GLOBAL FINANCIAL INTEGRITY

South Africa: Potential Revenue Losses Associated with Trade Misinvoicing

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Global Financial Integrity wishes to thank the Ford Foundation for their generous support of this project.

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We are pleased to present here our analysis, **South Africa: Potential Revenue Losses Associated with Trade Misinvoicing**.

Trade misinvoicing is a reality impacting South Africa and every other country of the world. Imports coming into a country can be over-invoiced in order to shift money abroad. Or imports can be under-invoiced in order to evade or avoid customs duties or VAT taxes. Similarly, exports going out of a country can be under-invoiced in order to shift money abroad. And exports are occasionally over-invoiced, for example in order to reclaim VAT taxes.

For much of the 20th century, diamonds went out of South Africa with no export data reported. Nothing appeared in government statistics concerning the value or weight of stones mined locally and shipped overseas. In 1997 I went to the South African Reserve Bank seeking historical statistics on diamond exports and was told that this was, beginning in the early 1900s, a state secret. A second request two years later produced the same answer.

Global Financial Integrity finds that trade misinvoicing is the most frequently utilized mechanism facilitating measurable illicit financial flows. Misstating import and export values has become normalized in much of commercial trade, and the same facilitating shadow financial system is used to move money of criminal and corrupt origin. We are dealing with a systemic problem that merits our most serious concerted attention.

Trade misinvoicing generates two sets of losses to emerging market and developing countries. One is losses of revenues available to governments that would otherwise be received through customs duties, VAT taxes, income taxes, royalties, and other measures. The second is losses to the rest of the economic structure through transfers of income and wealth out of domestic earnings, usually into wealthier countries abroad. Had such money remained in the domestic economy it would be used for investment, consumption, or savings. Transferred out, much of it is permanently removed from domestic activity. African nations have been particularly impacted by this global phenomenon.

In this analysis we seek to provide an approximate measure of revenues lost to the South African government due to trade misinvoicing. For the period from 2010 to 2014, we can reasonably identify losses in excess of US$7.4 billion annually, totaling US$37 billion over the five years. This is a most conservative figure, as it does not encompass many aspects of trade misinvoicing and illicit financial flows that do not show up in official statistics.

Furthermore, we take one aspect of this problem—import under-invoicing—and subject it to detailed analysis utilizing South African Revenue Service trade data. We find that imported machinery, apparel, and vehicles are particularly prone to under-invoicing.

All researchers on this issue of trade misinvoicing are constantly seeking better data and better analytical methodologies. Even as we work toward these goals, what is most important is to appreciate the order of magnitude of the problem and the potential for development revenues if the problem is curtailed.

Recognizing the shortcomings in data, Global Financial Integrity has developed **GFTrade**, a database of current world market prices of 80,000 categories of goods in the Harmonized System, as traded by 30 of the largest global economies. This enables emerging market and developing country customs and revenue authorities to assess instantly the risk that trade misinvoicing may be a reality in transactions as they are coming in or going out. **GFTrade** is in use in Africa now.

Global Financial Integrity thanks the Ford Foundation for its support of these efforts.

Raymond Baker
November 2018

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Executive Summary

This report analyzes South Africa's bilateral trade statistics for 2010–2014 (the most recent years for which sufficient data are available) which are published by the United Nations (Comtrade). The detailed breakdown of bilateral South African trade flows allowed for the computation of trade value gaps that are the basis for trade misinvoicing estimates. Import gaps represent the difference between the value of goods South Africa reports having imported from its partner countries and the corresponding export reports by South Africa's trade partners. Export gaps represent the difference in value between what South Africa reports as having exported and what its partners report as imported.

Analysis of trade misinvoicing in South Africa from 2010—2014 shows that the potential loss of revenue to the government is $7.4 billion annually or, a total of $37 billion during the period. The average portion of revenue lost due to import misinvoicing each year is $4.8 billion. This amount can be further divided into its component parts: uncollected VAT tax ($2.1 billion), customs duties ($596 million), and corporate income tax ($2.1 billion). Lost revenue due to misinvoiced exports was $2.6 billion on average each year which is related to lower than expected corporate income and royalties.

The study also examined trade data from the South African Revenue Service in order to conduct an in-depth examination of import under-invoicing. This process analyzed approximately 7.4 million trade transactions which included more than 8,200 commodity types for the period 2010—2015. A key conclusion is that goods categories with a preponderance of under-invoicing tend to be associated with higher effective tax rates than other classes of imports. The data show that the top five categories for potential revenue loss related to import under-invoicing are machinery, knitted apparel, electrical machinery, non-knitted apparel, and vehicles. Three of these commodities (machinery, electrical machinery, and vehicles) are among the most commonly imported goods into South Africa.

Trade misinvoicing occurs in four ways: under-invoicing of imports or exports, and over-invoicing of imports or exports. In the case of import under-invoicing fewer VAT taxes and customs duties are collected due to the lower valuation of goods. When import over-invoicing occurs (i.e. when companies pay more than would normally be expected for a product), corporate revenues are lower and therefore less income tax is paid. In export under-invoicing the exporting company collects less revenue than would be anticipated and therefore reports lower income. Thus, it pays less income tax. Corporate royalties are also lower.

Total misinvoicing gaps related to imports can be broken down by under-invoicing ($16.3 billion) and over-invoicing ($9.8 billion). It should be noted that these figures represent the estimated value of the gap between what was reported by South Africa and its trading partners. The loss in government revenue is a subset of these amounts and is based on VAT tax rates (12.9 percent),

customs duties (3.7 percent), corporate income taxes (21.7 percent), and royalties (1 percent) which are then applied to the value gap. Export misinvoicing gaps were $11.6 billion for export under-invoicing and $8.6 billion for export over-invoicing. Lost corporate income taxes and royalties are then applied to export under-invoicing amounts to calculate lost government revenue.

The practice of trade misinvoicing has become normalized in many categories of international trade. It is a major contributor to poverty, inequality, and insecurity in emerging market and developing economies. The social cost attendant to trade misinvoicing undermines sustainable growth in living standards and exacerbates inequities and social divisions, issues which are critical in South Africa today.

I. An Examination of Revenue Losses

Import over-invoicing is done for the purpose of shifting money abroad. Instead of paying US$100 per unit for an import, you can arrange for the invoice to read US$120 per unit and upon payment put the extra US$20 into a foreign bank account.

Import under-invoicing can be done for the purpose of evading or avoiding the payment of customs duties and VAT taxes. Instead of paying US$100 per unit, you can arrange for the invoice to read US$50 a unit and save on the duties and VAT that would have been payable at the higher price. Upon paying the invoice at US$50, you still owe the remaining US$50 and therefore must have a separate means of shifting money abroad to complete the transaction. In other words, import under-invoicing is always done with an additional mechanism for shifting money out of the country to meet the balance due.

Exports can be handled in the same way. Under-invoicing shifts money into foreign holdings. This practice has plagued resource exports from Africa for centuries. The High Level Panel on Illicit Financial Flows from Africa found that illicit financial flows are most evident in Africa's resource exporting countries. New data sources are available to shed light on this reality.

What would be the explanation for over-invoicing an export, indicating that a higher than world market price is payable to the exporter on the transaction? Customs duty and VAT tax drawback is one reason. In some countries and industries, exports are encouraged by offering rebates on the duty and VAT components within the costs of imported materials used in local production. This provides an incentive for over-invoicing of exports, enabling the over-invoiced amount of the transaction to generate an excessive refund to the exporter at the government's expense.

In analyzing the trade misinvoicing phenomenon and the potential for revenue losses to the Government of South Africa, Global Financial Integrity (GFI) has utilized data provided by UN Comtrade and the South African Revenue Service (SARS). In these data sets we look for gaps in export and import statistics, suggestive of misinvoicing. In this part of our analysis we take the gaps as they appear, without judging whether all are indicative of intentional trade misinvoicing. We do this because we regard the data as extremely conservative due to the many categories of trade that are not covered in such data, as will be explained further below.

In addition, tariff data has been provided by World Integrated Trade Solution (WITS). Tax data has been derived from the report *Paying Taxes 2017*, an annual analysis by the accounting firm PwC and the World Bank Group. Effective royalty rates are derived from SARS data.

The following table summarizes our findings, in average annual figures across the five-year period from 2010 to 2014.

Table 1. Trade Misinvoicing and Potential Revenue Losses in South Africa
(millions of U.S. dollars, average 2010-2014)

	USD, Millions
Average Import Value Analyzed	**92,052**
Import Under-Invoicing	16,308
Average VAT %, lost revenue	2,110
Average customs duty %, lost revenue	596
Import Over-Invoicing	9,833
Average company income tax %, lost revenue	2,134
Average Export Value Analyzed	**88,145**
Export Under-Invoicing	11,598
Average company income tax %, lost revenue	2,517
Average royalties, lost revenue	116
Export Over-Invoicing	8,584
Potential Revenue Losses	7,473

Notes: Only gaps with advanced economies (excluding Hong Kong) are considered.
Due to irregularities, gaps for commodity codes falling under HS 2-digit headers 77, 98, 99, and portions of 71 are excluded.
"." indicates unavailable data

Sources: UN Comtrade: Trade data.
WITS: Tariff data.
SARS: VAT rate and exemptions/zero-rated goods, royalty collections by commodity for calculating effective rate (inclusive of 5% unpolished diamond export tariff).
PWC/World Bank 'Paying Taxes' 2017: profit tax rate.

Imports averaged US$92 billion annually across the period. Exports averaged US$88 billion annually across the period.

Import under-invoicing and over-invoicing are indicating at US$16 billion and US$10 billion respectively.

Export under-invoicing and over-invoicing are somewhat smaller by comparison, at just over US$11 billion and US$8 billion respectively.

To these figures, we apply the following:

- VAT taxes at 12.9 percent on average for the sample analyzed. This is slightly lower than the flat rate of 14 percent due to exemptions on some categories of imports.
- Customs duties, at an average of 3.7 percent.
- Company income taxes at an average of 21.7 percent, drawn from the PWC/World Bank Group report.
- Royalties applied at effective rates at the commodity level at an average of 1.0 percent, arising from available sources but perhaps too conservative.

Applying these figures to the levels of indicated over- and under-invoicing produces an estimate of US$7.4 billion lost annually to government revenues over the period, totaling more than US$37 billion over the five years.

While this is the estimate arising from this set of data, we regard the US$37 billion figure as very conservative because of what is not included:

- **Same invoice faking.** The gaps that show up in export and import values in available trade data do not include transactions where the intentional misinvoicing has been agreed between the exporter and the importer and therefore no gap appears between the export and import documents. This methodology is widely used by both multinational corporations and long-term trading partners and is difficult to detect. GFTrade, GFI's global trade pricing database, enables same invoice faking to be detected.

- **Services and intangibles.** Available trade pricing data covers only merchandise goods. Not included are management fees, interest payments, licenses, etc., which have become commonly used avenues for overcharges, shifting money out of emerging market and developing countries.

- **Trade with other developing countries.** Our data in this part of our analysis only encompasses trade between South Africa and the developed countries reporting their transactions with South Africa. Not included is the country's extensive trade with neighboring and many of the more distant developing countries, which may also involve misinvoicing.

- **Cash transactions.** Sometimes used in commerce and often used in criminal transactions, cash transactions do not show up in our data.

- **Hawala and flying money transactions.** Our analyses cannot detect transactions that utilize mechanisms which avoid the immediate movement of payment. These techniques have become increasingly utilized as commerce becomes more internationalized.

II. A Detailed Examination of Import Under-Invoicing

GFI has chosen South African Revenue Service (SARS) data as the primary source for an in-depth examination of import under-invoicing.[1] The motivation for this focus comes in part from recent econometric research (using bilateral trade statistics) analyzing trade discrepancies for many countries.[2] Those studies are the leading edge of a growing body of empirical research finding associations between irregularities in trade data and tariff rates (i.e., potential revenue losses associated with trade misinvoicing). This study of South African import data uses considerably more trade and tax detail than are typically available for cross-country comparative studies, particularly for those involving developing and emerging economies. The analytical methodology utilized in the following section is not the same as the methodology used in the preceding section because the purpose is different. In this section we seek to identify particular commodity groups that appear prone to misinvoicing.

The prime objective of the analysis is to identify commodity-trade partner combinations which are more likely than others to present risk of revenue loss due to import undervaluation. GFI approaches this in several steps:

1. Identify potential sources of undervaluation in South African imports;
2. Identify and estimate tariff collections associated with potential sources of import undervaluation;
3. Evaluate the results in terms of potential revenue loss associated with trade misinvoicing.

The first two segments of the analysis are discussed in this section, while the results and evaluation are summarized in the third section.[3]

Identifying Potential Sources of Undervaluation in South African Imports

The SARS database on South African imports covered six years (2010-2015) of trade transactions with about 250 countries delineated for over 8,200 commodities (specified at an 8-digit level of

[1] Throughout the analysis, bilateral trade statistics published by the United Nations (Comtrade) and detailed export data from the U.S. Department of Commerce detailed export data were used to crosscheck the conclusions drawn from the analysis of the SARS data.

[2] Carrere-Grigourio[2015] and Kellenberg-Levinson[2017]. As part of the background research for this study, GFI replicated the kind of regression analyses reported in those studies for South Africa alone using the Comtrade database. While those econometric estimates supported the broader country analysis reported in those studies, the link between tariff rates and import gaps was typically weaker, possibly a reflection of the quality of SARS data relative to those reported in many other countries. In any event, because of the availability of both the SARS data and more extensive tariff data (relative to the earlier studies), GFI chose to privilege the results from using those data for the study.

[3] While literally millions of possible combinations of comparative valuations could be made using the data and procedures developed here, this section summarizes only those most relevant to the main question of this study. GFI will gladly supply all underlying data and software developed for the study to any individual or organization requesting it.

detail as defined by SARS).[4] Each import transaction was assigned to a particular group based on the year in which it was recorded, the commodity traded as well as the units in which import volume was reported.[5]

How can a particular import price be designated as low (or high, or neither)? The distribution of prices within each group was the basis for categorizing import prices, with any price falling below the 25 percent quartile of the group designated as indicative of possible undervaluation of that import transaction.

With millions of observations under study, the likelihood of extreme observations can be high. In order to ensure that truly extreme observations were prevented from unduly influencing the analysis, GFI designed a triple-pass of filters based on standard robust statistical criteria to screen out extreme values that would be most likely to be uninformative and distort the estimated price distributions. On the first pass, a determination was made for each group as to whether the size of the group and the nature of the observations undermined their fitness for further scrutiny.[6] In the second pass, individual prices within the surviving groups were designated to be statistical outliers and removed from further analysis.[7] Finally, the third pass of filtering screened observations from the remaining import transactions (i.e., those in "good" groups and not outliers with respect to the group) with an eye toward eliminating extreme observations evident across groups. The price observations that survived the first two passes were then standardized to allow comparison across groups. The entire remaining sample was screened and outliers removed from the sample.[8]

For each import transaction remaining in the filtered sample (recorded at SARS' 8-digit level of commodity detail), the reported price was compared with its group statistics. A price was

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[4] The detailed trade data were kindly provided by SARS to GFI in electronic form in April 2016. That database included some trade records for the early months of 2016, but those were not used in this analysis. The data for the years through 2015 were checked against the most recent annual trade aggregates published by SARS online (http://tools.sars.gov.za/tradestatsportal/data_download.aspx) and were found to match those closely, with differences in no year amounting to even 0.05 percent. The raw SARS data used for the analysis excluded import records that could not be used for analysis. Those excluded data (largely unclassified or unknown country/commodity classes) amounted to only about 1.5 percent of total reported SARS imports, on average over the 2010-2015 period. Additionally, import records containing no information on the volume of a trade transaction (necessary to compute a price per unit) were excluded as were records which reporting South Africa as both the origin and destination country. All in all, those exclusions left more than 7.5 million usable records for subsequent analysis. Finally, to allow comparisons between the SARS data and data in Comtrade and the U.S. Department of Commerce, the SARS data were converted to U.S. dollars at the same (annual average) exchange rates used in Comtrade.

[5] That categorization resulted in 46,898 distinct groups each of which was subsequently subjected to statistical analysis.

[6] Groups with fewer than 5 price observations were eliminated from further scrutiny as were groups recording basic oddities that would rule out further meaningful analysis of the group. For example, in a few cases, some admissible but relatively small-sized groups indicated that location of the price distribution could not be reliably distinguished from the dispersion of prices around the center (e.g., the median equaled the upper or lower quartile of the distribution.

[7] The size of the groups scanned under the second pass varied from a low of 5 observations (the minimum number for admissibility) to a high of 6,298 observations. The median group size was 59 observations; 25 percent of the groups had 21 or fewer observations while 75 percent of the groups contained 163 or fewer observations. The criterion for outlier selection was sensitive to the possibility of informative asymmetries in the price distributions within each group, a possibility most relevant to this study. Accordingly, we used the asymmetrical outlier detection criterion developed in Hubert-Vandervieren[2008] which, in turn, relies on the robust measure of skewness (deemed "medcouple") in Brys-Hubert-Struyf[2004].

[8] The standardized price is calculated by subtracting from the observed price its group median and dividing by a measure of scale. (This is analogous to standardizations which subtract the mean and divide by the standard deviation, except that neither the mean nor the standard deviation are robust measures of scale, respectively.) Three separate statistical measures of scale (i.e., dispersion) were assessed: the mean absolute deviation (widely used, but not especially robust) and two alternative and more robust measures developed in Rousseeuw-Croux[1993] (labelled Sn and Qn by those authors). While the resulting standardized price deviations were broadly similar, GFI decided to use Qn as the most robust measure to detect outliers in the standardized prices across groups. The same criterion for outlier detection used to identify extreme observations within groups was applied to the surviving sample across groups.

designated low if it was below the group median and very low if it was below the 25 percent quartile for its group.[9] Similarly, a price was designated to be high if it were above its group median and very high if it were above the 75 percent quartile for its group. Of central interest to the study is the group of import prices designated as very low. In keeping with previous empirical research, GFI viewed the group of very low price records to be the one most likely compatible with undervaluation of imports and trade misinvoicing.

All told, the triple-pass filtering of extreme observations reduced the number of usable observations by just over 4½ percent (from about 7.8 million records to 7.4 million) and the overall value of imports available for study from about $579 billion as reported by SARS to just over $494 billion in the sample used for analysis (see Table 2). While the reduction in value may appear large (at just under 13 percent), the elimination of extreme observations reduces distortions in the estimated price distributions.[10]

The price distributions based on the filtered data also indicate some distinct patterns. First, on balance, the price distributions are asymmetric—a higher proportion of South African imports (58.9 percent of import value) are associated with relatively low prices than are associated with high prices (41.1 percent).[11] The degree of asymmetry varies year by year, but remains close to the average across years throughout.

Second, the degree and direction of asymmetry varies considerably by 2-digit commodity class over the 2010-2015 period. A preponderance of low prices is indicated for commodities like plastics (75.2 percent), organic chemicals (73.4 percent) and electrical machinery (60.1 percent) while a preponderance of high prices is evident for vehicles (56.7 percent) and optical/medical products (53.3 percent), both well above the average for the sample (41.1 percent). However, there is no clear relationship between the price asymmetry and the relative size of imports by commodity class, at least for the top ten commodities imported by South Africa (which, together, account for nearly two-thirds of all South African imports over the period).

By contrast, the asymmetries in the import price distributions do exhibit a notable pattern across countries: while the price distributions for South African imports from advanced countries appear to be symmetric (low prices for 50.5 percent of those imports and high prices for 49.5 percent), the price distributions for South Africa's developing country partners are distinctly skewed toward the low side with 66.4 percent of the imports from those partners transacted at prices below the respective group medians.

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[9] From this point forward, the categorization of prices follows the procedures typically used in empirical P-F studies; see, for example, de Boyrie-Nelson-Pak[2007].

[10] The filtering altered a couple of rankings from those in the SARS data but in minor ways that will not affect the analysis of the price distributions.

[11] It is important to remember that the prices on particular transactions were categorized relative to their respective group median, not the overall sample median (in which case, of course, half the prices would be low and half high by definition).

Table 2. Selected Characteristics of South African Imports (millions of U.S. dollars)

	Reported by SARS	Filtered by GFI				
			Price categories (percent of total filtered value)			
	Value	Value	Low (p<median)	Very low (p<Q[0.25])	High (p≥median)	Very high (p≥Q[0.75])
Total (2010-2015)	**$578,853,611,802**	**$494,266,002,006**	**58.9**	**24.4**	**41.1**	**15.0**
2010	$82,959,746,250	$71,547,223,590	60.1	24.4	39.9	13.7
2011	$102,705,913,523	$87,814,470,305	58.0	23.8	42.0	15.6
2012	$104,148,113,167	$89,054,906,692	58.2	22.8	41.8	16.4
2013	$103,436,689,928	$88,218,409,548	58.6	25.9	41.4	14.3
2014	$99,890,452,671	$84,421,698,359	57.8	23.6	42.2	15.2
2015	$85,712,696,263	$73,209,293,512	61.1	26.5	38.9	14.2
By Commodity (top ten, 2-digit classification)						
Mineral fuels	$118,817,545,690	$102,684,582,313	53.2	17.2	46.8	14.7
Machinery	$83,139,100,686	$67,090,322,931	50.0	18.6	50.0	20.0
Electrical machinery	$57,029,813,852	$47,417,282,036	60.1	32.5	39.9	14.2
Vehicles	$50,050,344,892	$45,527,127,332	43.3	15.5	56.7	29.5
Plastics	$14,473,825,089	$12,390,571,338	75.2	37.4	24.8	5.8
Optical, medical products	$13,870,455,841	$11,499,423,734	46.7	19.9	53.3	22.3
Pharmaceuticals	$13,160,966,551	$12,314,583,452	52.3	24.8	47.7	21.1
Organic chemicals	$9,936,071,970	$8,427,222,367	73.4	38.3	26.6	7.0
Chemical products, misc.	$9,378,409,305	$8,782,795,925	57.4	27.1	42.6	19.1
Rubber	$8,111,489,220	$6,972,177,769	52.0	23.1	48.0	19.3
By Partner Country						
Advanced countries	$267,557,167,319	$232,465,202,855	50.5	15.5	49.5	19.7
Developing countries	$302,034,922,159	$261,800,569,446	66.4	32.4	33.6	10.8
Top ten countries:						
China	$87,453,450,081	$75,449,950,883	82.4	52.1	17.6	4.5
Germany	$60,307,051,256	$54,767,963,881	51.4	11.5	48.6	20.2
USA	$40,530,109,954	$34,729,246,170	42.0	12.5	58.0	27.1
Saudi Arabia	$33,422,769,671	$27,952,993,542	52.7	14.8	47.3	7.3
India	$25,608,861,622	$23,035,195,280	79.3	41.6	20.7	4.4
Japan	$24,585,411,879	$23,156,788,123	57.2	13.8	42.8	14.0
Nigeria	$20,830,223,717	$19,659,380,813	33.0	7.9	67.0	31.5
United Kingdom	$20,047,945,682	$17,835,477,876	46.8	16.5	53.2	18.3
Italy	$14,839,111,124	$12,584,729,801	53.0	20.8	47.0	15.0
France	$14,117,835,747	$12,252,724,918	46.7	12.5	53.3	20.6

Sources: GFI calculations based on data provided by the South African Revenue Service (SARS). Note that the SARS-reported data in the top panel (by year) includes unclassified and unknown categories of imports that are not included in the commodity and country detail below or the filtered estimates.

This pattern sharpens further when the price distributions for individual countries are assessed. A full 82.4 percent of the value of imports from China (South Africa's largest trading partner on imports) are priced below the respective group medians. Moreover, 52.1 percent of Chinese imports are designated to be very low (below the 25 percent quartile of the respective group medians). A similar situation is indicated with respect to South African imports from India: 79.3 percent of those imports are in the low price category and 41.6 percent in the very low category. One notable

exception in the table is Nigeria: the import price distributions for Nigeria (South Africa's principal foreign supplier of mineral products) are tilted toward the high side with more than two-thirds of South Africa's reported imports from that country transacted at prices above the respective group medians.

Identifying and Estimating Tariff Collections Associated with Potential Sources of Import Undervaluation

The SARS-based prices (8-digit SARS commodity classifications) were then aligned with South African tariff rates in the World Integrated Trade Solution (WITS) database published by the World Bank. The WITS tariff rates are compiled at a 6-digit level of commodity detail harmonized to allow comparisons across countries.[12] The 6-digit WITS tariff rates, published on an ad-valorem basis, are averages of more detailed underlying rates. Two sets of rates are available for each country with respect to the commodities it imports in a given year as well as the exporting country it partners with for that. The first set of average tariff rates correspond to "most favored nation" (MFN) rates—the tariff rates corresponding to what a country pledges to impose on imports from other members of the WTO with which it does not share membership in a preferential trade agreement. The second set of WITS tariff rates corresponds to "preferential" tariffs (PRF) which are lower tariff rates countries agree to as part of their membership in a preferential trade agreement (such as the South African Customs Union, which covers agreement between South Africa, Botswana, Lesotho, Namibia and Swaziland). The PRF rates are typically lower than the corresponding MFN rates.

For the purposes of the study, GFI combined the MFN and PRF ad-valorem averages from WITS into a single rate by year, commodity and partner country as follows: the PRF rate was used for those country-commodity combinations affected by preferential trade agreements with South Africa, and the MFN rate otherwise.[13]

In this way, each of the 8-digit import records from the SARS sample was aligned with its corresponding 6-digit WITS tariff rate for the exporting country partner in each year. Multiplying the aligned tariff rate by the import value reported in each record of the SARS provides an estimate of the value of potential tariff collections for that transaction. Those potential tariff collections provided the basis for identifying tariff sensitive import values in the study.

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[12] The 6-digit classifications are also designed to be compatible with harmonized bilateral trade data in the UN Comtrade database (http://wits.worldbank.org/). Inevitably, the use of 6-digit tariff rates would obscure any variation across 8-digit commodities within a particular 6-digit commodity classification. However, machine accessible SARS tariff data for 8-digit commodity trade by country were not available to GFI.

[13] As an overall test of the suitability of the EPTRs as predictors of SARS revenue collections, GFI examined the quality of the estimated EPTRs as predictors of actual SARS collections as reported online at the tariff chapter level by fiscal year (http://www.sars.gov.za/About/SATaxSystem/Pages/Tax-Statistics.aspx). Standard statistical tests generally could not reject the hypothesis that the EPTRs were unbiased predictors of collection rates at that high degree of aggregation.

Effective potential tariff rates (EPTRs) for classes of import transactions were computed based on aggregations of the individual potential collections divided by the corresponding aggregated import value for the class of transactions.[14] For example, the EPTR for a particular good imported in a particular year identified as a low price transaction would be calculated by summing the product of the tariff rates and import values across all trades designated as having been transacted at low prices and dividing that by the sum of all import values in that category (expressed as percent of value). Each EPTR then reflects the combined influences of import prices, import volumes and tariff rates in a way that allows easy comparisons to be made across categories.

The potential for tariff losses associated with import undervaluation for a class of imports will vary directly with the degree of the potential underpricing, on the one hand, and the tariff associated with that import class, on the other. So an important question is: are import classes with a preponderance of low price transactions (i.e., where undervaluation might be expected) associated with higher effective tax rates than other classes of imports?

GFI finds this to be the case for South Africa. The overall EPTR on South African imports averages to 4.5 percent over the 2010-2015 period (Table 3). For import transactions classified as very low priced, the EPTR averages to 6.8 percent over the period, well below the 3.5 percent EPTR estimated for very high priced transactions. That tendency is evident for the overall EPTR in each of the years.

EPTRs estimated by commodity classes exhibit some interesting features. Imports of some goods which were earlier seen to have a preponderance of low-priced transactions turn out to have relatively low EPTRs because they are taxed at low rates: examples are plastics, organic chemicals and electrical machinery all of which indicate below-average EPTRs (nearly zero for organic chemicals). For other commodities, the reverse was true. While a relatively small fraction of motor vehicle imports was classified as very low-priced, those vehicles are taxed at high rates on import to South Africa. As a result, the EPTR for vehicle imports in the very low price group was 16.5 percent, higher than the rate for very high-priced import transactions and well above the EPTRs for other leading commodities. A similar situation was evident in South Africa's imports of rubber.

[14] An algebraic formulation may help convey the nature of the EPTR measure and its usefulness in this context. If V^8_{tjk} denotes the value of imports of commodity k (8-digit) reported by SARS from country j at time t and R^6_{tjk} the ad-valorem tariff rate for the corresponding 6-digit commodity class at time t and for country j reported constructed from WITS, then $T^8_{tjk} = R^6_{tjk} * V^8_{tjk}$ is an estimate of the potential tariff revenue associated with that transaction denominated in monetary value (e.g., Rand). In comparing potential tariff revenue, say, for a particular trade partner j over all commodities at time t, the country specific effective rate for t would be given by $EPTR_{tj} = 100 * \Sigma_k T^8_{tjk} / \Sigma_k V^8_{tjk}$. Thus, the EPTR measure allows easy comparisons of aggregate tariff sensitivity across different combinations of import transactions. The EPTR reflects the influences of import price, volume and associated tariff rate. Of particular interest here are the EPTRs calculated for different import records categorized by price (low, high, etc.).

Table 3. Effective Potential Tariff Rates (EPTR) for Selected Classes of Imports
(millions of U.S. dollars)

	Value of imports in filtered sample with WITS tariff lines	EPTR (potential revenue as a percent of associated revenue base)				
		All	Price categories (percent of total filtered value)			
			Low (p<median)	Very low (p<Q[0.25])	High (p≥median)	Very high (p≥Q[0.75])
Total (2010-2015)	**$454,117,937,723**	**4.5**	**5.4**	**6.8**	**3.3**	**3.5**
2010	$65,717,625,111	4.8	5.7	7.2	3.7	3.6
2011	$80,989,601,645	4.6	5.5	6.7	3.4	3.6
2012	$82,160,554,174	4.4	5.3	6.9	3.2	3.2
2013	$81,488,799,456	4.4	5.2	6.3	3.4	3.9
2014	$77,468,567,182	4.2	5.2	7.1	3.0	3.5
2015	$66,292,790,156	4.6	5.4	6.8	3.4	3.5
By Commodity (top ten, 2-digit classification)						
Mineral fuels	$102,684,582,313	1.3	1.6	1.7	0.9	0.8
Machinery	$67,090,322,931	1.4	1.9	2.7	1.0	0.8
Electrical machinery	$47,417,282,036	2.2	2.4	2.9	1.8	2.0
Vehicles	$45,527,127,332	14.1	16.5	16.5	12.3	11.4
Plastics	$12,390,571,338	3.3	3.6	4.6	2.4	2.5
Optical, medical products	$11,499,423,734	0.2	0.3	0.4	0.1	0.1
Pharmaceuticals	$12,314,583,452	0.1	0.1	0.2	0.0	0.0
Organic chemicals	$8,427,222,367	0.6	0.7	0.7	0.6	0.7
Chemical products, misc.	$8,782,795,925	0.7	1.1	1.4	0.3	0.2
Rubber	$6,972,177,769	11.0	11.7	13.0	10.2	10.8
By Partner Country						
Advanced countries	$232,465,202,855	4.2	4.1	3.5	4.3	4.6
Developing countries	$261,800,569,446	4.7	6.1	8.1	2.1	1.8
Top ten countries:						
China	$75,449,950,883	8.6	9.8	12.2	3.0	2.8
Germany	$54,767,963,881	3.4	1.5	1.5	4.7	6.6
USA	$34,729,246,170	4.2	4.4	4.4	4.1	4.7
Saudi Arabia	$27,952,993,542	0.3	0.4	0.7	0.2	0.3
India	$23,035,195,280	7.7	8.4	8.9	5.2	5.5
Japan	$23,156,788,123	8.9	8.8	6.4	9.0	7.8
Nigeria	$19,659,380,813	0.0	0.1	0.2	0.0	0.0
United Kingdom	$17,835,477,876	2.7	2.1	1.2	3.2	2.9
Italy	$12,584,729,801	6.2	5.3	5.1	7.1	7.5
France	$12,252,724,918	5.1	5.5	5.4	4.9	4.4

Sources: GFI calculations based on data provided by the South African Revenue Service (SARS).

The distinctions evident earlier in the country comparisons of import price characteristics are also evident in the estimated EPTRs. The rates estimated for developing countries vary far more over the import price classes than is the case for the advanced countries. Imports from developing countries that are identified as having a very low price are associated with an average tariff rate of 8.1 percent, well above the estimated 3.5 percent rate associated with imports from advanced countries falling in the very low price class.

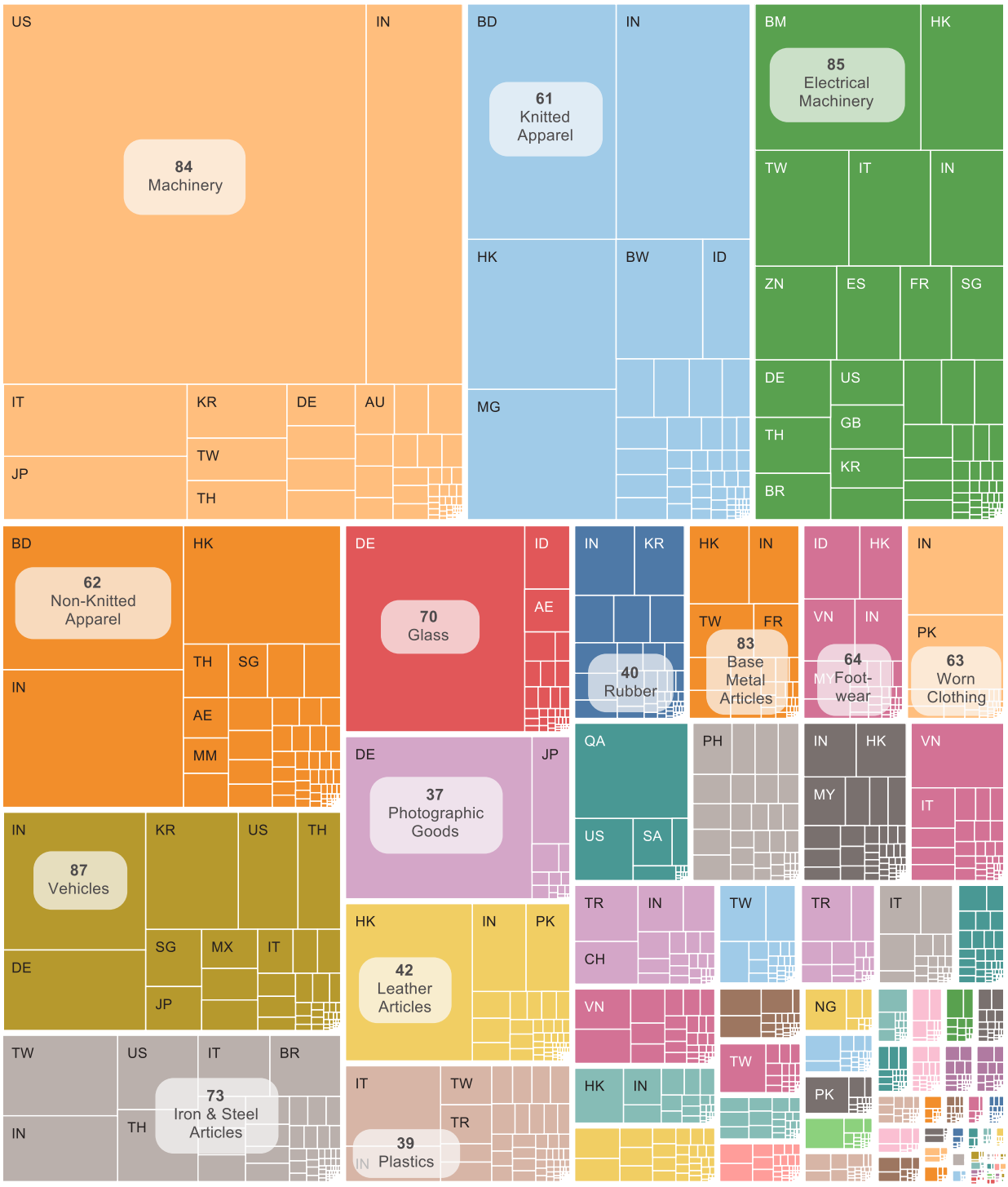
China contributes significantly to the asymmetry evident in the estimated EPTRs for the developing countries: South African imports from China designated as low price recorded an EPTR of 9.8 percent, while those in the very low price category averaged 12.2 percent. The estimated rates for India were also higher than average for all developing countries. Among advanced nations, though, Japan stood out among the leading trade partners as relatively highly taxed in all import classes. Finally, countries whose imports to South Africa tend to be predominantly low or zero taxed commodities (e.g., Saudi Arabian and Nigerian mineral products, principally oil) were assigned low EPTRs.

Evaluating Commodity Groups for Potential Revenue Losses

As illustrated on the following page (see Figure 1),[15] the top five categories for potential revenue loss in U.S. dollar value terms are machinery, knitted apparel, electrical machinery, non-knitted apparel, and vehicles. The largest of these is machinery (HS 84). Here, most of the very low-priced imports considered in the analysis came from the United States and India. This is followed by knitted apparel (HS 61) imported from Bangladesh, India, Hong Kong, and Madagascar. The third largest category is electrical machinery (HS 85), with a fairly varied set of import origins: Bermuda, Hong Kong, Taiwan, Italy, and India, among many others. Non-knitted apparel (HS 62) has the fourth-highest value of potential tariff revenue losses, stemming from trade with Bangladesh, India, and Hong Kong. Vehicle (HS 87) imports from India, Germany, South Korea, the United States, and Thailand also seem significant.

[15] South African imports from China were excluded from this figure. The prominence of China as a foreign supplier to South Africa, the preponderance of Chinese imports that are priced very low relative to similar goods and very high tariffs means that the counterfactual estimates of potential tariff losses would be dominated by Chinese imports, undermining the illustrative purpose of the figure.

Figure 1. Potential Tariff Losses by HS 2-Digit Code and Partner Country
(2010-2015, excluding China, size of box indicates dollar value)



Sources: GFI staff calculations using data from the South Africa Revenue Service.

Conclusions

There are three ways that South Africa can curtail revenues losses due to trade misinvoicing. First is through legislative and regulatory measures that posit substantial disincentives for importers and exporters. Second is detecting misinvoicing as transactions are occurring and taking corrective steps in real time. Third is clawing back lost revenues after misinvoicing is found through subsequent audits and reviews. Of these, by far the greater potential for gain is attendant to the first and second options. Clawing back lost revenues after the fact is a difficult exercise.

GFI's very conservatively estimated US$37 billion in lost revenues over the last five years of available data represents resources that could have made an immense difference in housing, education, and health services and could have gone far in easing poverty and inequality and accompanying social strains. We have identified some of the commodity groups and trading relationships that need much greater scrutiny. Opportunities exist for a whole-of-government approach to resolving much broader misinvoicing problems.

Pursuit of legitimate and transparent trade by the Government of South Africa and concerned civil society organizations can pay rich dividends to the nation in decades to come.

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About

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Founded in 2006, Global Financial Integrity (GFI) is a non-profit research and advisory organization, based in Washington, DC. GFI produces quantitative analyses of trade-related illicit financial flows, advises governments of developing countries on effective policy solutions and promotes transparency measures in the international financial system as a means to global development and security.

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