports and export misinvoicing, 1995–2014 (Millions of constant 2014 dollars)
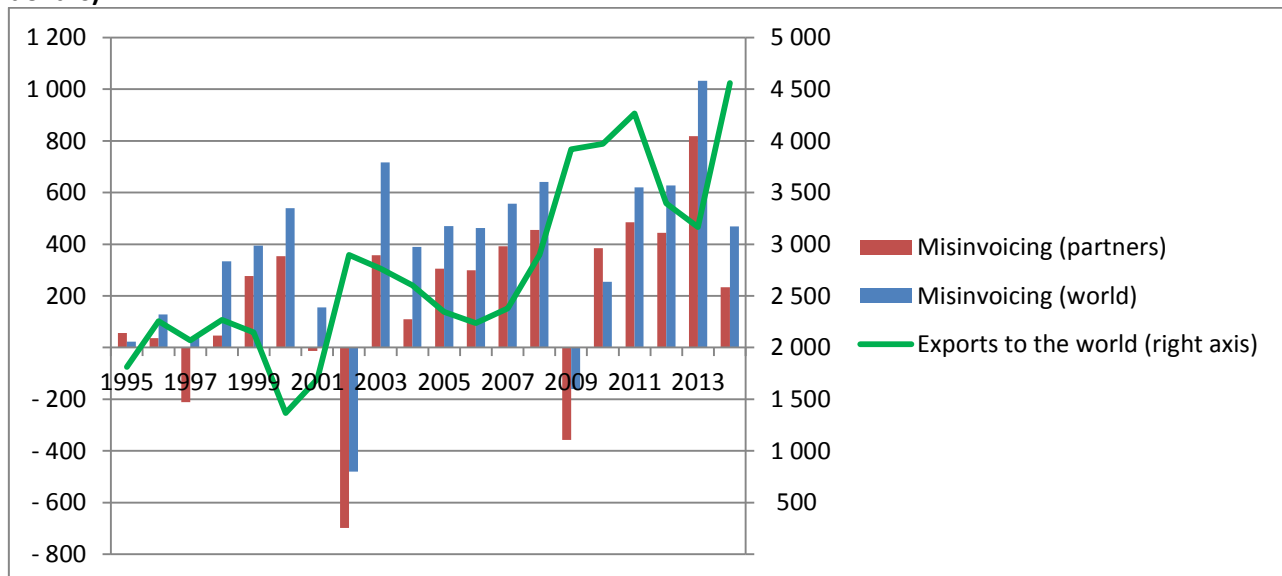
Source: Author's computation using UN Comtrade data.

5.6   South Africa: Silver and platinum export misinvoicing

The results for South Africa vary substantially by commodity. The estimations of trade misinvoicing for the silver and platinum group are reported in table 9 and figure 7. Exports of silver and platinum have increased substantially since 2005 (figure 7). The average annual exports of silver and platinum were three times higher over the period 2006–2014 than during the period 2000–2005: $9.2 billion compared with $3.4 billion using South African data; and $11.5 billion compared with $5.7 billion using partner data.

Analysis at the trading partner level reveals heavy concentration of exports. Using partner data, Japan and the United States account for 54.2 per cent of South Africa's total silver and platinum exports; adding China (11.5 per cent) yields 65.7 per cent of total exports of these products.

The estimation results show systematic export underinvoicing throughout the period. However, the amounts of export misinvoicing are relatively small, representing generally less than 10 per cent of total exports. Two years stand out as peculiar exceptions: in 2000 and 2002, underinvoicing of silver and platinum exports to South Africa's top nine trading partners amounted to 97 per cent and 98 per cent of total exports respectively. Another year that recorded substantial export underinvoicing was 2014, at 17 per cent of total exports. Except for these three years, export misinvoicing was low compared with total exports.

Trade with these three dominant trading partners accounts for the lion's share of silver and platinum export misinvoicing. Trade with China generates particularly high export underinvoicing, amounting to $13.9 billion, and with the United States, it amounts to $6.8 billion. There is also evidence of overinvoicing in exports to Hong Kong (SAR China) ($1.8 billion), to Switzerland ($6.3 billion) and to the United Kingdom ($4.8 billion). With respect to its nine major trading partners, South Africa saw a cumulative amount of export underinvoicing of $19 billion over the 15-year period starting in 2000. This represents 97 per cent of total export misinvoicing vis-à-vis the world ($24 billion), and 13.8 per cent of the country's cumulative exports of silver and platinum to the world over the same period.

Table 9. South Africa: Silver and platinum exports and export misinvoicing (Millions of constant 2014 dollars) and partners' share in South Africa's total exports (Per cent), 2000-2014

Economy	Silver and platinum exports and export misinvoicing			Partner's share in South Africa's total silver and platinum exports	
	Exports (South African data)	Exports (Partner's data)	Export misinvoicing	Exports (South African data)	Exports (Partner's data)
China	1 889.3	15 934.1	13 855.8	1.8	11.5
Germany	8 080.9	10 745.1	1 855.9	7.8	7.8
Hong Kong (China)	3 677.3	2 265.4	-1 779.6	3.5	1.6
Italy	536.8	3 642.9	3 052.5	0.5	2.6
Japan	35 118.8	41 949.6	3 318.9	33.9	30.4
Rep. of Korea	1 774.6	5 061.9	3 109.9	1.7	3.7
Switzerland	15 742.4	10 994.2	-6 322.5	15.2	8.0
United Kingdom	12 399.3	8 778.3	-4 860.9	12.0	6.4
United States	23 705.5	32 914.5	6 838.4	22.9	23.8
Partners	102 925.0	132 286.1	19 068.5	99.2	95.8
World	103 738.0	138 122.2	24 010.4	100.0	100.0

Source: Author's computation using UN Comtrade data.

Figure 7. South Africa: Silver and platinum exports and export misinvoicing (Millions of constant 2014 dollars), 2000–2014
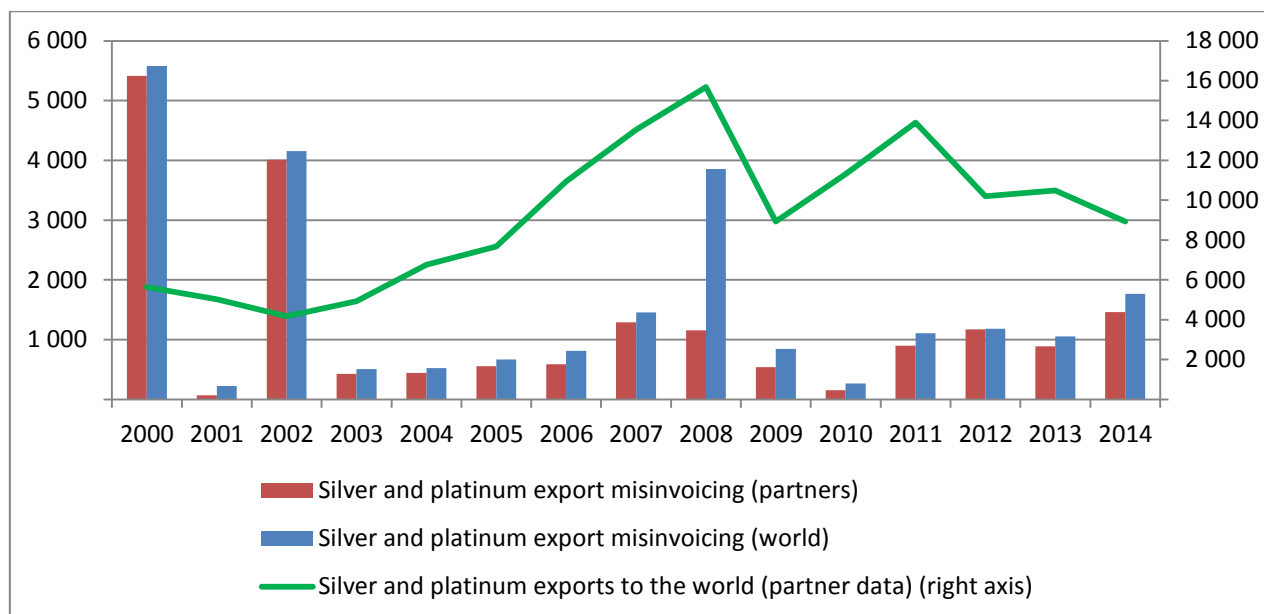
Source: Author's computation using UN Comtrade data.

5.7   *South Africa: Iron ore export misinvoicing*

Iron ore exports from South Africa exhibit the most extreme geographical concentration among the countries and products investigated in this study. China accounts for 61.7 per cent of total iron ore exports, followed by Japan with 13 per cent (table 10).

South Africa's iron ore exports, which rose steadily and rapidly until 2010, were accompanied by an equally rapid increase in export underinvoicing (table 10 and figure 8). But there was a drastic change in the pattern after 2010, from systematic export underinvoicing to systematic export overinvoicing. With respect to South Africa's seven leading export destinations, there was a cumulative amount of export underinvoicing of $5.6 billion over the period 2000–2010, or $512 million per annum. In contrast, over the period 2011–2014, the country recorded $1.3 billion in iron ore export overinvoicing or $338 million per annum. This pattern was driven primarily by trade with the Netherlands and Japan which exhibited substantial export overinvoicing during the period 2011–2014. If these two countries are excluded, export overinvoicing was recorded only in 2010, to the tune of $68.8 million.

Except for the Netherlands, there was net export underinvoicing in trade with all the other major trading partners. Along with the Netherlands, the top two trading partners, China and Japan, accounted for the bulk of export misinvoicing: export underinvoicing for China ($3 billion) and Japan ($1 billion), and export overinvoicing for the Netherlands ($1.4 billion).

Once again, trade with the Netherlands is distinct from the other trading partners as it exhibits substantial export overinvoicing. The results indicate that a large proportion of iron ore exports from South Africa to the Netherlands, as reported by South Africa, does not appear in the Netherlands' data. The large and abnormal discrepancies with these leading trading partners deserve detailed investigation.

Table 10. South Africa: Iron ore exports and export misinvoicing (Millions of constant 2014 dollars) and Partners' share in South Africa's total exports (Per cent), 2000-2014

	Iron ore exports (by volume) and misinvoicing			Partner's share in SA's total iron ore exports	
	Exports (SA data)	**Exports (Partner data)**	**Export misinvoicing**	**Exports (SA data)**	**Exports (Partner data)**
China	31 922.0	38 146.0	3 031.9	61.7	66.3
Germany	2 645.5	3 197.1	287.0	5.1	5.6
Italy	1 015.6	1 171.4	54.2	2.0	2.0
Japan	6 712.3	8 402.1	1 018.6	13.0	14.6
Netherlands	1 658.8	452.2	-1 372.5	3.2	0.8
Rep. of Korea	1 900.0	3 049.7	959.7	3.7	5.3
United Kingdom	1 496.5	1 948.0	301.8	2.9	3.4
Partners	47 350.7	56 366.5	4 280.7	91.5	98.0
World	51 733.0	57 527.1	620.8	100.0	100.0

Figure 8. South Africa: Iron ore exports and export misinvoicing (Millions of constant 2014 dollars), 2000−2014
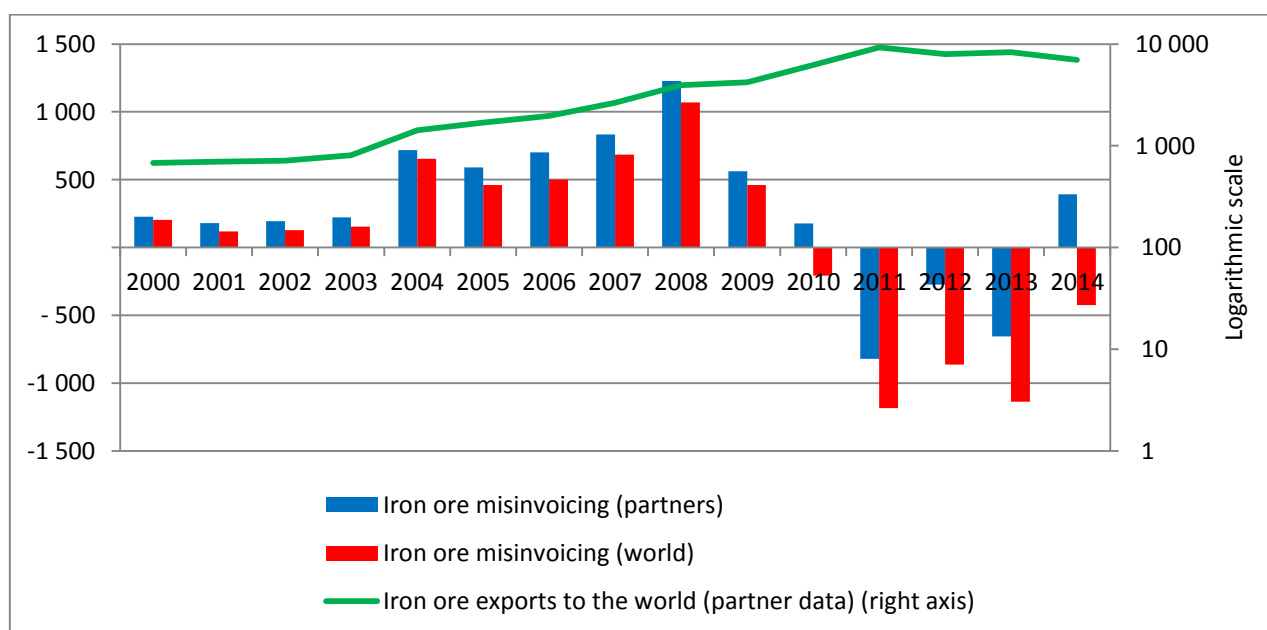
Source: Author's computation using UN Comtrade data.

5.8   The case of gold export from South Africa

The analysis of the data on gold exports in Comtrade revealed large discrepancies between the values reported in South Africa's data and those in the country's trading partners' data. To ensure that the results are not driven by any errors in recording data from government official statistics into Comtrade, the analysis also explores the statistics compiled by the Department of Trade and Industry (DTI), which are publicly available online.[7] The comparison is based on the Harmonized Commodity Description and Coding system (HS),[8] which is used to report trade data in DTI database. Exports are reported in DTI database in nominal Rand. For comparison with Comtrade series, the DTI series are converted into dollars using the

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[7] The DTI data are available at: http://tradestats.thedti.gov.za/ReportFolders/reportFolders.aspx.
[8] Non-monetary gold in the HS system is reported under codes H710800-710813; H7109; H711230; H711291. Monetary gold is reported in H710820.

average annual exchange rate between the Rand and the US dollar, and into real values (constant 2014 dollars) using the US GDP deflator.[9]

Like iron ore, silver and platinum, non-monetary gold exports from South Africa also exhibit substantial geographical concentration. The country's top four trading partners, together, account for 77 per cent of South Africa's total non-monetary gold exports. According to data recorded by South Africa's trading partners, India is the leading destination, accounting for 34.5 per cent of total non-monetary gold exports, followed by Hong Kong (China) (17.3 per cent), Italy (13.3 per cent) and the United Kingdom (12 per cent) (Table 11).

While Government statistics distinguish between monetary gold and non-monetary gold, this distinction ends in 2011; thereafter all gold exports appear under the category of non-monetary gold (Table 12). For this reason, the analysis will distinguish between the 2000-2010 period from the 2011-2014 period for comparability.

At the aggregate level, the values of gold exports under the heading of "non-monetary gold" as reported in Comtrade by South Africa are very close to those reported in South African customs data (by DTI) until 2008 (Table 12). However, the data shows large discrepancies between the amounts of non-monetary gold exports recorded by South Africa in DTI database and in Comtrade compared to the values reported by its trading partners. Over the period 2000-2010, South Africa's data show $2.8 billion of exports under the heading of 'non-monetary gold' in DTI and $2.3 billion in Comtrade, while its trading partners report $59.7 billion of non-monetary gold imports from South Africa.

If we apply the same methodology to estimate export misinvoicing for non-monetary gold, this would yield large amounts of excessive 'normal' discrepancies, which is *prima facie* indication of export underinvoicing (Figure 9). The results over 2000-2010 period would be comparable whether the estimation is based on South African trade data as reported by the DTI ($56.6 billion) or South Africa's export data as reported in Comtrade ($57.1 billion). The comparison is not possible over the 2011-2014 period due to the merging of monetary gold exports and non-monetary gold exports as shown in the DTI database in Table 12.

Given these peculiarities, the question is what part of the observed 'excessive normal' and 'perverse' discrepancies is due to errors in product classification or in recording of destination and what part reflects misinvoicing of gold exports. The analysis calls for improvements in trade data reporting, especially with regard to consistency of classification of the type of gold (monetary vs. non-monetary gold) and information on destination of gold exports. The merging of monetary and non-monetary gold exports in DTI appears to be a step backwards in terms of consistency and transparency of gold export trade data.

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[9] The rand/dollar exchange rate and US inflation index obtained from the IMF International Financial Statistics (IFS).

Figure 9. South Africa: Non-monetary gold exports and export misinvoicing (Millions of constant 2014 dollars), 2000–2010
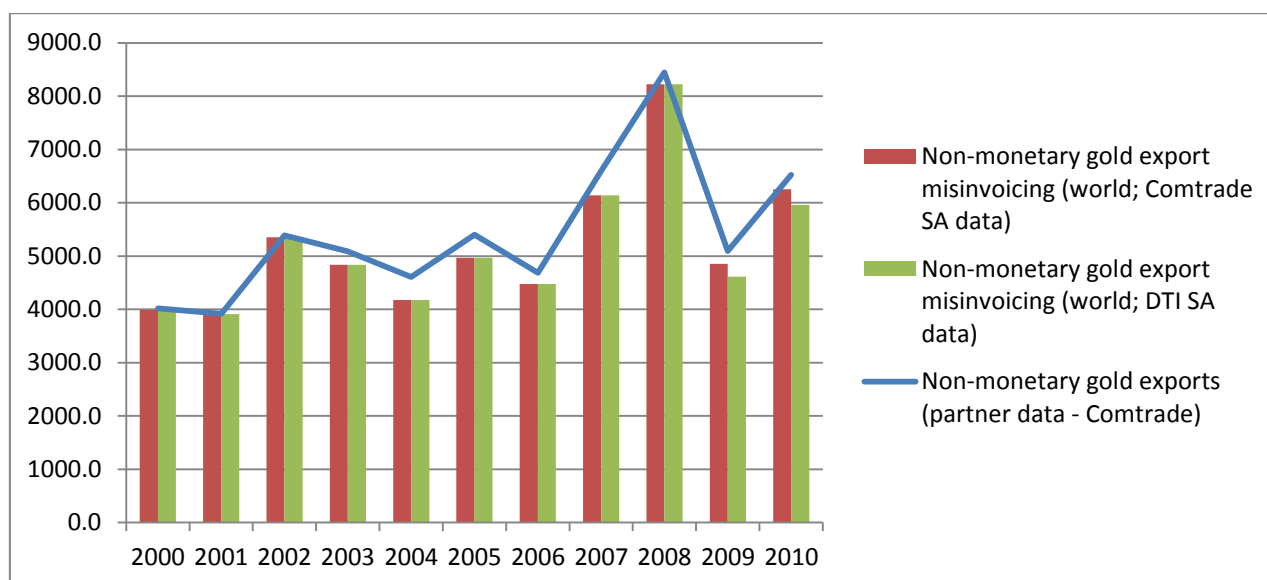
Source: Author's computation using UN Comtrade data and South African Government data (DTI), covering products under HS codes H710800-710813; H7109; H711230; H711291.
Note: The misinvoicing series based on DTI data ends in 2011 due to the merging of monetary gold exports and non-monetary gold exports.

Table 11. South Africa: Non-monetary gold exports by partner (Millions of constant 2014 dollars and per cent share), 2000-2014

Country	Value (Millions of constant 2014 dollars)		Partner's shares (per cent)	
	South African data (DTI)	Partner data (COMTRADE)	South African data (DTI)	Partner data (COMTRADE)
Australia	0.1	102.8	0.0	0.1
Belgium	49.9	109.8	0.1	0.1
Germany	622.9	1 228.6	1.0	1.1
Hong Kong (China)	2 617.4	20 150.3	4.2	17.3
India	214.0	40 253.0	0.3	34.5
Italy	22.7	15 539.8	0.0	13.3
Saudi Arabia	0.0	1 969.6	0.0	1.7
Switzerland	386.5	2 935.9	0.6	2.5
Thailand	0.0	4 748.7	0.0	4.1
Turkey	42.9	10 033.0	0.1	8.6
United Arab Emirates	37.5	2 918.0	0.0	2.5
United Kingdom	369.0	14 004.4	0.1	12.0
USA	17.8	584.3	0.6	0.5
Total 13 partners	4 380.6	114 578.4	7.0	98.2

Source: Author's computation using UN Comtrade data and South African Government data (DTI), covering products under HS codes H710800-710813; H7109; H711230; H711291.

Table 12. South Africa's gold exports by type and destination (Million, constant 2014 dollars)

Year	COMTRADE data		South African Government data (DTI)			
	Non-monetary gold exports (partner data)	Non-monetary exports (South Africa data)	Non-monetary gold exports	Monetary gold exports	Unallocated non-monetary gold exports	Unallocated monetary gold exports
2000	4 018.1	27.9	30.3	5 195.2	0	5 194.1
2001	3 915.0	5.8	6.1	4 659.2	0	4 659.0
2002	5 386.6	31.9	31.7	5 134.3	0	5 134.3
2003	5 090.1	232.5	231.1	5 759.8	0	5 759.0
2004	4 607.0	393.7	391.0	6 477.0	0	6 475.0
2005	5 402.0	392.5	392.9	5 186.7	0	5 185.3
2006	4 684.0	190.7	191.9	6 005.3	0	6 005.3
2007	6 598.6	417.9	416.9	6 295.7	0	6 295.6
2008	8 443.6	202.5	200.4	6 435.9	0	6 431.8
2009	5 091.1	217.7	432.7	13 563.2	0	13 563.2
2010	6 524.9	246.7	515.0	17 873.9	0	17 873.9
2011	12 867.5	11 187.7	18 759.4	3 547.1	18 204.9	3 547.1
2012	14 254.1	9 166.4	23 791.8	0.0	23 221.1	0.0
2013	16 648.9	6 925.1	11 033.5	0.0	10 717.5	0.0
2014	13 122.7	4 865.9	5 912.3	0.0	5 773.2	0.0
Total						
2000-2010	59 761.1	2 359.7	2 840.0	82 586.1	0.0	82 576.4
2011-2014	56 893.1	32 145.1	59 496.9	3 547.1	57 916.7	3 547.1

Sources: Author's computation using UN Comtrade data and South African Government data (DTI), covering products under HS codes H710800-710813, H7109, H711230, and H711291 for non-monetary gold and H710820 for monetary gold.

6. Conclusion and policy recommendations

The objective of this study was to investigate and quantify the extent of trade misinvoicing in primary commodities in a sample of five resource-rich developing countries. The analysis of the data confirms the widely known dominance of primary commodities in these countries' exports. But it also highlights another important dimension of concentration, namely that a few trading partners account for a large share of total exports for each of the sample countries studied. The results suggest substantial export misinvoicing – both underinvoicing and overinvoicing – in all the five countries, with a clear preponderance of export underinvoicing, except for copper exports from Chile. Hence, export misinvoicing could be an important channel of capital flight from these countries. The case of Nigeria exhibits misinvoicing of both oil exports and imports. The results for oil imports show underinvoicing, suggesting undervaluation of oil imports or smuggling of oil into the country.

A number of key results emerge at the product level. The first is the puzzling case of gold exports from South Africa, which exhibits large discrepancies between the country's reported exports and its leading trading partners' imports. Moreover, while South African records distinguish between non-monetary gold and monetary gold, the two are combined under the heading of non-monetary gold from 2011 onward. Given that the destination of monetary gold exports is not indicated – recorded under "unallocated" –, the merging of the two series obscures the analysis of gold export misinvoicing.

Second, similar products show different misinvoicing patterns across exporting countries, even with the same partners. In the case of Chile, there is systematic and massive export overinvoicing of copper, while the results for Zambia show substantial underinvoicing of copper exports. It would be worth investigating the sources of these differences, in particular, whether these disparities arise from differences in trade regulation regimes, tax regimes, capital control regimes, or statistical recording problems.

Puzzling results also emerge at the trading partner level. Trade with the Netherlands is peculiar, where a substantial part of primary commodity exports recorded at the origin as destined to the Netherlands do not appear in the Netherlands's trade data. This is also the case for copper exports from Chile and Zambia to Switzerland. The results call for improvements in consistency and transparency in the recording of trade statistics at both ends of the transactions.

The results show that, typically, the leading partners in terms of share in total exports also account for the bulk of trade misinvoicing. There is a strong correlation between concentration of trade and concentration of trade misinvoicing suggesting that trade misinvoicing is a systemic problem in these countries.

The analysis in this study provides strong reasons for investigating the sources of the large 'perverse' and 'excessive normal' discrepancies which could be interpreted as *prima facie* indication of trade misinvoicing in primary commodities. In some cases, it appears that products end up in destinations other than the ones listed in official records, as in the case of Netherlands and Switzerland which are major trading hubs. The lack of consistent information makes it impossible to assess whether exporting countries are receiving their legitimate share of gains from commodity trade in terms of foreign exchange and fiscal receipts. Export overinvoicing could also be motivated by the attempt by exporters to take advantage of tax incentives established by governments to promote export-oriented activities. Evasion of customs duties and other import charges could be a motive for import underinvoicing, as in the case of oil in Nigeria, where a large share of oil entering the country is unrecorded. These conjectures deserve to be investigated at country and product levels.

Circumventing foreign exchange and capital account controls is a classic motive for trade misinvoicing. The fact that trade misinvoicing remains pervasive in an era of *de jure* capital account openness and liberalization of currency markets raises the question of effectiveness of these reforms in terms of speeding up international movements of goods and finance.

The results from this study have important implications for research and policy. First, the fact that exports of primary commodities are concentrated by product and market could be a blessing in disguise. Export concentration implies that policy efforts could focus on a limited number of products and partners to increase the effectiveness of reforms. In each country, the government and its development partners should be able to identify which products and export destinations need to be scrutinized in the investigation of trade misinvoicing.

Second, the results demonstrate a need for improving the quality and consistency of trade statistics. In particular, improvements are urgently needed in data gathering at the product and partner levels, notably to ensure clarity and consistency in the classification of products over time and across partners, and appropriate recording of the origin and destination of exports. There is a need to strengthen coordination between national statistics and international statistical databases such as UN Comtrade and the IMF's Direction of Trade Statistics. This will require scaling up both financial and technical assistance to developing countries to help improve human capacity as well as the technological infrastructure for the compilation and management of trade statistics.

Third, the results highlight the need for an investigation at the company and transaction levels to assess the magnitudes and identify the mechanisms of export and import misinvoicing. Enhanced transparency in global trade is indispensable, especially through coordinated enforcement of the rules on country-by-country reporting by TNCs at the global level.

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8. Annex

Table A1. **Cumulative export misinvoicing by exporter and trading partner (Millions of constant 2014 dollars)**

Country	Chile: copper [SITC 682]	Cote d'Ivoire: cocoa	Nigeria: oil	South Africa: iron ore	South Africa: silver and platinum	Zambia: copper [SITC 682]	Comments: systematic pattern (if any)
Belgium	-3 151.3	290.3					
Canada	-1 000.5	1 249.0	-4 719.9				
China	-791.0	56.0		3 031.9	13 855.8	5 644.5	Underinvoicing except with copper from Chile
France	147.7	1 451.4	-12 714.6				
Germany	9 403.8	4 563.2	23 909.7	287.0	1 856.0		Underinvoicing
Hong Kong (China)					-1 779.6		
Italy	-2 272.2	237.2	-25 122.4	54.2	3 052.5		
Japan	-5 935.7			1 018.6	3 318.9	168.7	Underinvoicing except with copper from Chile
Rep. of Korea	-2 098.6		-2 643.6	959.7	3 109.9	3 923.5	
Netherlands	-16 085.4	-4 971.9	-20 533.0	-1 372.5			Overinvoicing
Switzerland	-874.7	234.8	6 907.1		-6 322.5		
United Kingdom	-5 502.3	198.1	3 382.7	301.8	-4 860.9	-4 360.4	
United States	-6 992.1	492.3	69 755.0		6 838.4		Underinvoicing except with copper from Chile
Comments: systematic pattern (if any)	Overinvoicing except with France and Germany	Underinvoicing except with the Netherlands	Both overinvoicing and underinvoicing	Underinvoicing predominant		Underinvoicing predominant	

Source: Author's computation (drawn from Tables 3-10)