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The Tragedy and Reliability of Zambian Trade Data

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Trade is an essential engine of growth and poverty reduction. Yet trade data suffers from poor quality and inconsistencies. There are several reasons for this: trade data is collected with little coordination between the reporting agencies and the central statistical offices, inadequate resources located to the data gathering agencies undermines archival process of good data, normal statistical errors of measurement and observation, and various complexities associated with international trade such as trade misinvoicing. This study explored the poor quality and inconsistencies in Zambian trade data which might render efforts at policy formulation to boost intra-regional trade and resolve issues of growth and poverty intractable. The study computed an index to depict the extent of trade misinvoicing and hence the quality of Zambia's trade statistics in comparison with other African countries. The study documented the tendency to over-invoice exports and under-invoice imports. This is of great concern; particularly in the trade liberalisation era where the need for high quality trade data to inform constantly evolving regional and continental trade arrangements is more urgent than ever. Plausible interventions include, but are not limited to: increasing intra-country coordination between statistical and other data reporting agencies, increasing collaboration between local and partner country level data collection agencies, and encouraging open collaboration between data collection agencies and users.

Introduction

The African Continental Free Trade Area (AfCFTA) agreement was ratified in 2012 with a view to "*create a single market for goods and services, facilitated by movement of persons in order to deepen the economic integration of the African continent and in accordance with the Pan African Vision*" (African Union, 2012: 4). Unlike the many other regional economic communities in Africa such as the Common Market for Eastern and Southern Africa (COMESA), Economic Community of West African States (ECOWAS), East African Community (EAC) and the Southern African Development Community (SADC) whose aim is to boost intra-regional trade, the aim of the AfCFTA is to boost intra-African trade beyond the regional communities. This is based on the premise that intra-African trade is low (Chidede and Sandrey, 2018). The rationale for the AfCFTA is clearly to remove tariff and non-tariff barriers and boost intra-African trade (United Nations Economic Commission for Africa (UNECA), 2018a).

Indeed, the argument for the creation of the AfCFTA is supported by official trade statistics. These indicate the relatively low level of intra-African trade. According to the International Trade Centre Trade Map (cited in Chidede and Sandrey, 2018: 2), intra-Africa imports averaged at about 13 per cent over the 2001-2017 period while intra-Africa exports averaged at about 15 per cent of all imports and exports of African countries over the same period. These statistics imply that there is a significant potential for boosting intra-African trade; particularly if the AfCFTA is effectively implemented.

However, official trade data against which trade arrangements are justified may be of poor quality (Ariyo, 1996: 2). This is for a number of reasons which may not necessarily be mutually exclusive: Firstly, the lack of coordination between domestic reporting agencies and the local central statistical offices, and between the local and trade partner data collection agencies (African Union, 2009: xiv); Secondly, inadequate resources for data collection and management (Adamu et al., 1998: 53; African Union, 2009: 33); Thirdly, the poor quality of trade data may simply be the result of normal statistical errors of measurement and observation (Adamu et al., 1998: 53; International Trade Centre, 2010: 6); Fourthly, the complexities of valuing international trade associated with unreliable shipping costs (Hummels and Lugovskyy, 2003: 3), re-exports (International Trade Centre, 2010a: 6), multiple (and fluctuating) exchange rates (International Trade Centre, 2010a: 7), product misclassification and the misdeclaration of the destination market (Nitsch, 2017: 1); Fifthly, the under- and over-invoicing of trade flows resulting from the above complexities or even from deliberate illegal attempts by importers and exporters to profit from incorrectly declaring the value of traded products (Nitsch, 2017: 1).

This study seeks to assess the quality of Zambian trade data (imports and exports) with respect to continental trade partners, within the misinvoicing framework. The study assesses the extent of trade misinvoicing relating to Zambian total trade flows with the rest of Africa at the aggregate, country and product levels using data on three broad product classifications. We specifically look at food, beverages and tobacco; textiles and clothing; and base metals.

The study is important in light of the structure of the Zambian trade flows and the country's commitment to the AfCFTA. The Zambian economy is dominated by the export sector. The performance of the economy is therefore heavily dependent on decisions made on the export and import of goods and services. In addition, the projections of fiscal revenues for the government depend on trade data. These will in turn depend on the quality of trade data.

Furthermore, policy makers and researchers use trade data for applied research and economic analysis. This is used to inform trade arrangements such

as the AfCFTA. Research results and underlying analyses can only be useful to the extent that they are based on comprehensive, timely and accurate trade data (Adamu et al., 1998).

The rest of the study is structured as follows. In section 2, we review the relevant empirical literature on the quality and inconsistencies of African trade data. In section 3, we outline the methodology adopted for the study. Section 4 highlights and discusses the main findings while section 5 concludes and gives policy recommendations.

Trade Statistics and the Irreversible Tragedy

Research has been carried out on the consistency and reliability of economic data in developing and developed countries. However, the problem of poor data and its lack of consistency is not much appreciated despite the importance of good data as an input into quality research and policy judgement.

There are major complaints that have been identified with the quality of African economic statistics. The major concern is in the external trade and agricultural statistics (Yeats, 1990a). These are general and specific concerns. The general concerns relate to the shortness of data in time series, the highly aggregated series that are not useful for analysis, the gaps in the time series data and the lack of timeliness in the production and dissemination of data (United Nations Development Programme, 2012: 1). The specific concerns are about basic recording problems in administrative data (McLennan, 2018). Thus there are both specific and general concerns that data is inconsistent, unreliable, and lacks validity, precision and accuracy (Adam et al., 1998).

Concerns about the reliability of African trade data were first brought out by Yeats in the 1990s. Yeats argued that Sub-Saharan Africa trade statistics cannot be relied on for analysis of trade flows. A major theme of Yeats' early work on African trade statistics was that if they are of any use, it is really to indicate the huge smuggling and under-reporting that takes place within Sub-Saharan Africa (Yeats, 1990a, 1990b).

The concern about African trade statistics is not so much about quantity but quality. According to Adamu et al. (1998), the problems of quality arise from administrative errors due to shipping costs, re-export of goods, multiple exchange rates, commodity classification and valuation problems; illicit activities resulting in over-invoicing or under-reporting of exports and imports and smuggling; and normal statistical errors of measurement and observation. Other drivers of the poor quality of African trade statistics include: time lags in compilation, the lack of a standardised reference period, and the lack of standardised units of measuring trade. (International Trade Centre, 2010b: 11).

Generating reliable statistics depends on correct reporting. Early researchers on the quality of trade statistics such as Morgenstern (1963), warned about the problem of misreporting and the careless use of trade statistics, seen in many publications. Ariyo (1996) laments the use of trade statistics by African Economic Research Consortium (AERC) researchers without even discussing or acknowledging the limitations of the data and their sources.

The tragedy of inaccurate and unreliable data is still prevalent among African countries in the 2020s. It is confirmed by Jerven (2014). Actually, Africa lags behind the rest of the world in the collection and management of (quality) trade data. Thus, Morgenstern's (1963) and Yeats' (1990a, 1990b) concerns on the quality and reliability of trade statistics are as relevant today as they were a couple of decades ago. All efforts to improve data have come to nought and failed to reverse the tragedy of bad quality trade data. This tragedy which should be overcome, however, seems irreversible unless drastic interventions are made.

Methodology

The study unpacks discrepancies in trade flows among trading partners. In general, observed exports from Zambia to another country, say Eritrea, accounting for freight costs and insurance (c.i.f), should match the observed imports of Eritrea from Zambia. If the exports from Zambia to Eritrea (c.i.f) are less than the claimed imports of Eritrea from Zambia, then the difference can be attributed to export under-invoicing by Zambia, or import over-invoicing by Eritrea. This assumes that trade statistics are accurate enough to be substituted for market values. In this study, we show that the accuracy of the assumption is questionable due to data inaccuracies across sources and destinations of products.

The net trade misinvoicing is computed, based on mirror accounts, as follows:

$$Xmis^{y}_{zj,t} = M^{y}_{jz,t} - (\gamma . X^{y}_{zj,t}) \qquad (1)$$

where *Xzjy* is exports of good y by country *z* to country *j* as recorded in country *z*'s data, *Mlz,ty* refers to imports of good *y* by country *j* from country z as recorded by partner j. The γ represents the cost of freight and insurance. The variable *Xmis* measures the discrepancy in Zambian exports to destination markets. The extent of misinvoicing is computed as:

$$Dmisinv = \frac{Xmis^{y}_{zj,t}}{X^{y}_{zj}} * 100 \qquad (2)$$

Trade misinvoicing can be estimated at three distinct levels. The first is for all trading partners taken together. Second, at partner country trade level and finally at product level. This study tests the accuracy of trade statistics using trade flows for three randomly selected broad product categories: food, beverages and tobacco; textiles and clothing; and base metals. If *Xmis>0* (i.e., a positive value) shows that export under-invoicing while *Xmis*<0 (a negative value) shows some over-invoicing of exports.

Data and Sources

The data for the study were obtained from the United Nations COMTRADE database through the World Integrated Trade Solutions. It was accessed from the website http://Comtrade.un.org/data/; The data are presented at product level, by country source and destination. Specifically, the harmonized system at six-digit level isused. The food, beverages and tobacco are aggregated from the HS chapters 16 to 24, textiles and clothing from chapters 50 to 62 and base metals from chapters 72 to 83. The computations, focusing on trade misinvoicing at the aggregate, country and product levels, are presented in the next section. Note, however, that the extent of misinvoicing at the product and country levels is determined only for exports.

Results and Discussion

Aggregate Level

The results are based on equation (1). The measure of import misinvoicing are presented in Table 1. In theory, the accuracy assumptions suggest a zero discrepancy, so that *Xmiszj,ty=0*. There are several observations that can be made from Table 1. First, there are negative discrepancies for export misinvoicing and positive discrepancies on the imports side. This suggests the existence of inconsistences in trade flows between Zambia and its African trading partners. Although part of the discrepancies could be explained by transport costs, the adjustment of the flows by the CIF could reduce their effect, indicating that the reporting of data may contribute to the gaps.

Table 1: Trade Data Discrepancies for All Selected Products

Year	Export Misinvoicing	Export Mis Index	Import Misinvoicing	Import Misinv Index
2002	-217,328	-83.6	12579	12.10
2003	-296,584	-90.3	43315	32.18
2004	-407,108	-84.2	36779	21.04
2005	146,203	30.4	36891	18.56
2006	-329,522	-63.8	90611	31.96
2007	-555,943	-76.9	113927	31.57
2008	-39,307	-5.0	218498	42.92
2009	-118,943	-23.5	100936	26.29
2010	-142,007	-21.4	211643	36.73
2011	-155,471	-16.1	186672	27.94
2012	-65,961	-8.6	129231	18.18
2013	-418,486	-42.6	71418	11.95
2014	-435,510	-55.0	42179	7.21
2015	-163,391	-27.6	82195	16.66
2017	148,297	29.8	12816	2.85
2018	895,089	142.0	-87306	-16.18

Source: Authors' Calculations from Comtrade Database

Secondly, the extent of the data inconsistency varied from year to year and across both imports and exports. For example, the extent of export misinvoicing ranged from an over-invoicing of US$ 555.9 million in 2008 to under-invoicing of US$895 million in 2018. A similar trend is observed for the export indicator in Column 3. These results suggest that there are significant amounts of exports and imports that are not reported across partner countries once a country's exports are subjected to mirror accounts. The aggregate pattern of misinvoicing may reflect some aggregation bias. Overall, there seems to be an over-invoicing of exports and an under-invoicing of imports.

Product Level

We look at the product level. Table 2 shows the possibility of misreporting at the product level. The results show large differences in trade misinvoicing across the three selected product categories. However, these differences exhibit large heterogeneities across the products and years. Across all the three product categories, Zambia tends to over-report exports.

The extent of the incomparability of trade flows across mirror accounts is larger for minerals and food and beverages. These are typically in excess of 100 per cent of the exports. The lowest misinvoicing is observed for textiles. This is typically less than 50 per cent. These large discrepancies are consistent with the assumption that trade data from developing countries is susceptible to higher errors in recording trade invoice values than that of developed countries. Furthermore, there is a possibility Zambia has weak information on market destinations of exports. This is because of the inherent weaknesses of the trade data collection agencies.

Table 2: Selected Product Level Heterogeneity in Export Misinvoicing

Year	Base Metals	Index (%)	Food Beverages	Index (%)	Textiles	Index (%)
2002	-188.3	-106.5	-28.3	-67.2	-35.3	-86.4
2003	-266.8	-107.4	-24.2	-54.8	-27.6	-79.9
2004	-305.2	-106.8	-64.2	-72.3	-102.3	-95.0
2005	-352.2	-104.4	-74.2	-70.8	-25.8	-69.5
2006	-387.3	-106.3	-74.7	-66.3	-23.6	-63.6
2007	-583.4	-107.2	-80.1	-69.1	-26.7	-58.1
2008	-633.1	-106.5	-85.2	-62.0	-8.5	-26.0
2009	-263.5	-102.1	-132.1	-68.8	-2.8	-10.1
2010	-382.4	-105.0	-181.4	-70.9	13.3	47.6
2011	-625.6	-103.6	-219.2	-73.6	1.9	4.0
2012	-239.8	-95.6	-322.7	-77.5	-32.3	-44.0
2013	-350.6	-102.9	-366.7	-77.0	-23.7	-32.4
2014	-285.5	-102.5	-304.5	-72.5	41.0	125.9
2015	-280.1	-102.9	-152.7	-58.1	16.5	47.3
2017	-132.7	-94.1	-187.8	-61.2	16.9	46.7
2018	-128.7	-61.1	-247.9	-67.7	23.3	99.7

Source: Authors' Calculations from Comtrade Database

Note: The index captures the difference ratio based on equation (2).

Country Level

We also look at the country level data. Table 3 presents the trade flows of declared export values by Zambia against the corresponding import values reported by the partner countries. Some general observations emerge from Table 3. Firstly, Zambia's exports of the selected products are concentrated with a few African countries.The exporter and importer records show that the top 10 destinations absorb over 75 per cent of the products.

Table 3: Average Distribution of Exports by Trading Partner 2010-2018

	Zambia Reported Figures		Partner Reported Figures		
Country	**2010-2018**	**Share**	**Country**	**2010-2018**	**Share**
South Africa	2,604.2	44%	**Namibia**	2,308.3	34%
Congo D R	813.9	14%	**Egypt**	1,796.2	27%
Zimbabwe	659.9	11%	**South Africa**	1,721.5	26%
Malawi	474.7	8%	**Zimbabwe**	251.8	4%
Kenya	248.6	4%	**Tanzania**	115.7	2%
Tanzania	240.5	4%	**Kenya**	97.5	1%
Mauritius	223.8	4%	**Botswana**	95.8	1%
Botswana	163.4	3%	**Burundi**	75.6	1%
Mozambique	123.7	2%	**Mauritius**	65.8	1%
Namibia	65.0	1%	**Rwanda**	61.9	1%
Egypt	64.6	1%	**Malawi**	55.2	1%
Rwanda	63.4	1%	**Mozambique**	19.3	0%
Others	142.4	2%	**Others**	98.0	1%
Total	5,888.0	100%	**Total**	6,743.4	100%

Source: Authors' Calculations from Comtrade Database

Second, for the selected products, the ranking of export destinations in the Zambian trade significantly differs from the importer data records. For example, while Congo DR and Kenya are reported to be among the top five destinations and South Africa (44% of total exports) as the top destination, the mirror account shows a shift in the ranking with Namibia topping the group (34%) and Egypt and Tanzania rising to the top five importers at the expense of Kenya and Congo DR.

Table 4 shows the extent of misinvoicing in these countries over the periods 2002 to 2007 and 2008 to 2018. The country-partner measures of misinvoicing reveal several general trends. Table 4 shows that three countries (Botswana, Congo DR and Rwanda) out of the 11 countries reported zero imports. This is despite Zambia recording exports to these countries in the period 2002 to 2007. Egypt, on the other hand, reports imports from Zambia without corresponding export records in the Zambian data.

Table 4: Partner Level Export Misinvoicing

Country	2002-2007	Index	2008-2018	Index
Botswana	**		-95,399.1	-56.9
Congo DR	**		**	
Egypt	**		1,855,740.0	334.0
Kenya	-18,195.0	-25.3	-178,564.0	-63.2
Malawi	-131,627.0	-1002.6	-474,673.0	-89.6
Mauritius	23,851.6	149.9	-214,031.0	-81.3
Namibia	-673.169	-25.7	2,003,170.0	2767.3
Rwanda	**		3147.952	10.9
South Africa	-758,184.0	-55.1	-1,245,926.0	-41.7
Tanzania	-86,967.4	-79.3	-140,034.0	-51.1
Zimbabwe	424,427.5	375.3	-535,397.0	-73
Others	-13,656.3	-0.63922	-55976.6	-0.35278

Source: Authors' Calculations from Comtrade Database

Furthermore, in the period 2002 to 2007, countries that reported some trade show large discrepancies in the extent of misinvoicing. This ranged from an export over-invoicing of 1,002 per cent for Malawi to an under-invoicing of 375per cent for Zimbabwe. Also, Zambia reports over-invoicing its exports to almost all countries in the period 2008 to 2018. However, the exports were under-invoiced in the markets of Namibia, Egypt and Rwanda over this period. The under-invoicing in the case of Egypt and Namibia arise from the huge base metal exports recorded in these countries' trade data. But this is not reported in Zambia.

Discussion

This study has documented evidence regarding the inconsistencies prevalent in African trade data. Using the misinvoicing framework, the study has demonstrated these inconsistencies using trade data on Zambia's trade with the rest of the African continent. At the aggregate level, the study has found evidence of a tendency by traders to over-invoice exports and under-invoice imports. This is consistent with evidence from similar empirical contexts in Africa (Nitsch, 2017; Global Financial Integrity, 2018; UNECA, 2018b).

At the country and product levels, the study also found a general tendency to over-invoice exports; although it is important to note that the degree of misinvoicing varies significantly across countries and product categories. For example, a UNCTAD (2016) study found evidence of trade misinvoicing in primary commodities traded by Chile, Cote d'Ivoire, Nigeria, South Africa and Zambia.

The above inconsistencies may be a reflection of the inadequate domestic capacity in data collection, management and reporting, inadequate coordination with other country-level partner agencies, and the inability to stem deliberate trader-initiated mis-declaration of trade volumes. The lack of capacity to produce high quality trade data may further be a reflection of inadequate funding to reporting and statistical agencies (Adamu et al.,1998).

The inconsistencies significantly undermine the relevance of this data for research and policy purposes. This is particularly critical at a time when there are several attempts, such as the AfCFTA, to increase intra-African trade. The successful formulation, implementation and evaluation of such trade-enhancing initiatives is contingent on the ability of statistical agencies on the continent to produce high quality trade statistics.

Conclusion and Policy Implications

Trade is an important engine for economic growth and development. However, the data on which a significant body of empirical research, policies and trade arrangements are based, are often inconsistent and of poor quality and, therefore, unreliable. These problems of trade data are documented in, among other things, the misinvoicing literature.

Thus, this study sought to document the inconsistency and inferior quality of African trade statistics by analysing the extent of trade mis-invoicing in Zambia's trade with the rest of Africa. The analysis, focusing on three classes of products (food, beverages and tobacco; textiles and clothing; and base metals), was conducted at the aggregate, country, and product level. For the product classes of interest, our study documents the tendency to over-invoice exports and under-invoice imports. However, the study found wide variations in the extent of trade misinvoicing across products and countries.

The poor trade data may imply poor quality of research output and policy-making. In the trade liberalisation era, the need for high quality trade data to inform constantly evolving regional and continental trade arrangements is more urgent than ever. In order to improve the quality of trade data, one can suggest the following interventions. Firstly, there is need to increase funding to and coordination between local statistical and other relevant data reporting agencies. This is to increase their ability to collect timely data and detect illicit trade flows. Secondly, there should be increased coordination between domestic and partner country-level data collection agencies; and lastly policy makers should encourage open collaboration between data collection agencies and users as a mechanism for validating the quality of trade data.

End notes

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