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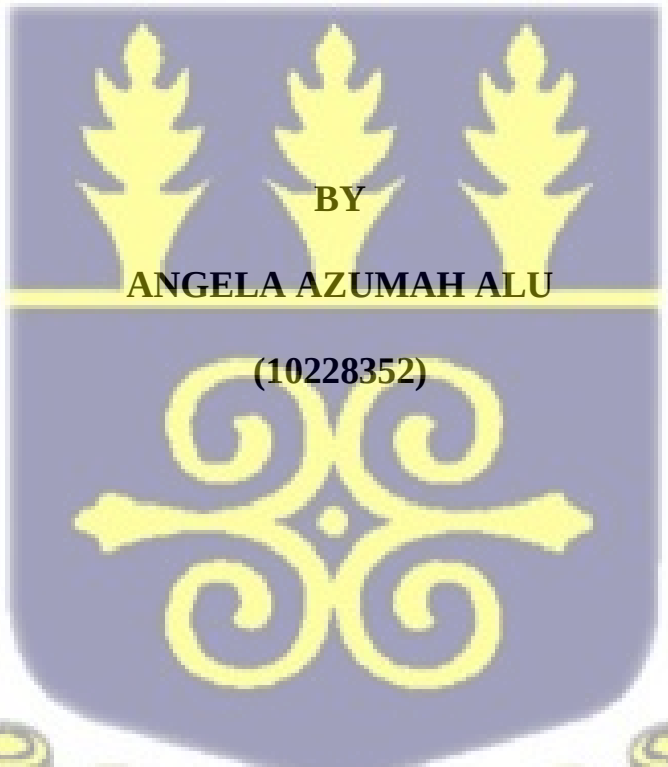
TRADE MIS-INVOICING AND ABUSIVE TRANSFER PRICING IN GHANA'S COMMODITY SECTOR



BY

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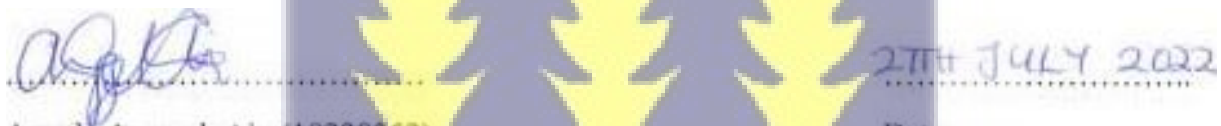
DECLARATION

I, Angela Azumah Alu, do hereby declare that this thesis is a result of my own work and has not been presented to any other academic institution. All references in the work have been duly acknowledged. I also declare my full responsibility for any shortcomings in the document.

I acknowledge that the value chain analysis and estimates of trade mis-invoicing for gold and cocoa were co-authored with Dr. Ama A. Ahene-Codjoe and Dr. Rahul Mehrotra under the Curbing IFFs project.



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CERTIFICATION

We hereby certify that this thesis was supervised in accordance with procedures laid down by the University of Ghana.

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DEDICATION

I dedicate this work to everyone who has supported me throughout my educational pursuits, especially my parents.

ACKNOWLEDGEMENT

I extend my sincerest appreciation to the Almighty God for the gift of life, family, strength, and all the graces needed for this journey; I am eternally grateful to Him for everything. My greatest appreciation goes to my family, especially my parents, for supporting me throughout the process.

Many people and institutions have provided support in one way or another for this thesis. To mention everyone by name would be to run the risk of creating a document longer than the thesis itself. I therefore extend my sincerest appreciation to everyone who has in one way or the other contributed to this work and to my PhD journey. I am very thankful for your support, encouragement, prayers and love and say thank you and God bless you.

ABSTRACT

This thesis contributes to the limited empirical analysis of the volumes of Illicit Financial Flows (IFFs) through trade mis-invoicing recorded in exports from Ghana. The thesis examines the volumes of illicit financial flows through trade mis-invoicing in five top export commodities of Ghana, namely: gold, cocoa beans, cocoa paste, bauxite, and manganese. It answers the questions of what the value chains and the risks for IFFs for those commodities are, how much trade mis-invoicing there is in these important export commodities and what the determinants for trade mis-invoicing are in those commodities.

The study uses the Partner Country Trade Gap (PCTG) method to measure trade mis-invoicing with macro macro-level statistics from the UN COMTRADE Database as an initial step to determine the presence of trade mis-invoicing, followed by the Price Filter Method, which has been shown to provide more accurate estimates of IFFs due to the use of transaction transaction-level data. The thesis employs transaction-level data from the Customs Division of the Ghana Revenue Authority in generating the estimates of trade mis-invoicing for the Price Filter Method. The study ends with a regression analysis of the determinants of IFFs in the selected commodities.

The value chain analyses of the commodities show that risks for IFFs arise mainly from transfer pricing due to multinational firms' international trade operations. Other risk factors include artisanal, small-scale, and informal firms, regulatory infrastructure for verifying export valuation and transit trade from neighbouring countries.

The estimates of trade mis-invoicing generated using the transaction level data from Ghana Customs with the price filter methods indicate that: 18.87% of bauxite exports, 11% of gold exports, 7.2% of cocoa paste exports, 1% of cocoa bean exports and 0.65% of manganese exports were undervalued while 0.2%, 0.9% 3.2%, 4.7% and 2.4% of gold, cocoa beans, cocoa paste, bauxite and manganese exports respectively were over-valued from 2011 to 2017. Overall, the results indicate the presence of trade mis-invoicing in Ghana's commodity exports.

In analyzing the determinants of trade mis-invoicing in the selected commodities, the study finds that for undervaluation, GDP growth, Current Account Balance and the Exchange Rate have some influence while the Current Account Balance, Inflation, Tax Differential, GDP growth, Transfer Pricing Risk and Transfer Pricing Rank have some influence in the overvaluation observed.

The study has the following policy implications. First, it recommends that policymakers need to prioritize the development of institutional expertise to map, control and block the sources of the resulting tax base erosion as a result of trade mis-invoicing. Second, there is a need to improve data collection capacity of the various institutions engaged in the export of these commodities, greater co-operation among the various institutions in these sectors to reconcile data collected and constant skills improvement of personnel of these units. Finally, information and communication technology tools, especially computers, relevant software and access to critical databases also need to be upgraded to match those of the private sector actors in order to ease tax assessments and payments tracking.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

It is important to build robust domestic fiscal and financial systems and improve domestic revenue mobilisation to finance the development agenda of African countries sustainably (African Economic Outlook, 2010). Domestic resource utilization can be strengthened by expanding the tax base and enhancing tax management in developing countries. To improve tax collection, leakages within the tax collection system should be plugged, especially precarious leakages that have been exposed recently; that is, the loss of tax revenue due to Illicit Financial Flows (IFFs). For example, the High-Level Panel on IFFs estimated that Africa loses approximately USD 50 billion annually through trade mis-invoicing (UNECA, 2015).

Similarly, Global Financial Integrity in 2017 estimated that trade mis-invoicing from developing countries could potentially equal USD 1 trillion. The funds lost through IFFs are a potential source of revenue mobilisation from Africa's domestic resources, which could potentially have positive effects on Africa's development agenda (Abor 2014). This is especially true of recent international economic trends, which signal that dependence on development aid is no longer a sustainable choice for developing countries (United Nations Economic Commission for Africa, 2015).

In general, IFFs refer to illicit or illegal transfers of funds or capital from one country to another. The Organisation for Economic Co-operation and Development (OECD, 2014) defines IFFs as financial resources generated outside of a country in violation of national or foreign legislation by processes and procedures or through crime. IFFs can include funds of criminal origin such as

proceeds from crime (including corruption), funds with criminal intent such as bribery, terrorist funding and conflict funding, tax evasion funds, payments to, from, or for organisations subject to financing penalties and money-laundering / counter-terrorist financing payments. The World Bank (2016) defines IFFs as "money illegally earned, transferred, or used that crosses borders". The term encapsulates international funds transfers generated through bribery, tax evasion and illegal markets.

Similarly, according to Kar and Freitas (2012), IFFs refer to money received, moved or used in breach of current legislation. Some studies approach the problem by describing IFFs not by behaviour but by adverse effects. For example, Blankenburg and Kahn (2012) consider any financial activity which damages the economy as part of IFFs, creating a slightly vague meaning which could include many borderline activities between legal and illegal.

The term IFFs is a relatively new concept (World Bank, 2016) which emerged to bring together previously unconnected issues concerning resources, strategies, illegal activities aimed at moving funds and properties across national boundaries in contravention of foreign or national laws (Goredema, 2011). There is still no consensus about what actions these and other illegal activities represent (World Bank, 2016). Despite the general agreement on using this relatively new term, there is a lack of consensus in literature regarding the sources of the IFFs. Most researchers agree that money earned from crime (illegal activities) or money legally earned but illegally used, such as terrorist funding or illegal transfers, should be included within this term. The current literature includes numerous sources of money originating from illegal activities such as corruption, illicit activities (including organised crimes), and unfair trading practices such as customs bribery,

mispricing and tax avoidance (Baker, 2014). There are also other classifications of IFFs. Jansky (2013), for instance, splits IFFs into three groups: illegal (criminal) flows individual illicit flows and corporate (commercial) illicit flows.

IFFs are of policy importance because it drains developing countries' capital and tax revenue (Reuter, 2017). Over the last 50 years, Africa is estimated to have lost more than USD 1 trillion through IFFs (see Kar & Cartwright-Smith, 2010; Kar & Leblanc, 2013). This amount roughly equals all official African development funding in the same timeframe. Also, the decisions by multinational corporations to transfer profits from high tax jurisdictions to low tax jurisdictions leads to reductions in tax revenue for the affected states which are predominantly developing economies characterised by high taxes (Shaxson, 2012). Furthermore, by illegally transferring these assets away from the government, tax evaders, corrupt officials, or criminals can better defend themselves against prosecution.

IFFs, however, do more than just plunder a nation. According to Shaxson (2012), IFFs constitute a major threat to the progressive realization of human rights. This is because they threaten every fundamental aspect of a country's growth and development. It is assumed that if the elite and other leaders of a nation can keep a lot of their wealth outside the country, they may tend to have less incentive to ensure the development of property rights, which is a crucial element of the rule of law. Furthermore, when it becomes public knowledge that the wealthy are moving their wealth out of the country, broader public trust is eroded.

According to United Nations Economic Commission for Africa (2015), IFFs are becoming a danger to sustainable development and are presently one of the most significant obstacles to global growth since they undermine economic growth and trade, also deprive governments of financial resources which could have been used in the provision of public goods including healthcare, education and infrastructure. In institutionally weak and emerging countries, IFFs are especially prevalent and destructive since they appear to exploit and aggravate vulnerabilities in public institutions, weaken governance and empower those outside that law.

Trade mis-invoicing is a type of fraudulent activity involving exporters and importers who deliberately misreport, in a commercial transaction, the value, quantity or nature of goods or services meant to be transferred to or from another destination. Estimates of trade mis-invoicing are closely linked to the term IFFs as both were popularised by Global Financial Integrity (GFI) (Forstater 2018). Trade mis-invoicing is a major channel for illegal financial flows such as capital flight and money laundering, tax avoidance and the elimination of duty. It occurs when the value of the transaction declared by the customs agency differs from the value of a non-binding export or import transaction (Hong & Pak 2017). There are four basic categories of trade mis-invoicing: import under-invoicing, import over-invoicing, export under-invoicing and export over-invoicing. Trade mis-invoicing, which is illegal, happens when traders under-invoice or over-invoice export or import for the purpose of tax evasion or capital flight. When this happens, the economy is stripped of national resources that could otherwise have been used domestically or exported overseas for revenue inflows. This causes a decline in economic growth because capital is not made available. Additionally, the lack of revenue also implies that the economy does not have the available resources to improve social services (Qureshi & Mahmood, 2016).

According to Kar and Cartwright Smith (2010), commercial activities of companies (through mis-invoicing and abusive transfer pricing) account for 65% of IFFs, while criminal activities account for 30% and bribery and corruption account for 5% of IFFs. Given these percentages, there is quite a focus on trade mis-invoicing and abusive transfer pricing. According to the High-Level Panel report on Africa's IFFs, more than 54% of Africa's IFFs are due to trade mis-invoicing, estimated at USD 407 billion over the ten-year period from 2001 and 2010 (UNECA, 2015). Global Financial Integrity (GFI) also estimates that trade mis-invoicing makes up over 80% of illicit outflows (Baker 2014). Trade mis-invoicing is the primary method used in IFFs, including capital flight (Kar & Freitas, 2012). It is therefore important to correctly estimate the degree of trade mis-invoicing to determine its contribution to IFFs and losses in tax and duty income in a country of interest.

In recent years the awareness of trade mis-invoicing has grown, thereby necessitating research to provide further insights into the scale of IFFs and their implications for lost revenue within the framework of the current global agenda on development funding and mobilisation of domestic resources. Most empirical studies (see de Boyrie, Nelson & Pak, 2007; Baker 2014) have focused on the analysis of estimates of illegal capital flows from developing countries through import over-invoicing and export under-invoicing, vis-à-vis their developing country trading partners and worldwide often generating aggregate figures. However, the measurement of trade mis-invoicing remains a challenge.

Trade mis-invoicing has mainly been measured using the Partner Country Trade Gap (PCTG) Method, developed by Bhagwati (1964a). This methodology operates on the principle of a trade

discrepancy. In international trade transactions, the data reported by one country is expected to be the same as the data reported by the other partner country after adjusting for transportation and insurance expenses. In certain instances, this does not occur for specific reasons. Choi and McGuaran (2018) noted that trade differences in trading data could occur simply on statistical and logistical grounds. For example, the difference in CIF/FOB ratio, incoterms, attribution of trade partner, Foreign Exchange rate, time, low-value thresholds between trade partners and any adjustments to the import customs value to be made under Article 8 of the Agreement on Implementation of Article VII of the GATT 1994. Also, discrepancies could arise in international trade transactions from transit trade, commodity processing and re-exports (Nitsch, 2016). Although trade mis-invoicing has also been identified as one reason for discrepancies in bilateral trade data, the estimates generated from the PCTG method have mainly been criticized for being "guesstimates" and for over-estimating the magnitudes of trade mis-invoicing (Nitsch 2016; Collin 2020; Marur 2019).

In addition, trade mis-invoicing of funds may be influenced by factors such as the real interest rate that reflects the expected return on capital spending in the economy as well as the corporate tax rate (Tandon & Rao, 2017). Also, the economic conditions of either the exporting country or the importing country may cause trade mis-invoicing. For instance, if the exporting country's interest rate is higher than the rest of the world, trade mis-invoicing may help to encourage inflows into the nation.

A similar but related thread is abusive transfer pricing. Thomas (1971) pioneered the discussions on transfer pricing. The transfer price is the transaction rate between two entities belonging to the

same business group. For example, on behalf of its Ghanaian subsidiary, a South African company might supply mining equipment or machinery and charge a service fee. The price agreed upon is the "transfer price," and the process for setting it is referred to as "transfer pricing" (Readhead, 2016). Transfer pricing affects transaction pricing between associated companies. An associated business in this sense refers to a parent, a trustee or a partnership where the entity is a partnership that controls at least 50% of the rights to the income or capital of the partnership and an enterprise managed by the person alone or with other associates. However, this transfer price can sometimes be abused, and this is referred to as abusive transfer pricing.

According to African Economic Outlook (2012), a provision for many Multinational Companies (MNC) subsidiaries and countries in developing and emerging markets, which requires strict secrecy, is one of the most significant challenges to the natural resource sector. This creates an atmosphere of secrecy where accounting laws can be abused with tax avoidance. MNCs in the field of natural resources are also more discreet than others. Accordingly, there is a common assumption that natural resource-rich developing countries do not benefit from the amount of tax they can earn from the industry itself. This goes deeper than a clear explanation of the lack of potential of developing countries.

In developing countries, there is an absence of effective and complementary regulations on transactions, thus enabling the climate for coercive pricing by manipulating the transfer price. Although the problems of price transfer manipulation affect all industries, mining natural resources can be particularly troublesome and can also be a refuge for corruption and other illegal activities (McLennan, 2012).

Another similar concept is profit-shifting. Generally, the literature defines profit shifting as a systemic benefit shift among MNC members to decrease global taxes payments (Schimanski, 2018). In the light of UN sustainable development goals 16.4 and 17.1, a reduction in profit-shifting is also considered a highly important area of study, considering that a significant reduction in illegal financial flows could enhance the mobilisation of domestic income (Schimanski, 2018).

Given the importance of tax revenue to developing countries such as Ghana in meeting their developmental goals, it is very necessary to have accurate estimates of the magnitudes of IFFs through trade-based mis-invoicing and the resultant revenue and economic losses in order to understand what actions need to be taken to curtail the loss of revenue through IFFs. In addition, there is a need to understand the factors influencing trade-based mis-invoicing.

1.2 STATEMENT OF THE PROBLEM

IFFs are a bane of developing countries because they divert critical resources for developmental projects. This has become even more critical as traditional sources of development finance, such as Official Development Assistance (ODA), are dwindling following the global financial crisis and other challenges facing developed countries. For instance, aid from OECD countries decreased by 2.7% in 2011 compared to 2010 because of the global financial crisis. Bilateral aid to sub-Saharan Africa also fell by 0.9% (28 billion USD in real terms). In comparison, bilateral ODA to the group of Least Developed Countries fell by 8.9% (USD 27.7 in real terms) billion during the same period (Balma, Bawumia & Ncube, 2018).

Reducing IFFs could make more resources available for financing the Sustainable Development Goals (SDGs). This is particularly important because most SDG funding is expected to come from

domestic resources. Indeed, one of the SDGs (goal 16:4) is to reduce illegal financial flows significantly, increase stolen asset recovery and returns and counter all types of organised crime by 2030. It also seeks to improve domestic revenue mobilisation (Goal 17.1). A study by the United Nations Economic Commission for Africa (2015) found that IFFs tend to be more prevalent in the extractives and commodity sectors. This makes it imperative to accurately identify the sources of IFFs and measure their magnitude to be able to introduce the needed policy measures to curb IFFs and improve domestic revenue mobilisation.

Although seemingly neglected in IFFs studies on Africa, Ghana is a country of interest as far as IFFs are concerned because of its rich natural resources and fast-growing economy. The country is endowed with natural resources such as cocoa, gold, bauxite, manganese, petroleum, cashew, timber and coffee. Ghana is also the second leading producer of cocoa in the world and the leading producer of gold in Africa. The country relies heavily on export revenue from these commodities and others, and as such is vulnerable to trade mis-invoicing incidents. In 2017, the mining sector contributed 16.30% to government revenue in the form of domestic tax and 43% of total merchandise exports (Ghana Chamber of Mines, 2018). According to Abor (2014), Ghana is reported to be among the top ten countries in Africa with high levels of IFFs. However, only a few studies have focused on Ghana, including Baker (2014), which estimated trade mis-invoicing in Ghana using the PCTG method with data from UN COMTRADE. Hence this thesis focuses on five of Ghana's top export commodities. Gold, bauxite and manganese are among Ghana's top export commodities and as extractives, tend to be vulnerable to IFFs (UNECA 2015). Cocoa beans and cocoa paste are also chosen because of their economic significance: Ghana is the second

leading producer of cocoa beans in the world while cocoa paste is Ghana's top Non-Traditional Export commodity.

Some studies have measured trade mis-invoicing using varying approaches with limitations. They focused on measuring trade mis-invoicing using the Partner Country Trade Gap (PCTG) Method. The PCTG Method, first developed by Bhagwati (1964b), is based on the concept that what one country exports should equal what is imported by the partner country after adjusting for transportation and insurance costs. Any discrepancy is assumed to be indicative of trade mis-invoicing.

In 2015, United Nations Economic Commission for Africa estimated IFFs losses in five African countries, while a study by Global Financial Integrity also estimated trade mis-invoicing in five developing countries using the PCTG method (Baker 2014). Other studies include Marur (2019) generated PCTG estimates for cocoa and gold from Ghana and copper and coffee from Laos; Mehrotra and Carbonnier (2020) for Switzerland as a trading hub and Nolintha et al. (2020) for Laos as an exporting country. Baker (2014) estimated that Ghana loses about USD 1 billion annually through trade mis-invoicing using the Partner Country Trade Gap (PCTG) Method.

Typically, studies that have used the PCTG method of 10% for transportation costs which is one of the acceptable reasons for trade gaps. However, the 10% has been criticised as being arbitrarily chosen (see De Wulf, (1981); Nitsch, (2016); Hong &Pak, (2017); Marur (2019)), hence the need for better, more informed estimates. According to Reuter (2012), GFI and other institutions' work is intended to encourage academic researchers, the International Monetary Fund (IMF), the World

Bank, and other interested parties to collect more reliable and complete data in order to develop more robust evaluation methods. National trade data estimates are considered inadequate because they do not fully present the volumes attributable to trade mis-invoicing based on the limitations of the PCTG methodology. As such, commodity-level data, or ideally transaction-level information, are needed for generating the right volumes of trade mis-invoicing (Cobham &Jansky 2017).

The criticisms of the PCTG method led other authors such as Pak and Zdanowicz (1994) and Hong et al. (2014) to develop the price filter method to measure trade mis-invoicing at the micro-level using transaction-level data. The methodology incorporates the arm's length price range which utilizes free-market prices of the commodities as the arm's length price and the Inter-Quartile Range (IQR) filter, which utilises a statistical range as the arm's length price.

The free-market arm's length price methodology is based on the World Trade Organization's Transaction Value methods for customs valuation and the Comparable Uncontrolled Price (CUP) method for transfer pricing analysis of trade between related firms (Platform for Collaboration on Tax, 2017; United Nations, 2017). This methodology has been used in some studies to measure trade mis-invoicing. These studies include Pak and Zdanowicz (1994), Hong et al. (2014), and Hong and Pak (2017). However, these studies used a 10% filter to generate their estimates of trade mis-invoicing using the arm's length price range of the price filter method. Hong et al. (2014), in a study on the US Banana trade, recommended the choice of 10% as an area for future research. In this thesis, extensive commodity research was used to choose the price filters for the arm's length price range rather than the arbitrary 10% commonly used.

The IQR filter presupposes those transactions falling between the 25th and 75th percentiles of a commodity's distribution represent normal prices. In contrast, any transactions outside of this range would be considered trade mis-invoicing, i.e. undervaluation or overvaluation. This method is suitable for commodities traded without reference to a single benchmark price. Since the IQR is calculated endogenously using the observed distribution of export prices, this method directly assumes the presence of under and over-valuation in the trade statistics. However, it provides useful insights from a risk analysis perspective by identifying exporters and trade partners who consistently appear in the extreme tails of the products' observed price distribution (Zdanowicz et al., 1999; Pak et al., 2003; De Boyrie et al., 2005; Hong & Pak, 2017). The OECD Transfer Pricing Guidelines recommend using the interquartile range (OECD, 2017). In addition, the thesis examines the determinants of trade mis-invoicing in Ghana.

To summarize, this study adds to literature by examining trade mis-invoicing in Ghana from a commodity-level perspective as follows; first, by analyzing the value chains of the commodities to identify the risks for IFFs in the commodities, second using different methods to measure trade mis-invoicing with data from the UN COMTRADE and the Ghana Revenue Authority, and finally examining the determinants of trade mis-invoicing. The commodities chosen are gold, cocoa beans, cocoa paste, bauxite and manganese.

1.3 RESEARCH OBJECTIVES

The main objective of this study is to examine trade mis-invoicing and transfer pricing in Ghana's commodity markets.

Specifically, the objectives of the study are:

i. to analyze the value chains of the gold, cocoa, bauxite and manganese commodity sectors and identify the risks for trade mis-invoicing and transfer pricing along the value chains

ii. to estimate trade mis-invoicing in Ghana's commodity sector using the Partner Country Trade Gap Method and the Price Filter Method, and

iii. to investigate the determinants of trade mis-invoicing in the commodity sector in Ghana.

1.4 STRUCTURE OF THE THESIS

The thesis is structured into five chapters. Chapter one presents the background to the study, the problem statement and research objectives of the study. Chapter two is the literature review chapter. It reviews relevant extant literature while chapter three presents the empirical methodologies and the data sources used. Chapter four presents the results and analysis obtained from the study and chapter five provides the summary of findings, conclusions, contributions of the study, policy recommendations, as well as limitations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews literature relevant to the study. The literature discussed in this chapter includes a theoretical overview of international trade. It further examines various concepts such as trade discrepancy and the arm's length principle, explains trade mis-invoicing and the various ways of measuring trade mis-invoicing and ends with the determinants of trade mis-invoicing. Various sub-themes are discussed to appreciate the state of the extant literature on IFFs while making way for the useful additions made by this study.

2.2.1 Mercantilism and Standard Theory

International trade before the nineteenth century strikingly displays a movement of the factors of production underlying, requisite to and proceeding out of the anticipation of profits to be made by international extension of markets and raw materials. Mercantilism was the main economic structure in many industrial nations from the sixteenth to the eighteenth centuries. The Mercantilist approach to foreign trade believed that a country's prosperity was mainly measured by its ownership of metals such as gold and silver. These metals were obtained by promoting exports and encouraging metal discoveries in the Americas, thus suppressing imports by introducing unnecessary tariffs (Peukert, 2012). After nearly 300 years of insecurity and economic failure, what became known as the Standard Theory of International Trade severely criticised mercantilism (Wilson, 1959). The Standard Theory's development can be traced back to 1776 and 1817, when Adam Smith's Wealth of Nations (Smith, 1776) and David Ricardo's Principles of Political Economy and Taxation (Ricardo, 1817a) were published. These two publications signalled the

formulation of a theory of free trade, given England's exceptional success in the respective fields of industry and trade (Sen, 2010).

The Standard Trade Theory relates merchandise to actual exchange rate fluctuations using a straightforward, common-sense method in which all other variables are kept constant. The value and amount of trade are also affected by exchange rate fluctuations. As a result, if the home country's real exchange rate rises, resulting in real depreciation, households receive less imported goods in exchange for a unit of domestic goods and services. This implies that a unit of imported goods would yield more domestic goods. Domestic households will ultimately buy few imports, while foreign households will buy comparatively more domestic goods. Finally, the greater the actual exchange rate of the home country, the greater the country's trade surplus (Zhang, 2008).

Lerner (1944) expanded traditional trade theory by incorporating the demand price elasticities of imports and exports as instrumental elements in calculating the impact of actual exchange rate fluctuations on the trade balance. As a result, an increase in exports and a decline in imports as a result of a depreciation in the real exchange rate does not always suggest a reduction in the trade balance deficit. According to Lerner (1944), the trade balance is concerned with the actual prices of tangible products rather than their number.

2.2.2 The Classical Trade Theory and Factor Proportion Theory

According to classical trade theory, the degree to which a country exports and imports is related to its trading pattern with other countries. That is, countries will benefit if each devotes resources to the development of products and services in which they have a comparative advantage (Ricardo,

1817b; Smith, 1776). As a consequence, classical trade theory essentially explains the situation in which a country produces goods and services in which it has an advantage for domestic consumption and then exports the surplus. As a result, it makes sense for countries to export products and services in which they have a comparative advantage. Comparative advantages/disadvantages can result from differences in factors such as resource endowment, labor, capital, technology, or entrepreneurship between countries. Thus, according to classical trade theory, the basis for foreign trade can be traced back to disparities in commodity characteristics and resource endowments, which are centered on domestic differences in natural and acquired economic advantages.

In comparison to classical trade theory, factor proportion theory may clarify the disparities in benefit shown by trading countries. As said by this theory, countries will strive to produce and export goods and services that harness large amounts of abundant production factors that they possess, while importing goods and services that involve large amounts of relatively scarce production factors (Hecksher & Ohlin, 1933).

As a result, this principle broadens the idea of economic benefit by taking into account the endowment and costs of production factors. However, both of these hypotheses have been shown to be ineffective in understanding more recent trends of foreign trade. For example, the 1960s saw major technological change and the rise of multinational companies, triggering a demand for new theories of foreign trade to represent evolving commercial realities (Leontief, 1966). The product life cycle theory of international trade was found to be a valuable framework for understanding and forecasting international trade trends as well as multinational business expansion at the time.

According to this theory, a trade cycle occurs when a commodity is made by a parent company, then by its international subsidiaries, and eventually anywhere in the world where prices are at their lowest (Vernon, 1966, 1971; Wells, 1968, 1969). It also explains how a product can begin as a country's export and progress through the life cycle to become an import. The essence of the international product life cycle is that technological progress and market growth are important factors in explaining international trade trends. That is, technology plays an important role in the creation and development of new goods, while market size and structure have an effect on the degree and form of foreign trade.

2.2.3 The Heckscher–Ohlin (H-O) Theory

The Heckscher–Ohlin (H-O) theory explains the source of international productivity differences: the driving factor that determines comparative advantage and the pattern of international trade. Two Swedish economists, Heckscher (1919) and Ohlin (1933) extended the Ricardian trade model into what is now known as the Heckscher–Ohlin (H-O) theory by introducing one more input, namely, capital, in addition to labour in the Smithian and Ricardian models. Heckscher and Ohlin argued that comparative advantage arises from differences in national resources or factor endowments. As a result, the more abundant a factor is, the lower its cost, giving the country a tendency to follow a production process that heavily relies on the relatively abundant factor. The H-O model predicts that countries will export goods that make intensive use of locally abundant factors and import goods that make intensive use of locally scarce factors, based on the assumption that different commodities need different intensities of factor inputs in their production. In summary, capital-rich countries such as the United States of America and other industrial

economies should export capital-intensive goods, whereas labour-rich countries such as Ghana and other developing economies should export labour-intensive goods (Hill, 2009; Salvatore, 1998).

In effect, the now famous Heckscher-Ohlin paradigm and the analysis of Mundell (1957a) provides a reference for studying the interaction of trade integration and capital mobility. In the classical Heckscher-Ohlin-Mundell (HOM), two-goods, two-factor framework and free trade lead to factor price equalisation with the rest of the world. Once factor price equalisation has materialised, the mobility of international capital becomes irrelevant. For example, consider two countries with different levels of capital endowment. If the two countries can trade with each other, there is no need for capital to flow from the capital-rich to the capital-scare country because rate of return disparities can be reduced by trade alone. As a consequence, global trade and capital flows function as substitutes. Several contributions, however, have introduced more practical features to the basic HOM framework, ranging from technical differences (Kemp, 1966; Jones, 1967) to production uncertainty (Helpman & Razin, 1978). Under these changes, trade and factor flows may be supplemented, with causality running from foreign capital to trade flows. Markusen (1983) shows that the finding of Mundell (1957b) is an exception rather than the rule, since Mundell concludes that trade in products and factor flows behave as complements in general by comparing multiple models and modeling assumptions.

Furthermore, recent contributions aim to integrate financial frictions into macroeconomic dynamics in order to model the trade-finance nexus. For instance, Antràs and Caballero (2009) forcefully argue that capital and trade flows are complements. In their model, greater trade integration leads to greater capital inflows to the capital-scarce region, as compared to previous

research that found a causal correlation between trade and foreign capital flows. Other modeling approaches provide a correlation between trade and capital flows and the maturity level of financial institutions. Furusawa and Yanagawa (2013), in their study, emphasize the fact that the less mature financial institutions are, the more trade and capital flows function as complements. Rose and Spiegel (2002) also present a theoretical model based on the argument that countries service their external debts out of fear of a drop in trade. As a result, countries prefer to trade more with countries with which they have stronger financial links. Other research suggests that transaction costs (Portes et al., 2001) or knowledge asymmetries (Hahm & Shin, 2009) contribute to complementarity trade in goods and financial assets.

2.2.4 The Market Imperfections Theory

According to the market imperfections theory, companies are always looking for opportunities. As a result, their decision to invest abroad can be viewed as a means of capitalising on capabilities that their competitors in other countries lack (Hymer, 1970). Market imperfections for goods and factors of production justify firms' capabilities or advantages. According to the principle of perfect competition, companies must produce homogeneous goods and have equal access to production factors. However, imperfect competition is a fact that is embodied in industrial organisation theory. Porter (1985) determines the degree to which companies achieve various types of comparative advantages. Nonetheless, market imperfections theory does not justify why the international output is regarded as the most attractive method of capitalizing on a firm's advantage. Dunning (1980) and Fayerweather (1982) have however addressed this issue and developed what can be described as international production theory.

2.2.5 The International Production Theory

According to international production theory, a firm's proclivity to begin foreign production is determined by the basic attractions of its home country in comparison to the resource implications and advantages of locating in another country. This theory makes it clear that not only do resource differentials and company advantages play a role in deciding overseas investment practices, but that foreign government decisions can have a huge impact on the piecemeal attractiveness and entry conditions for firms. A related element of this foreign investment theory is the idea of internalisation, which has been thoroughly researched by Buckley (1982, 1988) and Buckley and Casson (1976, 1985).

2.2.6 The Internalisation Theory

Internalisation theory is based on the idea that firms strive to create their own internal markets whenever transactions within the business can be completed at a lower cost. Consequently, internalisation entails a form of vertical integration in which new operations and activities, previously carried out by intermediary markets, are brought under the firm's ownership and governance. However, much of the theory used the global corporation as the unit of review and ignored the mechanism that led up to that stage of international growth. In response, a more complex, process-based viewpoint was needed, as well as recognition of the firm's internationalisation.

As Hayes and Abernathy (1980) illustrated in a seminal article, a country's trade deficit performance cannot always be described by macroeconomic phenomena. It must be acknowledged that the entrepreneur plays a role in explaining a country's foreign trading activities. Given that an

economy can consist of many industries housing a diverse range of businesses, it is fair that the position of decision-makers within such organizations may, collectively, provide a significant contribution to economic performance. Compared to the above-mentioned international trade and FDI theories, internationalisation theories attempt to understand how and why a company participates in overseas operations and, more specifically, how the complex essence of such behavior can be conceptualised. Despite the fact that the word "internationalisation" has been widely used, few genuine attempts have been made to provide an operational sense of its meaning. Piercy (1981) and Turnbull (1985) describe internationalisation as the outward movement of a firm's operations. This term, however, may be expanded to define internationalisation as "...the process of increasing participation in international operations." (Welch & Luostarinen, 1988, p. 36). The above term takes both inward and outward growth of foreign firms into account. The expansion of countertrade, for example, in the form of barter or buy-back arrangements, clearly shows how outward growth is related to inward growth (Huszagh & Huszagh, 1986; Khoury, 1984). The merits of Welch and Luostarinen's (1988) definition have been recognised by others (Young, 1990) because it is a working explanation that is concise and readily interpretable. Furthermore, it is comprehensive enough to account for the many variables associated with international expansion.

Moreover, the internationalisation process of firms has been subject to widespread research attention and empirical investigation (Anderson, 1993). Welch and Luostarinen (1988) have comprehensively reviewed this literature and concluded that "…there is a wide range of potential paths any firm might take in internationalisation" (p. 43). Various approaches and viewpoints have contributed to today's perception of firm internationalisation. To help clarify the systemic and

behavioural issues underlying internationalisation theory, economic, econometric, organisational, marketing, and managerial models, for example, have been developed (Dalli, 1994). Nonetheless, amid such a flurry of interest from such scholars, one approach has generated a substantial body of literature on the topic of internationalisation: exports development.

Given that the firm's export activities are constantly changing, the mode of export behaviour appears to be production (Albaum et al., 1989) and a significant number of studies have used this frame of reference to investigate the complex and evolutionary mechanism of internationalisation of firms. It has been argued that the literature on internationalisation, from the standpoint of export growth, is one of the most advanced and mature areas of expertise in international business (Haar & Ortiz-Buonafina, 1995).

2.2.7 Effects of International Trade

This section reviews the literature on how revenue and tax capacity affect international trade and economic growth and the effects of exports and imports on economic growth.

2.2.7.1 How Revenue and Tax Capacity affect International Trade

Regarding revenue and taxes, and data indicates that the amount of government revenue collected is determined by the taxation capacity of individual countries, the taxation goals set by the authorities, and the willingness of governments to raise revenue. However, the effectiveness of maximising revenue capacity and meeting taxation goals is dependent on a variety of other factors. These factors include the macroeconomic climate, economic structure, and level of growth, as well as administrative ability and tax willingness (Teera & Hudson, 2004). These factors can interact

in various ways at different times and in different countries, resulting in differences in government revenue collection across countries.

Inflation, public debt, and foreign aid are all macroeconomic variables that influence government revenue mobilisation. Inflation in this context is a surrogate measure for the consistency and stability of a country's macroeconomic policies. This reflects its direct impact on tax collection through its effects on consumption, expenditure, and other tax categories (Davoodi & Grigorian, 2007). Higher inflation rates demoralise the public, decreasing tax enforcement and reducing revenue collection (McMahon & Schmidt-Hebbel, 2000). In general, inflation harms government revenue mobilisation.

Furthermore, foreign aid, whether in the form of grants or loans, has an effect on the country's tax effort. The response of the tax effort to increased aid flows can be positive, negative, or zero, depending on the intent of the aid and whether it is a grant or a loan. Since governments are not required to repay grants, they have a negative relationship. Grants eliminate incentives for governments to implement good policies and retain effective structures, resulting in low tax revenues due to tax breaks for influential interest groups and poor tax enforcement, as well as diverting resources away from fixing governance flaws. In theory, a loan that a government promises to repay will induce the government to raise revenue to service the loan (Gupta et al., 2003; Agbeyegbe et al., 2006). Furthermore, the instability of foreign aid has consequences for macroeconomic stability, which can impact the country's tax effort (Gupta, et al. 2003).

Public debt also plays a role in determining the extent to which countries may take advantage of their taxable capacity (Tanzi, 1987). The influence of government debt is determined by its scale and how it is funded. A high public debt necessitates the government raising taxes to service the debt (Teera & Hudson, 2004). As a result, a high public debt has a favorable relationship with existing and future tax levels. However, if the majority of the debt is external, debt servicing causes macroeconomic imbalances that may result in a reduction in taxation. This is due to the fact that servicing international debt necessitates a trade account surplus, which necessitates a reduction in imports.

The economic structure of a country also explains its tax power. The proportions of agriculture and industry in GDP, population size (such as population density and dependency ratio), and urbanisation all represent the economic structure of the country. Agriculture's GDP contribution in developing countries tends to be insignificant due to the general difficulty of taxing agriculture and the government's deliberate provision of tax breaks and/or subsidies to the industry. As a result, the agricultural sector's share is inversely linked to government revenue mobilisation. This is due, in part, to the fact that the agricultural sector in most LDCs is dominated by small farmers, who are notoriously difficult to tax, particularly when a large portion of agriculture is subsistence.

Moreover, most agricultural activities organised in small-scale farming generate limited taxable surpluses (Davoodi & Grigorian, 2007; Suliman, 2005; Agbeyegbe et al., 2006; Khattry & Rao, 2002; Teera & Hudson, 2004)). In general, as agriculture's share of GDP grows, less revenue is received. However, in countries where agricultural products account for a significant proportion of total exports, the relationship may be positive (Agbeyegbe et al., 2006).

Industrial operations, on the other hand, are easier to tax in most countries because company owners keep better records and their activities are concentrated in cities. Unlike the agricultural sector, the manufacturing industry will produce greater surpluses, which benefits the tax base (Teera & Hudson, 2004; Tosun & Abizadeh, 2005). The share of the mining sector is also said to exhibit a positive relationship with tax revenue (Agbeyegbe et al., 2006) however, when resources are correlated with a higher probability of conflict, this relationship may be negative (Agbeyegbe et al., 2006; Ndikumana, 2004).

Population density is also an important factor that controls for the scale effect of the economy. According to economic intuition, if there are economies of scale in tax collection due to fixed administrative costs, then the higher the population density, the higher the taxes raised for a given tax base and tax ratio (Khattry & Rao, 2002; Teera & Hudson, 2004).

2.2.7.2 Exports and Economic Growth

Causality studies yield a wide range of findings about the relationship between exports and economic development (Giles and Williams, (2000); Gries & Redlin (2020)). It is possible to claim that there is no universal agreement on causality and its course in all countries. Indeed, while some researchers conclude that export has a single causal relationship with economic growth, implying that export promotes economic growth (Chow, 1987), others discovered that export has a single causal relationship with economic growth, implying that causality runs from economic growth to export growth (Giles and Williams, 2000). Furthermore, some argue that there is a two-way causal relationship between economic development and export, while others argue that there is none. It can be seen from this that there are primarily four findings about the causality between export and

economic growth based on a large number of country cases. The first is that the chain of causality extends from export to economic development. The second conclusion is that causality runs from economic growth to export. At the same time, the third and fourth argue that there is two-way causality between economic growth and export and that there is no causal link between the two. This demonstrates how broad the theoretical background of causality in this problem is (Chen, 2009).

However, the fundamentals of the export-led growth hypothesis indicate that increasing aggregate exports positively affects economic growth in two ways. Second, aggregate exports add to the country's circular flow of income by rising production levels through the multiplier impact. Furthermore, the level of exports raises foreign exchange receipts, leading to imports of critical inputs into the production system (Öztürk & Acaravcı, 2010). If the factors that affect export are considered, it could be argued that a country's degree of foreign openness in terms of rising competitiveness in domestic markets by increasing productivity and decreasing costs will enable it to increase its exports. Adopting advanced technologies, managerial expertise, and in-depth discovery of foreign markets can also be seen as export-boosting factors. Significantly, one factor that encourages exportation is ensuring adequate capital accumulation in a region, which could be provided by growing capital inflows into the country. As a result, the country is able to increase production with new capital and expand exports with rising economic growth (Temiz & Gökmen 2010).

Even though the relationship between foreign trade and economic growth is studied using either export-led growth or growth-led export approaches, the foregoing claims highlight the role of

importation in the process of exportation and economic growth. As a result, increasing imports may be viewed as a complement to exports. By relying on technology-intensive intermediate products, a country can maintain productivity by fostering the processes of research and development, learning, and technology adaptation. As a result, imports of these intermediate products could serve as the foundation for the production of goods for export, implying a kind of complementarity between imports and exports (Kotil & Konur, 2010).

2.3 TRADE MIS-INVOICING/SOURCES AND TYPES OF TRADE MIS-INVOICING

There is convergence in the literature regarding the definition of trade mis-invoicing. According to Salomon (2018), trade mis-invoicing refers to voluntary falsification by at least one party to the international transaction of the quantity and/or classification of the goods and services. Similarly, Choi and McGauran (2018) argue that trade mis-invoicing is characterised as dishonest cases in which both importers and exporters misuse or in their customs declarations handle the value (e.g. price, sum or quality) of trading goods. It is a means of moving money illegally across national boundaries. Trade mis-invoicing is typically not observed directly. A negative trade deficit does not automatically mean that there is trade mis-invoicing. A trade gap on its own cannot identify a person responsible. Trade mis-invoicing takes place if the true value of imports and exports differ from the number of exports or imports that the authorities report.

There are a number of ways trade mis-invoicing could occur. However, four (4) broad categories have been highlighted in the literature. These four common trade mis-invoicing categories are import under-invoicing, over-invoicing imports, export under-invoicing and export over-invoicing. Every subcategory of trade mis-invoicing gives the parties concerned many advantages.

The undervaluation of exports includes under-reporting the export amount from a nation to escape taxation on corporate income in the importing country by depositing the difference in value into a foreign account. Similarly, export over-invoicing means reaching the export amount leaving a country that also helps the vendor obtain additional export credits. Companies and individuals may also use this form of trade mis-invoicing to conceal capital flows, to prevent capital controls or scrutiny against the use of money laundering.

On the import side, traders also under-report the import amounts to avoid applicable import tariffs and VATs, which may occur due to the tariff and tax regime on the products. If an importer over-reports its imports, they frequently legitimise the transfer of additional capital under legitimate export payments. The over-invoicing of imports masks capital movements from a region. That could be an asset for capital controls, and a corporation could deduct the amount of production from its report on year-end sales to the government, lowering the taxes it owes to the government.

2.3.1 The Arm's Length Principle

Since 1979, the OECD has been developing practical guidance to implement the arm's length principle. The arm's length principle is the method recommended by the OECD, which in its Model Tax Convention on Income and Capital, adopted the arm's length standard in article 7, related to the business profit, and article 9, on associated enterprises (OECD, 2001). The OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations (thereinafter OECD TPG) are continuously revised and updated with new guidance to deal and manage with the enormous changes and challenges posed by an increasingly globalised economy. This principle has been the subject of five OECD reports in 1979, 1984, 1995 and 2010 (OECD, 2001). The last

update particularly took account of the revision of the guidance on comparability and profit methods and the new guidance on the transfer pricing aspects of business restructurings.

Additionally, the OECD TPG, released in 1995, was the culmination of the efforts made by the international tax community to review the existing standard and adapt them to the modern business world. The OECD Transfer Pricing Guidelines 27 made it clear that transfer pricing should not be confused with tax fraud or tax avoidance, even though transfer pricing transactions may be used for these purposes (Markam, 2004). Also, since transfer pricing may have other purposes aside from tax avoidance, fiscal authorities should not automatically determine that companies with cross-border activity are trying to manipulate profits. Mainly because it is not easy to establish the price market in a precise way. In this context, the Fiscal Affairs Committee of the OECD created a set of rules to reduce the risk of misunderstanding or abuse concerning the taxation of some operations in groups of companies by adopting the so-called arm's length principle.

The arm's length principle is usually applied by comparing the 'conditions' (e.g. price or margin) of a controlled transaction with those of independent transactions. The OECD has set forth a series of accepted methodologies according to Transfer Pricing Guidelines (1995). They are the comparable uncontrolled price (hereafter CUP) method, cost-plus (hereafter CP) method, resale price method, profit split method, and transactional net margin method. Among these methods, the CUP and the CP methods are the two most frequently used regulation rules (Ernst & Young, 2010). Again, the arm's length principle is usually translated into marginal cost pricing in the literature (Kind, Midelfart, & Schjelderup, 2005; Peralta, Wauthy, & van Ypersele, 2006). This is due to the fact that, in order to detect deviations from pricing in practice, tax authorities compare data from

the audited firm to data from comparable transactions between independent buying and selling firms. The general idea is that as long as the audited firm cannot influence the comparable transactions, then the data from either the CUP or the CP method should approximate the independent price of a competitive market. This situation implies that the arm's length principle can be proxied by marginal cost pricing in a competitive market.

Furthermore, the OECD notes in its 1995 study that the key justification for promoting the arm's length principle is to encourage the growth of investment and foreign trade because the principle considers related parties as being in similar tax positions as separate parties, thereby ensuring competitiveness. Furthermore, the OECD 1995 study concluded that the arm's length principle successfully resolved the vast majority of transfer pricing situations (OECD, 2001). However, even though the principle can be viewed as simple, its application has proved difficult (Elliot & Emmanuel, 2002).

In practice, applying the arm's length price has two main weaknesses. Firstly, it is difficult to find equivalent transactions that are the same or identical to evaluate the arm's length price or market price, mainly when dealing with intangibles. Second, various taxpayers and tax authorities can have different conceptions of the best method for determining the arm's length price since different approaches may result in substantially other arm's length prices. The United States transfer pricing guidelines use a range method to define the arm's length price when dealing with this issue. As a result, if the measured price or margin falls within the range of arm's length prices, tax authorities need no adjustment. The arm's length theory is based on the comparability of the same transaction between unrelated parties in the same situation. However, finding this level of sameness condition'

is problematic. As a result, for practical purposes, the theory is interpreted as ‘comparable transactions' between unrelated parties in ‘comparable circumstances.' (Feinschreiber, 2004).

Several tax scholars such as Owens, Hamaekers and Avi-Yonah believe that the arm’s length principle is still relevant and should be used when determining the arm’s length price (Owens, 2005). They argue that the continued presence of the arm's length principle since its implementation more than 70 years ago demonstrates that the principle is adaptable enough to adapt and evolve with current economic situations. This, they say, will continue in the future.

On the other hand, opponents of the arm's length theory contend that it would be impossible to apply in the future because multinational corporations' businesses are so intertwined. They claim this may cause problems under the arm's length principle because MNEs profit from combining some of their corporate functions to decide the price sold from production to sales divisions. Again, maintaining bookkeeping records of corporations' transactions with their associates in- the country would be costly. Another concern related to the arm's length approach's shortcomings is that it would be difficult to apply to cross-border electronic commerce because the OECD Transfer Pricing Guidelines favour conventional transaction-based transfer pricing methodologies (Hellerstein, 1975). In general, global formulary apportionment measures an MNE's total income as a company and divides the benefit among its subsidiaries based on specific formulae (Weiner, 2002). Electronic commerce transactions, for example, are more challenging to track than non-electronic transactions. This is due to the ease with which the server used in electronic commerce transactions can be transferred from one location to another. As a consequence, locating comparable data for such a transaction would be difficult. These issues pose significant challenges,

especially in developed countries with the limited administrative capacity to track transfer prices between associated parties (McLure, 2002).

Many scholars criticise its use as a substitute for the arm's length principle at the global (international) level, claiming that replacing the arm's length principle with global formulary apportionment is not a good solution to transfer pricing issues (Amerkhail, 2002; Engel, 1998; Neilsen et al., 2001). Furthermore, Nielsen et al. (2001) study reveal that the formulary apportionment method does not remove the profit-shifting problem but may increase the practice of profit-shifting by MNEs in oligopolistic competition. Another study by Devine, O'Clock and Seaton (2006) shows the potential for double taxation due to the implementation of different formulary apportionment models.

As a result, the arm's length price is the only concept generally recognised by most countries worldwide in deciding the transaction price between related companies. Supporters of the arm's length approach believe that replacing the arm's length principle would jeopardise international consensus among countries, potentially leading to double taxation (Roin, 2008). The OECD Transfer Pricing Guidelines and the 1979 OECD Report reject using global formulary apportionment to replace the arm's length principle. However, recent developments show that the OECD Transfer Pricing Guidelines' stand on this matter has softened. In its draft revision of the Guidelines, the OECD compromised using formulary apportionment to allocate profits (Bell, 2009).

Furthermore, in 2007, the European Commission approved a five-year pilot project to investigate the use of formulary apportionment within the European Union for small and medium-sized enterprises (Tropin, 2007). Though the OECD guidelines include a variety of methodologies for determining an arm's length price, each method's implementation may result in different arm's length prices. The OECD's preferred approaches, known as traditional methods, focus on similar data from third parties. As a result, MNEs can have the advantage of being able to choose one form over another.

2.4 MEASURING TRADE MIS-INVOICING

It is impossible to directly measure the magnitude of trade mis-invoicing because they conceal in countless trade transactions. Empirical studies have estimated trade mis-invoicing by comparing trade discrepancies using the PCTG method or using the Price Filter Method (World Customs Organization, 2018).

2.4.1 Trade Gaps/Trade Discrepancy

The PCTG method of measuring trade mis-invoicing is based on the concept of trade gaps/trade discrepancy. Further, Choi and McGauran (2018) define trade discrepancy as the difference between the importing country's trade value and the exporting country's value. In fact, trade disparities at the most divided level (i.e. transactional level) may indicate trade mis-invoicing. However, governments are hesitant to exchange data with trading partners due to the sensitive nature of transaction-level data. As an alternative, aggregated trade data from foreign organizations, grouped by the Harmonized System (HS) code and partner countries, has been used to study disparities in trade. However, it should be noted that the variations in commerce could arise from commercial data collection due to statistical and logistical reasons. Accurate trade

mismanagement interventions can and must aid customs authorities' work to curb illicit trading. Export underestimations intend to mask international exchange income, i.e. tax havens. The logic is that if a trade transaction has an abnormal unit price and irreconcilable differences in the trade value ascribed by the trading partner, it would be reasonable to suspect under-valuation or over-valuation.

The concept at the core of the PCTG method is the trade gap. The value of a particular international commercial transaction is described in the discrepancy (if any) separately stated by the two parties. Legitimate reasons for trade discrepancies include the following: the Cost Insurance Freight (CIF) and Free On Board (FOB) ratio, differences between trading partners regarding classification in the harmonized system, attribution of trade partners, foreign exchange rates and timing and low-value thresholds.

2.4.2 The Partner Country Trade Gap (PCTG) Method

The PCTG method was developed by Bhagwati (1964a). It uses mirror statistics whereby one country's exports are another country's imports and should balance out if there is no mis-invoicing. Usually, a 10% filter is allowed to cater for transportation costs. GFI updated this markup from 10% to 6% following updates to the OECD International Transport and Insurance Cost (ITIC) database. (Collin 2020). The PCTG has been widely used to estimate mis-invoicing, especially by institutions such as Global Financial Integrity (GFI).

2.4.2.1 Limitations of the PCTG Method

There have been several criticisms of the PCTG approach. These have been summarized by GFI (2017) as follows:

Incorrect to assume that trade statistics in advanced economies exhibit no mis-invoicing: One fundamental premise of partner country trade statistics is that they consider commercial statistics of developed economies as arms-length values for comparing commercial statistics of developing countries. However, a study by Hong and Pak (2017), using aggregate trade statistics from the IMF DOTS database and transaction-level trade data from customs agencies, show that a significant degree of trade mis-invoicing occurs in advanced economies**.**

Unobserved trade costs: Typically, import transactions are valued at a Cost, Insurance and Freight (CIF) basis. This has to be converted to Free-On-Board (FOB) format used for exports before any trade gaps can be calculated. Unfortunately, because data are usually not reported on transaction costs of trade, adjustments of 10% rule-of-thumb for these transactions are made. The thumb rule is built from a regional export-import gap. It means that a 10% minimum trade cost calculation cannot accurately convert bilateral trade values into all goods, with varying costs of transportation and insurance.

Use of aggregate trade statistics: The literature in this area concentrated on calculating trade deficiencies, using total annual exports and import figures. For some instances, however, bilateral data may not be available between trading partners for all exchanged goods and products, contributing to the creation of highly misleading trade loopholes estimates. However, using aggregate trade loopholes can mask or over-invoice particular goods that cancel the aggregate.

Data unavailability for certain countries, years, or commodities: A comprehensive collection of bilateral trade figures are usually not applicable to all global trading nations for all goods. This can lead to misleading estimates of trade gaps being calculated. For instance, there has been missing data on cocoa exports from Ghana for several years in the International UN COMTRADE database.

Exports and import transactions can be recorded in different years: International trade will take considerable time to complete according to the mode of transport and the distance between trading points. This could lead to the business partners recording the same transaction over various years, while trade gaps are calculated for one year using statistics.

Entrepôt trade: For several goods, the countries of origin and destination reported are reports from middle ports, where transportation is processed until it is eventually transported to its final destination. Furthermore, foreign commodity trading firms may agree to redirect transportation to warehouses to take advantage of arbitrage opportunities emerging when price rates fluctuate. Double accounting is given when transit countries and exporting-importing partners record export and imports that entrepôt ports. For example, some exporters from neighbouring countries, such as Burkina Faso, bring their gold to Ghana for assaying before they export.

Exchange rates used for currency conversion: International traffic transactions occur for certain vehicle currencies like, the US dollar or local currencies. Consequently, if trading partners use different exchange rates to convert trading values into USD, their trading statistics may have gaps.

However, some developed countries maintain multiple exchange-rate regimes that increase the risk of such errors.

Country idiosyncrasies: Countries that agree not to disclose bilateral trade flows for particular goods for specific years may be subject to an estimation of market gaps. Although Switzerland, for example, is a major importer of gold, its international trade in unmanned gold was not recorded until 2012. Also, there are some missing statistics for Ghana's exports in the UN COMTRADE database.

Mis-invoicing, as measured from macroeconomic data, appears to represent a specific cancellation between companies who may be faulted (over-invoicing and under-invoicing). Therefore, the use of aggregate statistics is likely to underestimate the true size of gross capital flow by mis-invoicing (Patnaik, Gupta and Shah 2012).

2.4.3 Price Filter Methods (free-market price filter and interquartile range price filter)

For each Harmonized Commodity Description and Code System (HS code), the price filter methods estimate price filters (price filtering process) as a proxy for prices at arm's length and use price filters to identify suspicious transactions with odd prices, a sign of possible trade mis-invoicing. Trade mis-invoicing occurs when a reported transaction's unit price differs from the transaction's arm-length price. The arm's length purchase price can vary depending on the specific situation of the deal, including contractual conditions, economic circumstances, and the company's business strategies. The method of price filtering is mainly used to estimate trade defaults. The price filter approach can effectively and at a low cost detect unusually priced transactions without

using partner transaction data. This can be used routinely and effectively in computerised real-time tracking of transactions and historical records.

There are two primary methodologies under the price filter analysis. These are the: inter-quartile range filter and the free-market price filter.

2.4.3.1 Free-market price filter

The free-market price filter method compares real unit price levels for a particular commodity with its contemporary free-market price, plus/minus an appropriate price volatility filter, particular trade contracts between firms, commodity types, and various countries' issues. Transactions that vary significantly from bad prices beyond what is explained by fair market fluctuations are either overvalued or undervalued.

The free-market price filter method has one advantage: researchers do not quantify the low price, as the free-market price is readily available. Also, the free-market price filters have some other advantages over the interquartile price filters, such as the following. Unlike the interquartile price filter, the free-market price filter accounts for variation in monthly commodity prices.

The free-market price filter is measured separately from the declared import values, while the prices for inter-quartiles dependent on declared import values are evaluated. Therefore, related party transaction information does not influence the free-market price filter in the import and export database. However, to apply this approach, a free-market price is needed that cannot be readily available, mainly if the commodity market is not developed (Hong et al., 2014).

2.4.3.2 Interquartile Range Price Filter

The inter-quartile price filter assumes that unit prices within the 25th and 75th percentile of the observed distribution of unit prices for a specific commodity denote the arm's length price range. Any transaction that falls above or below this price range is categorized as overvalued or undervalued. Thus, the overvalued transactions are identified by the values declared above the upper-quartile price range whilst the undervalued are those declared below the lower quartile price range.

2.4.3.3 Limitations of the Price Filter Method

According to Reuter (2011) and Carbonnier and Zweynert de Cadena (2015), the study of the price filter based on commercial micro-data is usually intuitive. However, it is still subject to the following methodological limitations:

Endogeneity of the chosen price filter: The lower and upper limits are calculated based on observed trade transactions to determine the interquartile price range. The 25%, and 75% percentiles use implies that 50% of the transactions are abnormally priced. Therefore, as long as each commodity's prices are at least somewhat variable, it will still generate overpriced and underpriced transactions.

Sensitivity to outliers: Because price filters are often calculated using the whole price distribution, a reclassification of transactions from usual to abnormally priced occur as a result of statistical outliers, possibly due to human recording errors and vice versa.

Potentially disproportionate impact of related party transactions: The price filter analyzes cannot differentiate between transactions of related or unrelated entities without clear details on the trading companies. It means that where related parties control foreign trade with an opportunity for deviating from prices at arm's length, the projected interquartile range may be prejudicial.

Product heterogeneity: Price filter analysis typically relies on a high disaggregation level product classification, generally when it is differentiated by the 10-digit HS code point. However, this approach can also wrongly classify high-end products as overpriced, low-end products underrated for goods that are rather heterogeneous concerning quality and prices. In the meantime, costly mid-range transactions may be wrongly listed as legal transactions.

Limitations in product classification system: Whilst most traded goods are described explicitly under the HS scheme, there are also product codes that collect different kinds of products that conform to the current classification. The product classes will produce an indeterminate amount of statistical noise in estimate price filters through a standard study of multiple product subcategories. For example, a catch-all other subcategory is included in a 2009 harmonized tariff schedule 12,581 out of 28,985 product categories.

Quantity faking: Price filter systems through several goods frequently fail to recognise the potential mis-invoicing of amounts instead of values, i.e. the reporting of exchange quantities or the reporting of them. Given that unit prices for transactions are a basis for price filter analysis, the estimates of the exchange market misprice may often vary from or underreport the quantities.

Large quantity transactions with small price differences: Large quantitative transactions in which reported prices only vary by a small margin because prices for the product will stay within the price range of the arm length, whereas the overall mispriced sum may still be significant.

Similarly, Pak (2018) also identified some limitations of the price filter methods as follows: product heterogeneity, different contract information, such as long-term contracts vs short-term or spot transactions, endogeneity in statistical price filter estimation (interquartile price range filter), clerical or tracking errors in data, missing identification of transactions with a large quantity but mispriced by a small margin, and goods with unpredictable price movements. Therefore, since not all the transactions that are priced abnormally are mispriced, customs may need to check commercial records concerning all the suspicious transactions found by price filters. The estimated sum should be treated with reservations when a pricing filter method is used to estimate mis-invoicing amounts because the price filter method may contain false positives and fail to recognise faulty transactions.

Empirically, several studies have used the price filter methodology focusing mainly on the United States due to data availability (Pak et al., 2003; de Boyrie et al., 2005; Hong and Pak, 2017). These studies have examined the magnitude of trade mispricing between America and its trading partners using pricing filter mechanisms to estimate millions of import-export transactions. Zdanowicz et al. (1999) studied examined commerce between Brazil and America to document the quantity of capital flight covered by commerce in mispriced goods. Their findings show that capital flight from Brazil to the USA through a trade mispricing took place in a single year, 1995, of 2-4 billion USD.

Pak et al. (2003) used a similar approach in the Greece-US exchange mispricing study. The authors consider that mispriced transactions have moved from Greece to the United States between USD 132-276 million and from Greece to the other part of the world in 1995 to about USD 5.5 billion. de Boyrie et al. (2005) studying the trade data from 1995-2000 between Switzerland and the USA, revealed that the economic mispricing of USD31 billion was used to transfer the Swiss to the United States. They also analysed the trade between Russia and the United States in imports and exports from 1995-99 to find 7.24 billion US dollars on undercutting Russian exports and 1.68 billion US dollars on over-invoicing Russian imports.

Hong et al. (2014), used interquartile price filters, arm's length price filters, and partner country-mirror data to derive comparative estimates of trade misprice in banana trading with Latin American and Caribbean countries. The authors conclude that although there is little evidence of substantial errors in inter-quartile and partner-country trade studies, the use of free-market, low-cost pricing filters indicated the existence of significant mispricing. The results show that underestimated transactions constitute 54 per cent of US importers' total banana imports reported in 2000-2009.

2.5 DETERMINANTS OF TRADE MIS-INVOICING

It is essential to understand and investigate the determinants of trade mis-invoicing. This is because it is crucial to understand the factors influencing trade mis-invoicing since the resources lost through the trade mis-invoicing could have been used to significantly contribute to economic development. Trade mis-invoicing is a loss of money as these resources leave the country without domestic control, thus reducing the funds required for growth and development. (Yalta & Demir,

2010). Trade mis-invoicing often adversely affects income distribution among many people as a result of moving funds from the jurisdiction of fund creation, escaping relatively high taxes. This inevitably erodes the national fiscal base and reduces public income (Farzanegan, 2009).

There has been exciting literature researching the reasons for trade mis-invoicing by examining the data on bilateral trading partners (for example, Fisman and Wei, 2007), Berger and Nitsch (2008) and Farzanegan (2008). Trade mis-invoicing usually stems from financial benefits, such as gaining a black currency premium or avoiding taxes and tariffs (Buehn & Eichler, 2006).

Several drivers can be grouped under headings such as political, legal and regulatory, economic and financial. Economic and financial drivers may include corporate income tax rates, tax rate differences, indebtedness, Import-Export taxes and duties, capital controls, interest rates and differentials in interest rates, domestic inflation, real effective exchange rate overvaluation (REER), capital account openness, exchange rate regimes, macroeconomic instability, large budget deficits, low growth rates, the spread between foreign and domestic interest rates and real exchange rates. Some political drivers of mispricing include patronage, political freedom, accountability, political instability, corruption and public-sector reforms. In contrast, some legal and regulatory drivers are tax disclosure requirements, transparency initiatives and industry-specific regulations.

The most common cause of illicit financial flows are corruption, fraudulent funds usage and tax evasion. These are therefore mainly a question of governance resulting from weak institutions and insufficient regulatory structures. These include limited access to financial and legal expertise and

misaligned policies on domestic tax and commercial reporting with global requirements. IFFs also thrive in the presence of obsolete knowledge gathering and communication systems and a lack of political will. A business which wishes to transfer capital from a country will underfund its exports, bringing reduced exchange to the government (Patnaik et al., 2012).

One political factor that drives mispricing is corruption. Berger and Nitsch (2012) study the relationship between trade mis-invoicing/mispricing and corruption from 2002 to 2006 for the world's top five importers: the US, Germany, China, the UK and Japan. They conclude that trade mis-invoicing by the partner countries increases with the level of corruption. Corruption would potentially lead to capital flowing out of Canada, distorting the economic and financial systems by enabling individuals to take control by patronage rather than capacity and the prevalence of approved bribes.

According to Pak (2014), trade mis-invoicing is driven by income tax avoidance or evasion, overvalued domestic currency, domestic inflation, import duty avoidance, export incentives, capital flight and money laundering. As IFFs are typically caused by corruption, illegality and tax evasion, they are considered a governance problem resulting from weak institutions and inadequate regulatory infrastructure. These include limited access to financial and legal expertise and misaligned domestic tax and commercial reporting policies with global requirements. They also have outdated systems to collect and exchange information and a lack of political will.

The current literature indicates that poor financial, administrative and legal institutions can abuse discretionary powers (see Bardhan 1997; Andvig et al. 2001; Aidt 2003). Under this situation, IFFs

arise from the will to hide illegally accumulated wealth abroad and not necessarily because of interest rates or macro-economic distortions (Kar and Cartwright-Smith 2008, 2010; Heggstad and Fjeldstad, 2010)

Traditionally, high customs duties (de Boyrie et al. 2007; Boyce and Ndikumana 2001; Beja et al. 2005) is given as a reason for trade mis-invoicing. Patnaik et al. (2012) argue that businesses can understate the actual value of goods while paying higher customs rates or VAT on goods or are subject to quantitative restrictions. To get reduced currency into the country, an enterprise which wants to transfer capital out of the country will under-report its exports. The evidence supports the argument that the strongly linked situation of foreign debt and capital flight occurs due to privileged classes taking money from their countries and dissimulating the profits abroad (Bracking 2003).

Some political drivers of mis-invoicing include patronage, political freedom, accountability, political instability, corruption and public-sector reforms. In contrast, some legal and regulatory drivers are tax disclosure requirements, transparency initiatives and industry-specific regulations.

The root cause of all IFFs is a lack of political will, not inherently bad management practices or capacity limitations. The absence of a political desire to create a legal and efficient state is thriving in tax evasion, mis-invoicing, transfer rates, corruption, and trafficking in persons and drugs. Such effectiveness, including tax systems efficiency, stems from formal and informal institutionalised arrangements or policy settlements that establish the legitimacy of government, encourage prosperity and increase public income. The undertakings of such arrangements is unconstitutional

and illegal. Political leaders and stakeholders must understand that efficient taxation structures are required to provide the state with the necessary resources to ensure that its property rights are protected and that political stability and economic development are fostered. The degree and form of tax avoidance result from a political consensus that taxes and enhances the institutional capacity to do so effectively. This shapes and demonstrates taxpayers' inherent readiness (tax morale) to pay taxes.

Patnaik et al. (2012) finds that in countries with significant commercial flows, capital controls are associated with high trade mis-invoicing. They find that faults are a channel of openness to de facto capital accounts. Capitals switch to international shores in countries with high current-account deficits. A continued current-account deficit manifests economic instability and causes owners of capital to transfer resources to foreign regions. To boost the current account balance, a nation that faces constant current account deficits will take on a devaluation. This can be achieved either by a direct appropriation/nationalisation of private properties or by inflationary taxation. Alternatively, it can internally raise capital by facilitating a private sector switch. In any case, the private sector would be allowed to withdraw its assets from the government's control.

According to some studies (Quereshi and Mahmood 2016; Patnaik et al. 2012), some traders are encouraged by high customs duties to declare their goods a lower value to avoid payment higher tariffs. Highly indebted countries will probably experience more significant capital outflow. Several studies focusing on the African countries, including Khan and Ul-Haque (1985), have shown that the government typically borrows from foreign countries and multilateral agencies, while the private sector shifts money from foreign countries to other countries. Also, disposing of

foreign exchange resources by capital flight creates more demand for foreign debt. Khan and Ul-Haque (1985) also point out that debt countries' residents are expropriated, implying that they can confiscate the government's domestic assets through open nationalisation, taxes, or exchange checks. In contrast, the risks of the like assets held abroad are negligible. Indebtedness is the ratio from the WDI database of external debt to GDP.

Yalta and Demir (2010) examine the extent of trade mis-invoicing for 1970–2007, surveying Turkish exports to its major trading partners. They conclude that exports are not paid, although Chinese imports are over-filled. They also examine the effects on commercial countdowns of customs unions and trade liberalisation policies and conclude that liberalisation policies hurt imports' overall price.

Mahmood (1997) examined data collected for 96 products and imports of six industrialised countries. The significant determinants of import under-invoicing in Pakistan during 1981-88 are investigated. The impacts of import taxes and nontariff import controls are tested: import taxes are perceived to be the highest and have the most significant component with a solid connection to import under-invoices. The rate variable is very relevant and optimistic for import under-invoicing. This is in line with Mahmood (1997) and Patnaik et al. (2012), who find the tariff rate to be highly and positively associated with import under-invoicing in Pakistan and other developing countries.

De Boyrie, Nelson and Pak (2007) examined trade mis-invoicing between 2000 and 2005 from Africa to the USA. The findings indicate a 60 percent rise in defaults, as low export rates encourage tax evasion and money laundering. Higher priced imports make capital flows and can be used for

hiding illegal fees. To boost the current account balance, a nation that faces constant current account deficits will take on a devaluation. Alternatively, it can internally raise capital by facilitating a private sector switch. This can be achieved through direct appropriation/ nationalisation of private assets or inflationary tax-generating seignorage revenue. In either case, the private sector will be encouraged to move its assets outside government control.

Cones (1987) and Williamson (1987) argue that higher GDP growth rates signal the presence of attractive investment opportunities at home which is an incentive for firms to undertake more domestic investment. This reduces the incentive to mis-invoice and send capital abroad.

2.6 ABUSIVE TRANSFER PRICING/TRANSFER MISPRICING

Transfer mispricing is a form of mis-invoicing by similar parties in different countries, such as different multinational corporate industries (Wang, 2007). In this way, companies can pass income to low-tax countries from their home country and avoid higher tariffs. The transfer price concerns the pricing of transactions between associated companies (OECD, 2010). The related business refers to an individual's parent, partner, trustee of a trust, a partnership in which the person is a partner and that controls at least 50% of the rights to the income or capital of the association and a company managed on its own or by other partners. Transfer prices are a method of price determination for products or services exchanged between parts of companies' multinational groups.

Transfer pricing is often used Multi National when interests travel through numerous jurisdictions in Multi National Company (MNC) functions. It is normally usually seen as a reaction to external

pressures, such as government regulations (Eden, 2012). The 'over-or under-invoicing' of such transfer prices is an abuse of such a mechanism. Manipulating the transfer price is an illegal flow that jeopardises developing states' capacity to establish capable and legitimate institutions. The transfer price must be understandable to determine Transfer Price Manipulation (TPM).

Hirschleifer (1956) provides one of the first extensive transfer pricing assessments. It argues from a rigorous neo-liberal perspective that transfers between international affiliates must react rationally and efficiently to market conditions and that transfer prices must comply with the rules of fully comparative markets. Whilst he acknowledges that there are no completely open markets, he prescribes transfer prices under more rational assumptions. In the words of Hirschleifer (1956), only if the product being transferred is produced in a comparative market, i.e. comparative in the theoretical sense, is the correct market price transference only if the single producer considers itself as being big enough to control demand through its own decisions concerning production. Suppose the need is unrivalled or there exists no need for the transmitted product. In that case, the appropriate practice is to sell it at a marginal cost or at any price between the marginal and marked costs, in the most general case, at some simplification conditions.

In general, it makes economic sense to conduct subsidiaries on sites close to fixed capital operations and in the proximity of resources themselves, to ensure sufficient marginal pricing environments (depending on the requirements of such items as untrained or skilled labour, for example). Hirschleifer (1956) concludes that apart from either the demand or the marginal price of transfer rates (the closest pricing) will distort the order in a manner that can yield suboptimal results for the various trading subsidiaries.

The most commonly applied anti-profit shifting laws are transfer price laws and exist in 10 LDCs/LICs, 26 LMICs and 31 UMICs (Ernst & Young, 2010). They determine intra-firm prices to align with the arm's length principle. The OECD Pricing Directives control most transfer pricing laws in developed countries. Whether rules for a community of high-income countries are always in line with the interests of developing countries is unclear. Brazil is an example of a country that does not comply with the OECD Guidelines on the transfer pricing rules to suit its scheme better. Generally, it is challenging to enforce transfer price rules because there are often no comparable internal or external cases where correct transfer pricing can be established. The tax authorities have no technical expertise and capacity to effectively audit corporate taxpayers' transfer pricing documentation reports. Most multinational companies (MNCs) competing in Africa aim to reduce their tax burdens, make enormous profits, and transfer revenues to their country of origin.

Through tax evasion, corruption and inadequate transfer prices, and maladministration, the continent lose billions of dollars annually, leading to Africa's illegal financial flows. Previous studies have shown that if adequate flow control mechanisms are in place, African revenues could increase between 60 and 65%. Recent reports have also demonstrated that Africa loses around USD58 billion annually on exports and imports-related activities (UNECA 2015). Some multinational corporations (MNCs) usually benefit from concessional tax through corrupt African government activities. Most MNCs tend to maximise profits while illegal financial transactions destroy Africa's economy. These corrupt actions are why Africa remains very poor and incapable of competing with the world's best countries.

2.7 OVERVIEW OF ANTI MONEY LAUNDERING

Money laundering (ML) is the practice of making a substantial sum of unlawfully obtained money (from drug trafficking, terrorist activities, or other major crimes) appear to have come from a legitimate source. The criminal act of concealing money from illicit operations and converting it into legitimate money (Le-Khac et al. 2016; Syed et al. 2019) changes the clandestine character of money. Money laundering is the process through which illicit money is transformed into white and clean money (Cotoc et al. 2022). If done correctly, it helps criminals to keep control of their gains and, eventually, to offer a respectable cover for their source of income. The International Monetary Fund (IMF) and World Bank are now involved in money laundering issues as a result.

Money laundering is critical in assisting the objectives of drug traffickers, terrorists, organised criminals, insider dealers, tax evaders and many others who seek to escape the type of attention from authorities that sudden income from unlawful operations brings. These criminal businesses strive to gain money and influence through illicit activity before infiltrating normal society and altering the parameters of the bargain. They create millions of dollars for the enterprise's members and allow its associates to live extravagant lifestyles built from the pain and sorrow that their illicit activity causes (Kumar, 2012).

According to the literature, the money laundering process consists of three stages: placement, layering and integration (Demetrias and Vassileva 2020). The initial step of money laundering is the most dangerous since it includes the entrance of illegal gains into the financial system, with the chance of being identified by authorities (The World Bank and Schoot , 2003; Jaara and Kadomi 2017; Jayantilal et al. 2017). Stratification denotes laundering and obscuring the unlawful

source through many transactions (Demetrias and Vassileva, 2020), and in the last step, integration, money or income are reintroduced into the legal economy (Teichmann et al. 2020). Money laundering can be done locally ("adding cash to the cash registers of a cash-intensive firm") or globally (depositing filthy money by criminals in the bank and targeting the financial system to lose the unlawful mark with the aid of offshore corporations (Ferwerda et al. 2020).

The Reagan US Presidential Commission on Organised Crime (1986) spearheaded efforts to encourage investigators to "follow the money," but academic criminologists and economists had little to no influence on the anti-money laundering movement, despite any small influence some individuals may have had on the fight against organised crime.

Despite the private reservations of some law enforcement officials and professionals, academic criticism and/or empirical research had no discernible impact on slowing the anti-money laundering movement down. Even within the EU, however, there are differences in emphasis and structure related to national cultures and legal principles (Vogel and Maillart 2020). Since the process of identifying and recovering proceeds of crime can frequently last longer than a pre-determined or elapsed time year, the data reviewed would require a longitudinal flow method of accounting rather than an annualised method. This fact has, however, received relatively little attention to date.

The Financial Action Task Force (FATF), an intergovernmental organisation founded in 1989 on the initiative of the G7 to develop policies to combat money laundering, makes no mention of doing a formal risk assessment. The standard merely requires such nations to 'identify, analyse and

comprehend' hazards, not to generate a written record. Thus, a country may have a range of papers or instruments that, when considered together, may fulfill the requirements of the FATF guidelines but do not constitute a genuine National Risk Assessment (NRA). Many Global South countries in Asia and elsewhere do not publish their NRAs, and those that do so only publish sanitised versions: it is debatable whether the classified versions are significantly more informative, not least because, while they may contain more detailed cases and names, it is unclear what data they could collect.

There is no proof that any of the global statistics produced and repeated endlessly (e.g., UNODC 2011) as "facts by repetition" are used operationally as a baseline for evaluating the effectiveness of AML or of any other policy; if they were, as with the various "wars on drugs" have been, the policy framework may have to be abandoned or significantly altered. However, performance statistics are still required even in those nations where evidence-based policing is not the norm, even if many of these nations struggle to effectively use analytical data as proxies for efficacy. There are several articles that address the issue of suspicious money laundering transactions from a theoretical perspective, as well as articles that address the same issue through case studies (Naheem 2016; Raza et al. 2020; Gilmour 2020), but an approach from a statistical perspective of the suspicious transactions available in annual reports for recent years has not been found. The findings of this study assist governmental and non-governmental organisations by emphasising areas that require immediate action to mitigate the consequences of ML. Setting global guidelines or having nations apply them and demonstrate compliance with the requirements is insufficient. They must also have an impact and improve the efficiency of AML and CFT, the execution of relevant EU legislation in line with international standards in the fight against money laundering,

as well as how it is implemented, must be examined on a regular basis. We could not find an adequate statistical analysis of suspicious transactions in our inquiry.

The underlining importance of international money laundering legislation in the battle against money laundering was studied, based on data collected and analysed from 20 reports of European Union Member States' FIUs. This study shows an increase in suspicious transaction reports (STRs) received by anti-money laundering national bodies between 2018 and 2019, as well as the newest money laundering scheme of national Financial Intelligence Units (FIU) because of European Union measures and their transposition into national laws.

The time frame chosen for analysis coincides with the final term for the implementation of the latest European AML Directive, the directive issued in June 2018, with a deadline for transposition into national legislation of January 2020; thus, the statistics available in the field for 2018 and 2019 more or less reflect the result of the new European measures. The AML/CFT frameworks operate in tandem to maintain the financial system's safety, integrity and soundness, as well as depositor protection. To run an effective AML/CFT framework, institutions should tighten their regulations, which may contain duties that fit the capacity of both public and private institutions, and law enforcement should be placed in both institutions to preserve order.

In practice, the state should adopt some flexibility in the application of AML/CFT measures, which would increase the chances of attracting more segments of the population into the formal financial system, making it easier to monitor and detect any movement of funds or attempt to conceal the proceeds of crime. The proper AML/CFT procedures, according to Shehu (2012), to minimise the

impact of any financial crisis on the financial system. Lack of financial inclusion, particularly restricted access to financial services, usage of informal channels, and the predominance of major informal service providers, among other factors, make tracing and monitoring transactions harder, resulting in a weaker AML/CFT regime.

AML/CFT procedures are mechanisms put in place to support financial institutions' effective intermediation function, defend the integrity and soundness of the financial system, and guarantee that only real economic operations are done to promote economic growth and development.

Money laundering is a worldwide concern that demands policymakers' immediate response to protect financial institutions from criminals. A jurisdiction is necessary to build a system to regulate or limit the impact of multifaceted crimes on the global economy. Global crime prevention poses a challenge not just to jurisdictions but also to global norm setters. The banking sector and other regulated entities bore the brunt of the consequences of these misdeeds. Anti-money laundering/counter-terrorism financing (AML/CFT) supervision is a developing field; hence, a solid AML/CFT supervisory regime is required to support worldwide endeavors in this area. The implementation of an effective risk-based AML/CFT supervision of financial institutions as well as specified non-financial businesses and professions is important for AML/CFT regulators to strengthen the AML/CFT regime of a country.

2.8 CHAPTER SUMMARY

This chapter reviewed relevant literature on trade mis-invoicing, abusive transfer pricing and the determinants of trade mis-invoicing. This chapter explained various relevant concepts such as trade

mis-invoicing, abusive transfer pricing and trade discrepancy. Also, the multiple ways of measuring trade mis-invoicing such as the PCTG method and the Price Filter method, were discussed with their limitations to provide a thorough understanding of the study. The chapter also reviewed the factors which affect trade mis-invoicing and concluded with an overview of money laundering.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter presents the methodology used for the study. It begins with the qualitative research methodology used to analyse the value chains for the commodities and identify the risks for IFFs. Then it outlines the methods used for estimating illicit financial flows and ends with the methodology for measuring the determinants of Illicit Financial Flows.

3.2 VALUE CHAIN ANALYSES AND IDENTIFICATION OF RISKS FOR IFFS IN SELECTED COMMODITIES

This thesis adopted mixed research methods, i.e., expert interviews and literature searches, to understand and identify the risks of trade mis-invoicing in the value chains of the selected commodities. In addition, the methods adopted allow the study to triangulate relevant data sources and existing analyses and set up the assumptions underpinning the estimations of trade mis-invoicing in the commodities. The combination of quantitative and qualitative approaches offers more significant insights into research concerns and problems than the individual use of one tool (Creswell, 2012). Similarly, Salmona, Kaczynski, and Smith (2014) posit that the service of qualitative research allows the researcher to ask different questions and explore multiple forms of data in unique ways.

The purpose of the qualitative research was to gain knowledge of and evaluate expert perspectives, existing research, new data and economic incentives for trade mis-invoicing in the commodity

export sector in Ghana. Data was gathered through desktop research and semi-structured interviews with experts at related private and public sector institutions. Purposive sampling, defined by Etikan, Musa and Alkassim (2016) as a sampling technique suitable for selecting interviewees based on their expertise in a particular field, was used.

The institutions and interviewees were therefore selected based on their special positions in the gold, bauxite, manganese, and cocoa sectors in Ghana. They included private sector trade associations and government agencies responsible for managing natural resources, foreign trade governance, and tax and revenue authorities. Expert interviews were suitable for the research due to the technical knowledge needed to support the study of the risks and magnitudes of trade mis-invoicing. A total of twenty-five people were interviewed. The interviewees were primarily at the level of senior management and as such could be considered experts in their respective fields.

Wide-ranging additional desktop research was used to identify current research studies and data to inform the interviews and statistical analyses. Data for the desktop analysis was collected from the websites of the listed institutions and their annual reports, which were accessible online. Journal articles and current literature on keywords, such as product supply chain analysis, trade mispricing and foreign trade, were also used.

For the gold, manganese and bauxite sectors, the organisations contacted were the Minerals Commission (the regulators), Ghana Chamber of Mines (responsible for large-scale mines) and Precious Minerals Marketing Company (PMMC) (the national assayer). Additionally, Ghana Revenue Authority (Customs Division), Ghana Extractive Industries Transparency Initiative

(GHEITI) and ISODEC were included to enrich the source of data. With respect to the cocoa sector, COCOBOD, Cocoa Marketing Company (CMC) and Ghana Export Promotion Authority (GEPA) were contacted.

The following institutions, with overall responsibility for the governance of the natural resource sector in Ghana: Bank of Ghana, Ghana Revenue Authority (Customs Division) and Ghana Investment Promotion Centre (GIPC), were contacted.

There was a positive response of about 95% from all the organisations contacted. However, there were no interviews with representatives of the individual gold, bauxite, and manganese mining firms, the Ghana Free Zones Authority, and individual cocoa paste processing firms.

Table 3:1 displays the list of institutions contacted for information and validation purposes.

Table 3.1: List of Institutions Contacted

Cocoa Beans and Cocoa Paste	
Role of Institution	Name of Institution
Production	Ghana Cocoa Board (COCOBOD)
Transportation	
Export	Cocoa Marketing Company (CMC) (COCOBOARD), Ghana Export Promotion Authority (GEPA)
Gold, Bauxite and Manganese	
Role of Institution	Name of Institution
Regulator	Minerals Commission
Private Sector Organisation	Ghana Chamber of Mines, Freight Forwarding Agency, Gold Exporting Agencies
Assaying/Valuation	Precious Minerals Marketing Company (PMMC)
Civil Society Organisations	Ghana Extractive Industries Transparency Initiative (GHEITI), Integrated Social Development Centre (ISODEC)
Natural Resource Sector Governance	
Purpose of Institution	**Name of Institution**
Regulator/Tax Authority	Customs Division (Ghana Revenue Authority)
Regulator/Central Bank	Bank of Ghana
Business Promotion	Ghana Investment Promotion Centre (GIPC)

Data Source: Expert Interviews 2018, 2019

3.3 MEASURING ILLICIT FINANCIAL FLOWS

IFFs, by their very nature, are difficult to measure (Collin, 2020). As a result, the trade gap analysis method has become one of the most widely used methods for measuring IFFs. This works on the principle of estimating the trade gaps. However, there have been a lot of criticisms about the use of the trade gap methods for measuring IFFs because trade gaps/discrepancies could exist for other reasons aside IFFs (WCO 2018).

Trade Gap Analysis is a method of measuring IFFs, which was first developed by Bhagwati (1964a). The concept is very simple: the declared price and quantity of exports from one country will, after accounting for shipping and insurance costs, be compatible with the declared price and quantities when that good arrives and is registered as an import. Shipping and insurance costs (which are generally non-registered as aggregated trade statistics) or a mistake in reporting import/export value or quantity are the only valid distinction between the two records.

As described by Bhagwati (1964b), the value (or quantity) of an export or import may be declared under or over an incentive. For example, if an agent wants to move money secretly from Malawi, he might charge USD100,000 for importing cell phone shipments from the USA to an intermediate outside Malawi. There are various incentives ascribed to over-/under-reporting exports/imports, which include:

(1) over-invoicing imports—retaining money abroad, avoiding capital controls (by obtaining excess foreign exchange), reducing taxable profit;

(2) under-invoicing imports—evading customs duties;

(3) over-reporting exports—taking advantage of export credits;

(4) under-invoicing exports—avoiding export tariffs, retaining money abroad, avoiding capital controls (by obtaining excess foreign exchange). (Collin 2020)

The "gross exclusion reversals" method of Global Financial Integrity (GFI) explores mirrored statistics (i.e., which country A says it exported from country B and which country B declares it imported from country A, respectively) between developed countries on the basis that the values reported in the first case to customs officers are most likely valid. The GFI method tests the "gross exclusion reversals"(GER) process. GER takes into account that, due to shipping costs and insurance costs, the two values mentioned shall be automatically divided into 6% of export value when real details on those costs are not available. Based on the incentives mentioned above, GER assumes that any difference in reflected trade statistics indicates over-valued or under-valued exports. The approach presupposes that shipping costs will be corrected. Note that the assumption of 6% is invariant in respect of export distance travel, so it is possible if distance leads to increased costs of shipping and vice versa, that under-invoicing is reported (a false positive).

GFI uses GER for the first time to add up the total IFFs amounts due to commercial money laundering for each developing country and the wealthier counterparts to estimate countries and global figures. The IMF uses both aggregated data from the database of the IMF Trade Statistics and commodity-specific data from the UN COMTRADE database in its latest report (GFI 2017). It then uses the amount to estimate the share of trade in the country involving unlawful transactions and increases that share to an aggregate value for unlawful outflows by aggregate estimates. When summarizing figures at the country level, the worldwide projected money laundering is focused on trade. In 2015 alone, GFI figures put the total volume of money left by developed countries for mis-invoicing at approximately 85 per cent of the total amount (598–807 billion dollars per year)

(Salomon 2018). In addition to GFI, several research outfits and NGOs have developed similar figures for each region, country group, and category of goods (Nicolaou- Manias, 2016).

Those methods were strongly criticised for suggesting more innocent reasons why the representative trade statistics could differ. The reasons include price or quantity errors, differences in product categorization between countries, differences in rules or accountability on reporting, discrepancies between real shipping and insurance costs and the 6% assumption used in the GER method (Johannesen and Pirttilä, 2016; Nitsch, 2016). Some of the same critiques have challenged the claim of GER that figures on trade are calculated from rich countries without (or at least with) error. As a result of these valid critiques, trade disparities are likely to be both misleading and unnecessarily inflationary.

Some have also pointed out that re-exporting through bonded warehouses is not sufficiently protected by the GER system. For example, GFI corrects its re-export figures between China and Hong Kong, but the issue will likely still affect other bilateral estimates (Forstater 2016). Such problems are not strictly theoretical, as high-profile cases of the GER cycle which have led to substantial overestimation of IFFs have been identified. Most significant in 2016 was the study by the United Nations Trade and Development Conference (UNCTAD), which revealed that 67% of South Africa's gold exports were mis-invoiced and IFFs amounted to about 80% from 2000 to 2014.This disparity was discovered later because of a gap in reporting requirements that prevented accurate registration of gold exports in the COMTRADE database (Forstater, 2017a and b).

There are two main methods for estimating trade mis-invoicing – the Partner Country Trade Gap (PCTG) Method and the Price Filter Method.

3.4 THE PARTNER COUNTRY TRADE GAP (PCTG) METHOD

The partner-country trade gap methodology compares partner countries' import and export reports for the same trade flow. Trade gaps differ between the partner's reported imports and the partner countries' reported exports. Following the literature, a correction factor of 10% is applied to the export values to account for the cost of freight and insurance (Baker, 2014; Berger and Nitsch, 2012). For each commodity, the gaps were calculated according to the following equations

Export Trade (ET) gaps in a year *t* are: $ET_{ij,t} = IM_{ij,t} - \beta * EX_{ij,t}$ .....Eqn 1

$EX_{ij,t}$ is partner *j*'s reported export value, $IM_{ij,t}$ is country *i*'s reported import value from partner *j* and β is the freight and insurance factor. The partner *j*'s imports are compared to the interest country *i*'s corresponding exports for the same trade flow. A positive trade gap value of *ET* indicates export under-invoicing while a negative value indicates export over-invoicing. (Bhagwati, 1964b; Ndikumana, 2016).

This method is implemented as follows:

First, annual import data (measured using cost plus insurance and freight or c.i.f. method) are converted to the free-on-board basis using a standard factor of 10 per cent used by the International Monetary Fund's (IMF) Direction of Trade Statistics (DOTS). Next, the import and export discrepancies (I.D. and E.D., respectively, as denoted below) are calculated using the following formulae:

$ID_{ij,t} = \frac{I_{j,t}}{r} - X_{j,t}$ .....Eqn 2

$$ED_{ij,t} = \frac{I_{p,t}}{r} - X_{p,t} \quad \text{.....Eqn 3}$$

Where:

$I_{j,t}$ is the imports by country *j* from the partner country *p* at time *t*

$I_{p,t}$ is the Partner country *p*'s imports from the country *j* at time *t*

r is the Standard freight and insurance cost adjustment factor of 10 per cent,

$X_{p,t}$ is the Partner country *p*'s exports to country *j* at time *t*

$X_{j,t}$ is the Country *j*'s exports to partner country *p* at time *t*

These discrepancies or trade gaps are usually calculated at the aggregate level, including all traded product categories, but they can also be calculated at the product level (based on the Harmonised Commodity Description and Coding System or HS code) subject to the availability of disaggregated data. Most recent applications of this approach include the empirical literature on IFFs conducted by advocacy organisations and policy institutions.

3.5 THE PRICE FILTER METHOD

Following the criticisms of the PCTG method, some researchers developed another method for estimating trade mis-invoicing in international trade known as the price filter method. (eg. Pak & Zdanowicz, 1994; and Hong et al., 2014). This method makes use of transaction-level micro-data to estimate trade mis-invoicing. It also uses the Harmonised Commodity Description and Coding System (HS Code) at the 10-digit level.

Additionally, the price filter method estimates illicit financial flows based on export/import deviations from some reasonable price range instead of using mirror trade statistics. Zdanowicz (2009) examines US exports and imports and argues that transactions with prices above any

distribution margin are reasonably the result of unlawful behaviour (e.g. 50% of the retail price, or upper / lower quartile). Using this analytical method combined with corporate tax rate data, Christian Aid (2009) calculated the loss of USD 160 billion per year of developed countries as a result of consumer mispricing. There is a problem in this method in which two different forms of transactions are conceptually combined: commercial mis-invoicing (over / under-invoicing at one end of the transaction and reporting at the other end) and transfer mispricing (where the price is accurately stated at both ends of the transaction but is skewed to impact the position of the transaction report). An unexpected low export price may be triggered by an artificially low sale price or by a low bill.

As the price variance estimates of the IFFs obtained under this approach can increase in a given product category, it is difficult to determine which percentage of such estimates are driven by natural price deviations and which estimates are actually driven by some form of illegal flow. As with studies of trade disparities, data errors also appear as illegal sources. Forstater (2015) notes that price outliers for trading data (e.g. a bucket at USD 973 used as an example of mis-invoicing for many non-profit companies) are likely to be explained partially by errors in the registration of either the price or the quantities of shipment. Likewise, products that have a higher / lower quality than or different from the desired classification could be flagged erroneously as prices that are higher / lower than normal.

Given these limitations, it is possible that the study of significant anomalies in exchange rates would be a valuable way of identifying forensic behaviours used by actors such as customs officers.

There are two main methodologies under the price filter analysis. These are the: inter-quartile range filter and arm's length price filter. For this thesis, the inter-quartile price filter will be used. This is due to the unavailability of free-market prices for the commodities in question in order to use the arm's length filter methodology.

An endogenously calculated interquartile range (IQR) price filter method is calculated. This method is motivated by the United States Internal Revenue Service (IRS) transfer pricing regulation (Internal Revenue Code 482) which specifies that an interquartile range is an acceptable arm's length transaction range (Hong et al., 2014). The OECD Transfer Pricing Guidelines also mention that the interquartile range or other percentiles can be used to help enhance the reliability of any transfer pricing analysis (paragraph 3.57, OECD, 2017). All transactions valued in the top and bottom quartile of these distributions are designated to be abnormally valued.

Accordingly, any transaction value which exceeds the 75th percentile or falls below the 25th percentile of the observed price distribution is designated to be abnormally priced. The under or over-valued amounts for each transaction is then calculated as follows:

Undervalued amount = Quantity x MAX(0, LoQ - P)……Eqn 4

Overvalued amount = Quantity x MAX(0, P - UpQ) ……Eqn 5

where:

P = Declared price (unit value implied in quantity and value in each trade record)

LoQ = Lower-quartile price calculated using price distribution over the previous 365 days

UpQ = Upper-quartile price calculated using price distribution over the previous 365 days

It is relatively straightforward to observe that since the interquartile price range is endogenously estimated using the observed price distribution, this hypothesis will be rejected by design for a certain proportion of transactions. Therefore, these estimates of trade mis-invoicing should be interpreted carefully and supplemented with a further discussion regarding the product, price, and individual market characteristics. For example, the level of purity of precious metal and any contemporaneous political, economic or environmental shocks may play a key role in determining whether the observed transaction price falls within the interquartile price range during a given period.

3.5.1. Arm's Length Price Range for Gold Exports

Gold doré produced in Ghana ranges between 67:33 and 100:0 gold – silver split (after accounting for a maximum of 5% of impurities like lead, copper, and arsenic). Accordingly, the first step is to calculate the relevant benchmark prices for the various proportions of gold and silver found in the gold doré bars produced in Ghana. Secondly, the commodity-specific factors which result in further variation of observed export values to deviate from the free-market reference prices are assessed. This information is combined to estimate the arm's length price range between $\mathbf{P_{Low}}$ and $\mathbf{P_{High}}$.

Benchmark Price for Gold: In order to establish the benchmark prices for different levels of gold-silver mix, the firm names in the gold exports data from Ghana Revenue Authority are merged with mine-level production information from the Metal Focus Gold-Silver Dore Service database. However, not all the exporters can be matched to individual gold mines due to the presence of intermediate buyers and logistical firms in the GRA export data. In these cases, conservatively the minimum and maximum gold purity levels observed across all gold mines are

used to estimate the benchmark prices. In all cases, the gold and silver content is adjusted to account for a maximum of 5% permitted impurities in the doré using the following adjustment: (gold/silver purity*0.95)/100.

Accordingly, the benchmark is calculated as follows:

Case 1 - GRA exports data matched with mine-level gold-silver content:

*Benchmark price = (the price of gold*gold content) + (the price of silver * silver content)*……Eqn 6

Case 2 - GRA exports data which cannot be matched with mine-level gold-silver content. In this case, a minimum and maximum range for benchmark prices are calculated as follows:

*Maximum benchmark price = (price of gold * maximum gold content) + (price of silver *minimum silver content)*……..…….Eqn 7

*Minimum benchmark price = (price of silver * maximum silver content) + (price of gold * minimum gold content)*……..Eqn 8

Upper bound of arm's length price range (P_{High}): The arm's length price range is estimated by first calculating the upper bound using the following commodity-specific factors based on estimations by interviewed gold sector experts:

1. Transport, storage, and insurance costs (negligible impact): These costs are included in all export transactions, however, their impact on the total value of precious metals like gold is negligible i.e. maximum of 2% of the total value. This decreases further for larger volume transactions (Personal Communications, A. Tawiah).

2. Market conditions and contract terms (up to 10%): Export prices also fluctuate due to the terms of underlying contracts which include different types of transactions (spot and futures contracts). This also reflects differences in price bargaining power between trading companies. Favorable forward/futures sales can determine gains of the doré exports against spot prices used as a benchmark. Also, Ghanaian Cedi – US Dollar exchange rates and prevailing interest rates affect export prices of gold from Ghana (Personal communications, C. Nyarko).

Based on the above analysis, an estimate of 10% above the previously calculated benchmark prices is used as the upper bound of the arm's length price range for gold:

*Upper bound of arm's length price range = (Benchmark price*1.10)*……..Eqn 9

Lower bound of arm's length price range (P_{Low}): The assumption for the lower bound of the arm's length price range as arrived at as follows:

1. Market conditions and contract terms (up to 10%): Contract types and market conditions have a negative impact in terms of reducing the observed export prices below the calculated benchmark prices. Therefore, a total downward impact of 10% is assumed to calculate the lower bound of the arm's length price range as follows:

*Lower bound of arm's length price range = (Benchmark price*0.90)*……Eqn 10

Declared export values falling above the upper bound arm's length range indicate overvaluation while those below the lower bound arm's length range indicate undervaluation of exported gold.

3.5.2. Arm's Length Price Range for Cocoa Beans

Unlike gold, the empirical methodology for estimating mis-invoiced cocoa beans exports does not require detailed information on different types of purity levels. This is because Ghana exports only Grade I and Grade II cocoa beans which are generally considered as high-quality beans, even above standards set by the international market, hence, attracting premiums in addition to the international market reference prices (Quarmine et. al., 2012; Abbott, 2013). In order to ensure maintenance of this internationally recognised high-quality cocoa beans standards set by COCOBOD, Cocoa Marketing Company (CMC), a subsidiary of COCOBOD, have (by law) been given the sole right to sell and export cocoa beans from Ghana as well as perform the take-over function within the internal marketing system.

The cocoa marketing procedure in Ghana is unique with its partly liberalised system where internal marketing undertaken by LBCs are privatised, although with strict oversight by CMC.

Benchmark Price for Cocoa Beans Exports: The London Futures Prices are used as the benchmark prices to estimate trade mis-invoicing in cocoa beans. This is because export prices of the beans are negotiated based on these prices. The Intercontinental Exchange (ICE), London, particularly represents delivery in Northern Europe and serves as reference prices for West

African cocoa; hence, CMC's trading of cocoa beans, especially to foreign buyers, is based on these prices. In the agreement outlined, buyers and sellers present the futures contract as a reference price and then negotiations are undertaken in relation to differential premium or discount depending on quality, default and counterparty risks in delivering the quantities for which prices are fixed.

Ghana's institutional reputation with regard to quality and counterparty risk, for instance, allow for sales that are usually conducted six to 12 months (or sometimes 15 to 18 months) prior to delivery. The main reason for the futures sales is that the sales serve as collateral for the syndicated loans acquired to pay LBCs for their cocoa beans, provide research and extension services to farmers as well as funds for the general administration of all cocoa institutions in the country (Tröster et al., 2019; Personal Communications, CMC Personnel). Based on assumptions guided by the qualitative research conducted, i.e. communications with experts in the industry and desktop research, an arm's length price range is subsequently estimated by focusing on market conditions and contract types as well as transport and insurance costs. The upper and lower bounds arm's length price ranges are set as follows:

Upper bound of arm's length price range (P_{High}): The following considerations are used to estimate P_{High} for cocoa beans exports from Ghana:

1. Market Conditions and Contract Terms: With the peculiar cocoa supply chain in Ghana, varied sales strategies undertaken by the traders based on instinct with experience, plausible portions of estimated abnormal pricing are assumed to be a reflection of premiums earned as a result of a combination of an established guaranteed delivery of sold cocoa beans on time, quality

of beans, market power and counterparty premium. For example, CMC/COCOBOD selects top-grade quality and size of cocoa beans for export that attracts roughly 3 – 5% price premium on the world markets. Certifications such as Organic, Fairtrade, UTZ, and traceability also attract a price premium of 150 USD per tonne which is about 5.4% of the average value of London's Futures Prices for the period 2011 – 2017 (Gilbert, 2009 in Kolavalli and Vigneri, 2011; Dand, 2011).

Some reasons given for the premiums include slightly higher-than-average fat content, low levels of debris that result in higher cocoa butter yields, and low levels of bean defects that generate cocoa liquor flavor preferred by some end users (Kolavalli and Vigneri, 2011). Premiums have been known to go as high as 16.5% of the market reference (Personal Communications, CMC/COCOBOD Personnel; Stakeholder Meeting at COCOBOD).

2. Transport, Storage, and Insurance Costs: According to CMC, cocoa beans are sometimes exported with pre-financed shipments by COCOBOD upon customers' request. On these occasions, the beans are exported under Cost, Insurance and Freight (CIF) terms, which usually cost around USD 100 per tonne or 10% of export value (Dand, 2011; Personal Communications, CMC/COCOBOD Personnel). Also, using the world market price in 1999, Pedersen (2001) estimated the transport cost of cocoa exported from Tema to Rotterdam to be around 13% of the market price.

Overall, a 30% increase above the benchmark price is used (i.e the futures market reference prices) to set the upper bound for the arm's length range beyond which export values are considered overvalued (trade mis-invoicing)

Lower bound of arm's length price range (P_{Low}):

Market conditions and contract terms: It is deduced that based on market conditions and contract terms that fix the majority of export values ahead of the season in forwarding sales, risks such as exchange rates, lower than expected estimated volumes due to crop failures and smuggling can lead to sales that fall short of the expected prices due to defaults (Tröster et al., 2019). Also, CMC exports about 20 – 30% of cocoa beans at spot prices (mostly light crops of relatively small sizes (Quarmine et al., 2012)) that are subject to the same risks, especially smuggling and speculations. Discounts due to non-delivery or default of the expected quality (which hardly occurs) and size can result in export values below the benchmark market reference prices. Thus an approximation 20% deviations from the benchmark is used to constitute the lower bound arm's length price range. Consequently, cocoa beans export values falling below this lower bound are considered undervalued.

3.5.3 Interquartile Range Price Filter Analysis

The inter-quartile range price filter method assumes that values between the 25th and 75th percentile of the observed distribution of unit prices for a specific commodity denote the arm's length price range. Any transaction that falls above or below this price range is categorised as abnormally valued. Traditionally, this method relies on the inter-quartile range being calculated for each calendar year. However, in a methodological innovation from previous studies (for example, Hong and Pak, 2017), a dynamic version of the previous method is implemented by updating the calculation of the inter-quartile range on a daily basis using the price distribution observed over the previous 365 days i.e. a 365-day rolling window estimate of the interquartile range. The main advantage is to make the definition of the arm's length price range more responsive to pricing dynamics observed over the course of the year. For example, in the case of

agricultural commodities, the observed trade prices may be affected by planting seasons, climatic variation and market conditions which do not directly correspond to calendar years used by previous studies to calculate the arm's length price range.

Accordingly, any transaction value which exceeds the 75th percentile or fall below the 25th percentile of the observed price distribution is designated to be mis-invoiced. The under or overvalued amounts for each transaction is then calculated as indicated in equations 4 and 5 and repeated below

Undervalued amount = Quantity x MAX(0, LoQ - P)……Eqn 11

Overvalued amount = Quantity x MAX(0, P – UpQ ……Eqn 12

where:

P = Declared price (unit value implied in quantity and value in each trade record)

LoQ = Lower-quartile price calculated using price distribution over the previous 365 days

UpQ = Upper-quartile price calculated using price distribution over the previous 365 days

It is easy to observe that since the interquartile price range is endogenously estimated using the observed price distribution, this hypothesis will be rejected by design for a certain proportion of transactions. Therefore, the estimates of trade mis-invoicing should be interpreted carefully and supplemented with further discussion regarding product, price and individual market characteristics. For example, contemporaneous political, economic or environmental shocks may

play a key role in determining whether the observed transaction price falls within the interquartile price range during a given period.

3.5.3.1. Arm's Length Price Range for Cocoa Paste, Bauxite and Manganese

Due to the lack of commonly acknowledged market reference prices for cocoa paste, bauxite and manganese exports from Ghana, the interquartile range method is used to calculate its abnormal estimates. Furthermore, It was observed that a high degree of export price rigidity in the cocoa paste exports data, which suggests advance pricing agreements at constant prices between trading partners which do not respond to observed prices from relevant commodities exchanges. Therefore, apply the rolling-interquartile range price filter method as described above to approximate the arm's length price range for cocoa paste exports was applied.

Upper bound of arm's length price range (P_{High}): The 75^{th} percentile is used to set the **P_{High}** for cocoa paste, bauxite and manganese exports from Ghana. Thus, export values that are found above the 75^{th} percentile are estimated as the overvalued amounts of cocoa paste, bauxite and manganese.

Lower bound of arm's length price range (P_{Low}): Similarly, the 25^{th} percentile is set as the **P_{Low}** for cocoa paste, bauxite and manganese exports from Ghana. Calculated values below this boundary are declared as undervalued amount of cocoa paste, bauxite and manganese.

3.6 DATA SOURCES

The data was sourced from the UN COMTRADE database and the Customs Division of the Ghana Revenue Authority. Additional data from the Metals Focus Database was used in the case of gold.

3.6.1 UN COMTRADE Database

Data from the UN International Trade Statistics Database was used for the partner-country trade analyses. The database contains annual trade transactions between partner countries. The UN International Trade Statistics Database (UN COMTRADE) contains commodity and partner-specific trade statistics provided by the national statistical authorities of each reporting country. It contains annual trade data from 1962 onwards. This data is transformed into a standard format with consistent coding and valuation using the UN's processing system. Commodities are generally reported according to the latest classification system and then converted to the earliest classification. Therefore, if data is received in HS 2012 version, it is converted all the way to the earliest classifications such as the HS 1988. COMTRADE recommends recording imports as 'Cost, Insurance and Freight' (CIF) and exports as 'Free on Board' (FOB) and most participating countries adhere to this recommendation in their data submission process.

UN COMTRADE explicitly states the limitations of the database. Due to confidentiality, countries' trade reports might only include data at an aggregate commodity code. The dataset also contains missing values as countries do not necessarily report their data for every year. Furthermore, data cannot be perfectly converted into earlier classifications due to, among other factors, the addition of new commodities over time. Similarly, commodity classifications can also differ between countries and over time. This makes comparability difficult over the period considered. Lastly, COMTRADE does not report trade flows below USD 1000, necessarily censoring our estimates upwards.

Finally, the absence of a standardised procedure in recording import origins and export destinations weakens the comparability of trade statistics. The term 'partner country' does not necessitate any direct trading relationship since exports and imports are recorded by either country of first consignment or the country of the last consignment, and 'partner country' could refer to either.

3.6.2 Data from Ghana Revenue Authority-Customs Division

Ghana Revenue Authority (GRA), Customs Division, provided the transaction-level export data for this study. The recorded transactions cover trading activities from 2005 to 2017. The data also contains the weight of each exported commodity, a detailed description of the commodity type, and the receiving country of the exported commodity. The weight is described as net mass, the weight of the commodity exported without packaging in the system unit of the HS classification. The assigned unit for weight in the data is kilogram (kg).

3.6.3 The Harmonized Commodity Description and Coding System (HS Code)

The Harmonised Commodity Description and Coding System, commonly known as the Harmonised System (HS) or HS code is an international multipurpose product nomenclature developed by the World Customs Organisation (WCO). The group consists of approximately 5,000 product classes, each of them classified by six-digit codes, organised in a legal and logical structure, and backed by clearly defined rules for uniform classification. The system is used for their customs tariffs and for the collection of international trade statistics by more than 200 countries and economies. More than 98% of goods are classified as HS in international trade.

Internationally, products are classified up to the 6-digit level while countries may classify products up to the 10-digit level. The first two digits show the chapter of the HS code the specific commodity falls under. The third and fourth digits relate to the headings under the specified chapter and provide further details about the class of commodity. In addition, the fifth and sixth digits denote the subdivisions of the heading. Contracting parties to the WCO HS Code are permitted to create extra subheadings to cater for their domestic tariff arrangements. Thus these would differ from country to country as an export from Ghana for instance would be considered an import in other countries. Individual countries use additional ratings and the tariff ratings can therefore be 8-10 digits, depending on how accurately the product has been classified. For example, with the coming into force of the ECOWAS CET, the seventh and eighth digits have become regional sub-divisions in West Africa. There is also a different opinion that the last two digits consist of a statistical code that helps a country to compile its statistics on the products of trade.

The HS code is key in research on abnormal pricing in illicit financial flows. In the Partner Country Trade Gap Method, the 6-digit level of the HS code is used for the mirror trade statistics of the commodities the countries in question export and import. Similarly, for the Price Filter Methods, the 10-digit level of the HS Code is used for the analysis of the commodities.

One challenge realised especially at the developing country level, is the issue of misclassification of commodities. As mentioned earlier, this could potentially cause a lot of problems since it is expected that commodities will be classified pretty much the same across all countries.

3.6.4 Free-Market Commodity Price Data: 2011–2017

Daily market price data is from Thomson Reuters Datastream, a database of global financial markets and economic indicators. The commodity exchanges' data used as free-market reference prices for the analyses are the London Bullion Market Association (LBMA) for Gold Bullion LBM (US dollars per troy ounce) with 99.5% to 99.9% purity levels and London International Financial Futures and Options Exchange (LIFFE) prices for the assessment of the raw cocoa beans (US Dollars per metric tonne).

3.6.5. Metal Focus Gold Doré Flows Service Database: 2019

This database provides mine-level information on historical, current and forecasted doré production (up to 2030) by company and country. It also contains information on current refining location, historic production costs, current mineral reserves and resources as well as the gold – silver split of doré production. This information covers 652 mining companies in 77 countries. Specifically, the database has information on 16 mines in Ghana owned by Newmont Goldcorp Corporation, Golden Star Resources, Kinross Gold, Gold Fields, Perseus Mining, AngloGold Ashanti, BCM International, Asanko Gold/Gold Fields and Golden Star Resources. Except for Newmont Goldcorp Corporation and AngloGold Ashanti, all the mines listed are co-owned by the Government of Ghana (GoG).

This study primarily used the gold – silver split information from this database for companies that exported gold doré within the study period. The gold – silver split recorded are 100 – 0%, 97 – 3%, 96 – 4%, 86 – 14%, 81 – 19% and 67 – 33%. Since the data is merged on the company level with the GRA dataset where companies have differing gold – silver splits from different

mines, the lowest gold – silver split is used for the analysis of that company. Of the gold – silver split recorded, up to 5% constitutes impurities such as copper, lead and bismuth, which is permissible by refineries; and mines are paid based on the percentages of both the gold and silver in a doré (Metal Focus Report, 2019).

Table 3.2 Main Gold Mines in Ghana, Ownership and Gold-Silver Content in Production

Mine Name	**Mine Ownership**	**Gold:Silver Split (%)**
Ahafo	Newmont Goldcorp Corporation	100:0
Akyem	Newmont Goldcorp Corporation	86:14
Bogoso Prestea	Golden Star Resources / Government of Ghana	100:0
Chirano	Kinross Gold Corporation / Government of Ghana	67:33
Damang	Gold Fields / Government of Ghana	97:3
Edikan	Perseus Mining / Government of Ghana	100:0
Iduapriem	AngloGold Ashanti	100:0
Obotan	Asanko Gold / Gold Fields / Government of Ghana	81:19
Tarkwa	Gold Fields / Government of Ghana	96:4
Wassa	Golden Star Resources / Government of Ghana	100:0

Source: Metal Focus Gold Doré Flows Services Database, 2019

3.7 DETERMINANTS OF TRADE MIS-INVOICING

Given the nature of IFFs, they are usually measured by generating an estimate or by taking a proxy. This measure is then regressed on a series of observable characteristics that are considered to be linked in one way or the other to illicit flows. When a certain characteristic has a major impact on the measure of IFFs, and that effect is backed by theory, there are two ways to interpret the result — depending on a priori assumptions. The first is to interpret the result as suggesting a useful knowledge on IFFs' figures, when the theoretical relationship between the feature in question and the latent value of the IFF is assumed to be valid. The second interpretation is that if one's prior was that the measure of IFFs (e.g., the trade-gap measure) picks up meaningful variation in IFFs (e.g., trade mis-invoicing), then correlation with a given characteristic (e.g., customs administration quality) provides empirical validation as to which characteristics predict IFFs. For example, if one's measure of IFFs is found to increase after an unexpected windfall in natural resource rents, but only in countries with weak institutions, then this might contain information on where IFFs are likely to be occurring.

Disconcertingly, these two interpretations are somewhat competing: they require priors either about the theoretical relationship between the measure of IFFs and the characteristics being regressed on or about the validity of the IFF measure in the first place. Furthermore, both interpretations rely on an important identification assumption: that the various characteristics being investigated are uncorrelated with measurement error in the estimate of IFFs. For example, countries lacking institutional capacity might struggle both to detect illicit behaviour and to produce error-proof statistics that can be used in IFF estimates (Collin 2020).

It is therefore important to understand and investigate the determinants of abnormal pricing. This is because the resources lost through the abnormal pricing could have been used to make a major contribution to economic development. Abnormal pricing leads to "lost resources" as the resources leave the country without domestic authorities' control, and the funds needed for growth and development would decrease. (Yalta & Demir 2010). Abnormal pricing also has unfavorable impacts on high taxes on the income distribution of society through movement of funds abroad by other people. That ultimately undermines the national tax base and reduces public income (Farzanegan, 2009).

As afore mentioned, there are several drivers which can be grouped under headings such as political, legal and regulatory, economic and financial. Economic and financial drivers include corporate income tax rates, tax rate differences, indebtedness, import-export taxes and duties, capital controls, interest rates and differentials in interest rates, domestic inflation, real effective exchange rate overvaluation (REER), capital account openness, exchange rate regimes, macroeconomic uncertainty, high budget deficits, low growth rates, splitting interest rates between international and domestic and actual exchange rates. Some political drivers of mispricing include patronage, political freedom, accountability, political instability, corruption and public-sector reforms while some legal and regulatory drivers are tax disclosure requirements, transparency initiatives and industry-specific regulations.

One important political factor that drives mispricing is corruption. Berger and Nitsch (2012) studied the connection of the top five world importers from 2002 to 2006 (United States, Germany,

China, UK, and Japan) between trade mis-invoicing and corruption. They conclude that trade mis-invoicing by the partner countries increases with the level of corruption.

Another variable the study focuses on is transfer mispricing**.** Transfer mispricing refers to mis-invoicing by related parties in various countries, such as countries and branches of a multinational company. This practice allows businesses to move income from the home country to low-taxation countries and escape higher taxes. By its very nature, transfer mispricing is difficult to measure. This study makes use of some proxy variables to represent transfer mispricing. These are Transfer Pricing Risk and Transfer Pricing Rank calculated for various countries. The Tax Rate Differential is another factor that could potentially influence abnormal pricing between the exporting country and the partner country.

Another variable this study focuses on is inflation**.** Kwaramba et al. (2016) found that both the higher capital outflow and increase in capital flight are correlated with high inflation. The Real Effective Exchange Rate (REER) is also another variable of interest. Kwaramba et al. (2016) found that a high value of exchange rate signals a high level of capital flight.

3.7.1 Variables Used for Regression Analysis

Some potential drivers of abnormal pricing include corruption, inflation, Transfer Pricing Risk, Transfer Pricing Rank, current account balance, GDP growth, interest rate and the Real Effective Exchange Rate (REER). The table below presents the variables together with their sources.

Table 3.3: Variables used for regression analysis

Variable	**Source**	**Measurement**
Corruption	Trading Economics	1-100 with higher values showing higher levels of corruption; Corruption Perception Index
Inflation	Trading Economics	Measured as a percentage
Interest Rate	Trading Economics	Measured as a percentage
Real Effective Exchange Rate (REER)	Trading Economics	Measured as a percentage
Transfer Pricing Risk (TPR)	Mescall, & Klassen, (2018) Adapted from Marur (2019)	Values generated for each country by Mescall &Klassen (2018); measured as a number ranging from 0 to 10
Transfer Pricing Rank (TPR)	Mescall, & Klassen, (2018) Adapted from Marur (2019)	Values generated for each country by Mescall &Klassen (2018); measured in decimal values ranging from 0 to 1
Current Account Balance	Trading Economics	Measured in USD
GDP Growth	Trading Economics	Measured as a percentage
Overvaluation (Ove)	Estimates Generated	Measured in USD
Undervaluation (Und)	Estimates Generated	Measured in USD

The general form of the model can be specified as:

$$Y_{i,t} = \alpha + \beta X_{i,t} + \varepsilon_{i,t}$$

where the subscript *i* denotes the cross-sectional dimension and *t* represents the time series dimension. $Y_{i,t}$ represents the dependent variable in the model, while $X_{i,t}$contains the set of explanatory variables in the estimation model, α is the constant and β represents the coefficients. $\varepsilon_{i,t}$is the error term

The regression model estimated is outlined as follows:

$$Und_{it} = \alpha + \beta_1 Inf_{i,t} + \beta_2 Corrupt_{i,t} + \beta_3 IntRate_{i,t} + \beta_4 TaxDiff_{i,t} + \beta_5 Corr_{i,t} + \beta_6 CAB_{i,t} + \beta_7 GDPGrowth_{i,t} + \beta_8 REER_{i,t} + \beta_9 TPR_{i,t} + \varepsilon_{i,t} \ldots\ldots \text{(Eqn 13)}$$

$$Ove_{it} = \alpha + \beta_1 Inf_{i,t} + \beta_2 Corrupt_{i,t} + \beta_3 IntRate_{i,t} + \beta_4 TaxDiff_{i,t} + \beta_5 Corr_{i,t} + \beta_6 CAB_{i,t} + \beta_7 GDPGrowth_{i,t} + \beta_8 REER_{i,t} + \beta_9 TPR_{i,t} + \varepsilon_{i,t} \ldots\ldots \text{(Eqn 14)}$$

Where Und represents Undervaluation, Ove represents Overvaluation, Inf represents Inflation, IntRate represents Interest Rate, TaxDiff represents Tax Differential, Corr represents Corruption, CAB represents Current Account Balance, GDP Growth represents GDP Growth, REER represents the Real Effective Exchange Rate and TPR represents Transfer Pricing Risk or Transfer Pricing Rank.

An Ordinary Least Squares (OLS) and a Random Effects equation are estimated. The Random effects model was chosen based on the results of the Hausman test. A Quantile regression is also estimated as a robustness check.

3.8 CHAPTER SUMMARY

This chapter outlines the methodology used in the thesis. It explains the qualitative methodology used to analyse the commodity value chains and identifies the risks for IFFs and the various methods of measuring trade mis-invoicing such as the Partner Country Trade Gap (PCTG) method and the Price Filter methods. It also outlines the regression model used to estimate the determinants of trade mis-invoicing.

CHAPTER FOUR

DISCUSSION OF RESULTS

4.1 INTRODUCTION

This section presents the value chains of the export commodities and the risks for IFFs in the commodities. Next, the estimates of illicit financial flows in some of Ghana's top export commodities using the price filter method and the Partner Country Trade Gap (PCTG) method are presented. The section goes further to present the estimates and discussion of the determinants of trade mis-invoicing.

4.2 VALUE CHAIN ANALYSES AND RISKS FOR IFFS

The thesis analysed the value chains of the commodities studied: gold, cocoa, bauxite and manganese to identify the risks for IFFs along the value chain. A value chain maps the entire range of activities required to bring a product or service through the different phases of production from beginning to end (Kaplinsky & Morris, 2003).

Some of the risks identified included: transfer pricing risks due to the nature of ownership of the firms operating in the sector; the presence of artisanal, small-scale, and informal firms in the sector; regulatory infrastructure for verifying export valuation; and transit trade from neighbouring countries

4.2.1 Gold Value Chain and Risks for IFFs

Gold is Ghana's most valuable export product, accounting for 49 percent of the country's overall value exports (OEC, 2019). In 2017, gold accounted for 96.4% of the total revenues from mineral exports from Ghana (Minerals Commission, 2018). In 2018, Ghana became Africa's largest producer, producing about 4.8 million ounces of gold, which exceeded South Africa's 4.2 million ounces of gold produced (Whitehouse, 2019). Ghana's top four mines for the period understudy, have been Goldfields Ghana Limited, Newmont Ghana Gold Limited-Ahafo, Newmont Golden Ridge Limited, Akyem, and AngloGold Ashanti Iduapriem Limited in terms of production and revenue output according to the Ghana Chamber of Mines 2018 survey (Ghana Chamber of Mines, 2019).

Overall, the minerals and mining sector is the largest contributor to Ghana's GDP (Minerals Commission, 2017). The fiscal contribution of gold mining to public finances is observed via general taxes on profit and labor borne by all companies as well as specific revenue generators such as mining royalties, license fees, property rate payments and export duties. Additionally, mining companies in Ghana contribute to the socio-economic development of their communities, as part of the Corporate Social Responsibility (CSR). According to the Annual Report, 2016 of Ghana Chamber of Mines, its producing members invested US$ 12.29 million in their host communities.

The Government of Ghana is the overall regulator. Its mandate is exercised through the Ministries of Land and Natural Resources (MLNR), the Ministry of Environment, Science, Technology and Innovation (MESTI) and the Ministry of Finance and Economic Planning (MoFEP). Other

agencies which also have oversight roles include the Minerals Commission, the Lands Commission, the Office of the Administrator of Stool Lands (OASL), the Environmental Protection Agency (EPA), the Bank of Ghana (BOG), the Ghana Revenue Authority (GRA), the One Stop Service Centre (OSSC), the Geological Survey Authority (GSA) and the Precious Minerals Marketing Company (PMMC). Others include the town and country planning unit, the district mining committees, the security services and the traditional rulers or clans who own lands in Ghana.

Traditional Rulers/Clans play a key role in the mining sector. In Ghana, land is vested in the chiefs and clan heads and they are mandated to sell or lease to prospective buyers. However, the minerals buried in the land are the properties of the state of Ghana according to the 1992 constitution. Article 257 (6) of the 1992 Constitution states explicitly that "Every mineral in its natural state in, under or upon any land in Ghana, rivers, streams, water courses throughout Ghana and the exclusive economic zone is the property of the Republic of Ghana and shall be vested in the President on behalf of and in trust for the people of Ghana". As such, there is sometimes conflict between the traditional rulers, new owners of lands and the government in land acquisition, exploration and mining. In some instances, traditional rulers have been blamed for the high incidence of illegal mining in Ghana.

Gold is mined in almost all the regions of Ghana through Large-Scale Mining (LSM) and Artisanal and Small-Scale Mining (ASM). Many of the LSM companies are members of the Ghana Chamber of Mines whilst the small-scale miners have their own union known as the Small-Scale Miners Association. The large-scale mining companies in Ghana, that are members of the Ghana Chamber

of Mines include Gold Fields Ghana Ltd.; AngloGold Ashanti Ltd., Golden Star Resources; and Newmont Gold Ghana Ltd. (2016 Annual Report, Minerals Commission). As at 2018, there were over 300 ASMs registered in Ghana. Apart from the ASMs, there are also quite a sizeable number of illegal miners (*galamsey*) in the industry. These are managed by foreign operators usually under the cover of locals because according to the Minerals and Mining Act (Act 703), small-scale mining is a prerogative of only Ghanaians. However, many mining sites are operated by foreigners (Hausermann and Ferring, 2018). According to the same authors, this has largely been made possible due to loopholes in the acquisition of licenses to operate on small-scale mining concession sites (ibid).

In Ghana, the process of extracting gold from its ore is such that mined amalgam gold is smelted to obtain more bars that can be up to 23 carats; just below the 24 carats for which prices are usually quoted for global trading. After mining, gold is assayed for its value before sale or export. The large-scale mining companies do their own assaying at the mines as well as the airports, in the presence of a customs officer, before shipment. However, ASMs are required to send their gold to PMMC for assaying before shipment. In 2018, a new assaying regime was established in pursuant to Regulation (3) of the Minerals and Mining General Regulation 2012 (LI 2173), which requires both Small and Large-Scale Mining Companies to assay all their produce at PMMC before export from the 19th of February 2018. Due to this directive of PMMC to become the national assayer for all, a modern national assay laboratory was built and personnel capacity was upgraded to cater to its new role. This is in a bid to have accurate and valid records of all exported gold values. PMMC has also agreed with GRA (Customs Division) that allows gold produced in neighbouring countries to be brought into Ghana for assaying, documentation and shipment as Transit Gold.

Most of the gold ore bars mined in Ghana are exported while the rest are mainly made into jewelry and sold on the local market. Ghana exports gold to Switzerland, South Africa, Netherlands, Pakistan, Sierra Leone, India, Lebanon, Saudi Arabia, United Arab Emirates, Turkey, Singapore and Hong Kong. The types of gold exported include semi-processed unwrought gold, monetary gold, other semi-manufactured forms of gold, powder of gold and non-monetary gold. Unlike cocoa beans that is exported by only one institution in Ghana, there are many licensed gold exporters, including AA Minerals and Adfat Company Limited, to mention a few. Until 2013, there were no gold refineries in Ghana. Asap Vasa Gold Refinery, Sahara Royal Gold Refinery, and Gold Coast Refinery are recent firms that were established in 2013, 2015, and 2017 respectively.

The risks for IFFs in the gold sector are identified as follows:

Transfer pricing risks arising from multinational firms' international operations: Many leading mining firms in Ghana are multinational corporations with offices outside Ghana and several other foreign branches in various tax and legal jurisdictions (Oppong, 2013). This leads to substantial economic incentives for transfer mispricing and tax optimization through intra-company exchange and financial transfers. Readhead (2016) contends that the extractive sector to Ghana's economic growth could be much higher, except for tax evasion by companies operating in the sector by mispricing, mispricing of trade and thin capitalisation. In order to minimise their state tax liability, the sector-based MNCs may have an incentive to under-report their exports. The explanation is that the revenue earned by the state from the industry primarily comes from corporate and income taxes, royalties as well as withholding tax (Minerals Commission, 2018; Personal Communications, A. Tawiah; Aryee, 2018).

Artisanal, small-scale, and informal mining firms: Artisanal, small-scale, and informal mining is a characteristic of Ghana's intensively worked local output of gold mineral and ore bars by small-scale concession holders (CSSM, 2019). Gold mining is permissible for people, small groups (less than nine persons), or a cooperative society with ten or more members (Parliament of Ghana, 1989). The mining of small mines is a prerogative of Ghanaians according to the Minerals and Mining Act of Ghana (Act 703), which is popularly called galamsey. The lack of domestic capital and technological support from the government, however, encourages foreign enterprises to capture small-scale mining concessions through local or traditional leaders. The role of these foreign actors will extend to the entire activity of a mining site beyond providing technical support (Hausermann & Ferring, 2018). This sector is difficult to regulate due to its small-scale, geographically scattered and informal existence involving numerous intermediaries. Licensed gold exporters can also buy gold from licensed and non-licensed gold miners in Ghana. This situation allows intermediate buyers and other persons to export undervalued and/or misreported gold doré bars and engage in trade-based money laundering (Hunter 2020; Personal Communications, K. Opare-Hammond).

Regulatory infrastructure for export valuation: Before shipment, the gold bars must be assayed to assess the purity of their contents. Large mining companies typically perform their own assay or use foreign pre-shipment inspection firms to certify the contents of each shipment independently. Dedicated customs officers are supposed to be present at the stage where gold bars are assayed but may neither be present nor qualified to decide how gold is assayed.

The verification of the assay values is only conducted at a foreign refinery after the gold has been exported (Personal Communications, C. Nyarko). Any value anomalies found would likely be disclosed only to the mining enterprise and not to the state. This can contribute to revenue losses for the state if the business declares the prices of the export of gold ore bars. In addition, artisans, and small and informal mining companies that lack their own assays must submit their gold to a state-owned company, Precious Minerals Marketing Company (PMMC), for assay before shipping.

However, until 2016, due to this lag in gold valuation, the coverage of the testing infrastructure continued to be minimal. Under the new legislation, the Minerals and Mining Act of Ghana (Act 703), small and large mining firms are now obliged to test the government regulator, PMMC, for their golden shipments. A new national assay laboratory was therefore designed and fitted with professional staff (Minerals Commission, 2018; Personal Communications, K. Opare-Hammond).

Transit trade from neighboring countries: Trade flows can be listed as exports, imports, transit, and re-exports (Bensassi & Jarreau, 2019). The government of Ghana allows for gold mined in neighboring countries to be assayed, documented, and exported from Ghana as transit gold. However, this creates a situation where local actors can corrupt regulators and combine gold from different sources to misreport its true value and origin before shipping abroad (Rahman, 2018). The Head of the Tax Policy Unit at the Ministry of Finance reported that Ghana Revenue Authority (GRA) had lost an accumulated revenue of GH¢4.5 billion over the past five years as a result of infractions by traders, and importers and governmental agencies (Ocloo, 2018). The government

of Ghana lost GH¢2 billion in revenue in 2018 through non-observance of rules governing transit trade and the probable complicity and collusion of Customs officials (Sarpong, 2019).

4.2.2 Cocoa Sector

Ghana is the second largest cocoa bean producer in the world. Cocoa exports account for around one-quarter of the total export profits (Peprah, 2019). The sector employs nearly three million farmers, provides business to service providers using shipping, warehousing, insurance and so on; and contributes by bursaries to primarily farmers' wards and the needy people in cocoa farming communities. Cocoa is a primary source of livelihood for many rural communities in the southern part of the country, where it is largely grown. This sector accounted for approximately 2.3% of Ghana's annual gross domestic product and 9.9% of agricultural output between 2010 and 2017.

Cocoa is the most important agricultural export commodity, contributing about 80.7% of agricultural export averages between 2014 and 2017 (ISSER, 2018). Due to the socio-economic value of the commodity, the Ghana Cocoa Board (COCOBOD) regulates the industry with great interest. Around 70%-80% of the produced cocoa is exported (mainly the bigger beans from the main cultivation for the year). The remaining beans, mostly the small beans, are primarily sold to local manufacturers, i.e., both the Cocoa Processing Company and others in producing cocoa products such as cocoa pastes, liquors, powder, husks, and other products such as cocoa waste.

Ghana's specialised cocoa business regime is such that the Government of Ghana (GoG) plays a dominant role in a partly liberalised market. This has been described as unique in the industry (Williams 2009). GoG, through Ghana Cocoa Board (COCOBOD), regulates the sector with keen

interest due to the revenue generating and socio-economic benefits derived from the commodity. Other statutory bodies with some oversight for the sector include the Ministry of Finance and Economic Planning (MoFEP), the Ministry of Food and Agriculture (MoFA), and the Ministry of Lands and Natural Resources (MLNR). However, it has been observed that the various regulatory agencies do not co-operate fully. This has been identified as a disadvantage to the reaping of the full potential benefits of the commodity.

COCOBOD, the main link between the Government of Ghana (GoG) and the cocoa sector, was established by ordinance in 1947. Its mission is to encourage and facilitate the production, processing, and marketing of cocoa efficiently and cost-effectively. To achieve its mission, COCOBOD has several subsidiaries which enable it to be engaged in the cocoa sector at all levels. These subsidiaries are the Seed Production Division (SPD), the Cocoa Research Institute of Ghana (CRIG), the Cocoa Health and Extension Division (CHED), the Quality Control Company (QCC) and Cocoa Marketing Company (CMC).

After production at the farm level, the cocoa beans are dried, examined by the Quality Control Company (QCC) and then sold to Licensed Buying Companies (LBCs). The LBCs sector is fully liberalised; this has led to some cocoa processing companies owning LBCs. A farm-gate price is set by the Producer Price Review Committee (PPRC) at the beginning of the farming season. This guarantees the fair minimum price to be paid to the farmers. COCOBOD requires more than $1 billion US dollars annually to finance its crop purchases. COCOBOD obtains an off-shore trade finance facility via syndicated loans from a consortium of international and local banks to enable it to raise funds to pay cocoa farmers via LBCs. After purchase, the beans are transported to various

ports for export. The Cocoa Marketing Company (CMC) is solely mandated to sell and export cocoa beans in Ghana. Its trading unit sells the cocoa beans, while the port operations and shipping units are responsible for transporting and exporting the beans.

About 80% of the cocoa (mostly the big main crop beans and some light crops) is exported. For the period 2011 - 2017, Ghana exported a total of 5.5 million metric tonnes of cocoa to countries such as Turkey, Brazil, Malaysia, Belgium, the United States, Japan, Great Britain, Germany, Iran, Netherlands, Switzerland, and New Zealand, and Ireland among others. Ghana's foremost cocoa trading partner is the Netherlands. Chocolate and other confectionary items are also made for sale both locally and in international markets. The cocoa processing companies in Ghana include local companies such as Cocoa Processing Company (CPC), Plot Enterprises, and multinational companies such as Cargill, Barry Callebaut, and others.

Risks for Trade Mis-invoicing

Transfer pricing risks due to multinational firms' international trade operations: Transfer mispricing in the cocoa bean industry is not a major risk in Ghana, because COCOBOD in the government of Ghana dominates the market and serves as a regulatory and supervisory body to all operations in the market. The operations of state-owned companies permeate all stages of cocoa bean production. Some of the key acting stakeholders include the Ghana Cocoa Research and Institute (GRIG), the SPD, seeds supplying farmers with seeds, the Divisional Health and Extension of Community (CHED), the farmers supporting service, the Quality Control Division (QCD), which certifies the value of cocoa beans, and the Cocoa Mar research division, which is the most important contribution to our report (David 2013; Personal Communications, COCOBOD

Personnel). Since all but one of the COCOBOD subsidiaries is a state-owned corporation, it is presumed that most cocoa export revenues return to the state to establish a situation where transfer errors are not a major problem (Bulir, 1998). In addition, an audit committee has been formed since 2018 to oversee the administration of the Board's financial resources following the regulations that oversee the financial management in government institutions. This is following the 2016 Public Financial Administration Act (Ampofo, 2018). The cocoa paste industry does have several multinational companies (MNCs), however, that provide some transfer mispricing incentives in Ghana to lower the tax liabilities (Kwaramba et al., 2016).

Artisanal, small-scale, and informal firms: In cocoa production and exports, some peculiarities could render unto the risks of mis-invoicing. This study finds that the government finds it difficult to control artisanal, small-scale, and informal companies operating in the cocoa paste industry. This lack of control and regulatory adherence can lead to some risks of evasion and non-compliance in the field. Consequently, this could and has potentially resulted in Ghana losing substantial tax revenues. For instance, while Ghana Investment Promotion Council (GIPC) includes multinationals operating in the region, the same criteria do not apply to craft, small and informal companies (Personal communications, M. Acheampong). Moreover, COCOBOD and Ghana Export Promotion Authority (GEPA) partially control the cocoa paste market (Personal communications, E. Quao). This creates loopholes within the sector those companies can take advantage of to reduce their tax liability to the government, particularly when the state institutions that oversee the sector do not have effective cooperation and information sharing systems or procedures.

Regulatory infrastructure for verifying export valuation: The COCOBOD Quality Control Division verifies before the sale of both the cocoa beans and paste for export. The main crop, cocoa beans, are exported by CMC directly. In contrast,the light crop cocoa beans are processed for export and domestic consumption by cocoa paste companies (Personal communications, CMC Personnel). Approximately 90 per cent of all cocoa processed is exported and the remaining 10 per cent is used to produce confectionary (Ashitey, 2012). Though CMC sells cocoa paste products, supervision is not as strict as it is with cocoa beans since they are not owned directly by COCOBOD.

Furthermore, since many companies in the sector are multinationals, they are regulated by the Free Zone Authority of Ghana (Personal communications, M. Acheampong; Personal communications, F. Mate-Kodjo). This creates a situation in which several entities supervise the same sector and thereby create some differences and a lack of consensus about data and regulated procedures within the sector. The multinationals in the sector, have the potential to minimise their tax burden on the State.

Transit trade from neighboring countries: Like gold, there are risks to the trading of cocoa products from neighbouring countries. Several cases of cocoa beans between Cote d'Ivoire and Ghana have been reported based on the price differentials between the two countries (Bulir, 1998). Reuters estimated that in 2017, approximately 100,000 to 200,000 tonnes, because of the higher prices Ghana is giving farmers exports to Ghana from nearby Ivory Coast (Kpodo, 2017). The two countries have, however, agreed since 2018 to announce their prices jointly to end the phenomenon (Bruce, 2018).

4.2.3 Bauxite

Bauxite is an ore which serves as the world's leading source of aluminum. It was first discovered by a French Geologist named Pierre Berthier in 1821 in France. Currently, Australia is the world's largest producer of bauxite, followed by China. Other leading bauxite producers include Guinea, Brazil, Canada, India, and Russia. Bauxite is usually processed first into alumina and then to aluminum. For bauxite to be commercially exploitable, it should contain more than 25–30% aluminum oxide. The major steps in aluminum processing are bauxite mining, refining of bauxite into alumina, smelting of alumina into raw aluminum ingots, and processing or casting of aluminum ingots into sheets, coils, and profiles. The processed aluminum is the input for aluminum goods ranging from packaging material, automotive parts, and construction elements to household goods. Although most of the world's bauxite reserves are found in tropical and subtropical regions, converting aluminum from bauxite requires a lot of investment and advanced technology, including cheap electricity. As such, aluminium production tends to be concentrated in developed countries.

The African history of bauxite and aluminum is quite recent and started in the early 1950s when demand exploded, partly because of the Korean War and, consequently, when European and North-American companies or consortiums began to prospect Guinea, Ghana, or Cameroon for investment (Lesclous, 2002). Although Alcan had mining concessions on the Loss Islands in the early 1920s, the Guinean saga for this Canadian group really began with the discovery of the renowned Boke ore field in 1952. From that time on, Guinean willingness to process bauxite was explicit but was, with rare exceptions, constantly rebuffed by the multinationals operating in the country (Lesclous, 2002).

In Ghana, the mining sector includes 16 large-scale mining companies, of which 14 produce gold, one produces bauxite, and the other produces manganese. Also, over 300 registered small-scale mining groups and 90 mine support service companies (GIPC, 2016).

Bauxite was first discovered in Ghana in 1914, but exploration and mining works started in the 1940s. Currently, Ghana is the 17th largest exporter of bauxite in the world (Index Mundi) and has some of the world's largest bauxite reserves, with 960m tonnes worth an estimated $460bn. Bauxite can be found in many places in Ghana, such as the Sefwi Bekwai area in the Western Region, which the Ghana Bauxite Company is mining with available reserves of 29.5 Mt, sufficient to support a mine life of 100 years. Other deposits include those at Nyinahin near Kumasi and in the Atewa range. The Nyinahin deposit has a total inventory of 350 metric tonnes (MT) at an average grade of 48.9% to 51% alumina and 2.8% to 4.4% silica.

In contrast, that of the Atewa range has about 150 MT ranging in grade from 40.8% to 45.7% alumina and 1.8% to 3.9% silica (Kesse, 1985). Ghana's bauxite is described as high alumina and low silica bauxite ore, which is among the best deposits of bauxite. There are several types of bauxite depending upon the end use. Some examples include the metallurgical-grade bauxite which is used for aluminum production and the refractory-grade bauxite which is used in the ceramic and refractory industries. The grade of alumina in bauxite ores in Ghana falls below the refractory grade.

In 2016 alone, 1.278 million metric tonnes of bauxite were produced in Ghana, while a total of 1.476 million metric tonnes of bauxite was produced in 2017, amounting to an increase in bauxite

exports from $38.7m in 2016 to $50.9m. The quantity, however, declined to 1.011 million metric tonnes in 2018 (Minerals Commission, 2017; 2018).

The Government of Ghana regulates the Bauxite industry through the Ministry of Lands and Natural Resources and its relevant agencies, such as the Minerals Commission, the Geological Survey Authority, and the Environmental Protection Agency (EPA).

Historically, the sector has been centred on one company, the Ghana Bauxite Company, and its mine at Awaso. The company is currently owned by the Bosai Group, a Chinese-owned company that acquired it in 2009 from Rio Tinto Group. The Bosai Group is a mining company specialising in bauxite and manganese and can be found in Chongqing, Southwest China. It also engages in aluminum and ferroalloy production.

The mine at Awaso is an open pit with a low stripping ratio, which poses little difficulty for mining operations. Exploration is the first step in the extraction process, which is followed by mining and transporting the extracted materials to the export port. After the exportation of bauxite to smelters in Scotland and Canada, alumina is imported from Jamaica and the United States of America for the local smelter; Volta Aluminium Company Limited (VALCO) which has faced significant challenges in recent years, particularly energy issues (Oxford Business Group, 2013). In 1965, the Volta River Project led to the creation of the Akosombo dam, which was to provide electricity for the Volta Aluminum Company (VALCO), which, in turn, was expected to provide enough revenue to mine the local bauxite resources in Aya-Yenuhin and end alumina imports.

Additionally, the Government of Ghana announced its intention to develop the country's bauxite value chain and address the factors impeding the industry's efficiency and cost-effectiveness. Interactions with relevant players and stakeholders in the Bauxite industry indicate that there are potential for downstream processing of aluminum into different aluminum products. These products in turn could serve as inputs to Ghanaian firms, such as construction and other aluminium-oriented industries. Such aims in higher value aluminum products are quite ambitious. They would require overcoming the energy as mentioned above and capacity constraints and an increase in production to achieve economies of scale.

The Government of Ghana as part of its efforts to establish an aluminum industry created the Ghana Integrated Aluminum Development Corporation in 2018. The roles of the corporation include promotion of responsible mining and ensuring the development of the industry. They are also responsible for developing necessary infrastructure, including rails, roads and energy, industrial parks and associated social infrastructure to support related businesses in the sector and the industry as a whole.

So far, the corporation has identified some bauxite deposits that could form the basis of new mining operations, including a deposit of around 150 million metric tonnes of the mineral underneath the Atewa Forest, one of the last enduring rainforests in Ghana. However, there has been a backlash about the potential damage to the environment.

Risk for trade mis-invoicing

Transfer pricing risks due to multinational firms' international trade operations: Trade mis-invoicing due to multinational firms' international trade operations is a risk in Ghana's Bauxite

sector since a foreign company owns the Ghana Bauxite Company Limited; a Chinese Company. There is a high risk of export undervaluation for developing countries, and in this instance Ghana, because the amount of tax these companies pay is usually determined by how much has been exported. According to Readhead (2018), commodities such as Bauxite are vulnerable to undervaluation due to a lack of quoted bauxite prices and limited spot sales. In 2018, Ghana Bauxite Company was slapped with a GHC 3.5 million tax liability for transfer pricing and underselling bauxite to its mother company.

4.2.4 Manganese Value Chain and Risks for IFFs

Manganese is a transition metal that is a vital industrial alloy. It is used in iron and steel production, manufacturing of dry cell batteries, fuel oil additives, anti-knock agents, manufacturing of glass, the production of potassium permanganate and the production of fungicides and tanning of leather. However, despite its general usefulness, it is known to be a common environmental contaminant, which can cause toxic effects in humans (Milatovic et al. 2011). Some of the top countries where manganese resources are found include South Africa, Australia, China, Gabon, Brazil, India, Kazakhstan, Ghana, Ukraine and Malaysia. About 80% of the world's manganese resources are and recognised in South Africa.

The manganese value chain consists of three segments: ore producers, alloy producers, and steel producers. Ore characteristics segment the manganese ore industry. It comprises of high-grade ore (with more than 35% manganese contents) producers who account for two-thirds of production, and low-grade ore producers contributing a third of production. Alloy production is performed either by independent alloy smelters (70% of production) or by integrated alloy smelters (30% of

production). The latter are vertically integrated firms involved in both ore mining and smelting. The end-use customers are primarily steel producers (94% of demand) who can be classified into integrated mills, mini mill flat producers, mini mill long producers and speciality mills. Chemical and specialist metallurgical segments contribute to the balance of the demand.

In Ghana, manganese was first discovered by a colonial official, Albert Ernest Kitson in 1915 and mining works began in 1916. The Government of Ghana is the overall regulator of this sector and directives can be expressed through the Lands and Natural Resources Ministry. Various agencies under the Ministry, such as the Minerals Commission and the Geological Survey Authority also have oversight of the sector.

Currently, two manganese deposits can be found in the Yakaw area near Dixcove in the Western Region of Ghana. These have estimated reserves of about 5.5 MT with 42% manganese content and 1.0 MT containing 32% manganese content, respectively. Two other deposits can be found in the Northern Region with total reserves of over 13.8 Mt with a manganese content of 30% to 45%. However, the only operating manganese mine in Ghana is at Nsuta near Tarkwa with 37 Mt of manganese ore reserves (Kesse, 1985). Since mining activities began in 1916, the mine has produced and exported about 28 MT of high-grade manganese oxide ore. The types of manganese ore exported include the battery grade (Mn > 52%), metallurgical grade (47 – 52% Mn), and chemical grade (40 - 46% Mn). With the oxide ores almost depleted, the mine has begun mining and processing the low-grade carbonate ores which are available in large quantities on the mine. The average manganese content of the carbonate ore is 34.5% (Amankwah et al., 1999).

Manganese in Ghana is mined solely by Ghana Manganese Company Limited (GMCL), one of the world's leading producers of manganese. It operates the largest manganese reservoir in Ghana in the Nsuta Manganese mine. There are also proprietary mining rights in an area 175 kilometres refrom Nsuta and around. The headquarters of GMCL is in the Western Region of Ghana.

GMCL's Nsuta mine has considerable potential. At the same time, mining operations on the site date back to 1916, less than 3% of the 175-sq-km concession has been mined. The concession has 45m tonnes of proven reserves and the ores have one of the highest manganese-to-iron ratios in the world with a low level of impurities, which means that they are well-suited for alloy and manganese metal production. The qualities of the Nsuta reserves' carbonate ore was one of the most important factors behind TMI's acquisition of Consmin. Its immediate expansion potential is set to meet the Chinese company's growing feedstock needs, as one of the world's leading producers of electrolytic manganese metal.

Manganese production in Ghana increased from 2.034 million metric tonnes in 2016 to 3.003 million metric tonnes in 2017 to 4.552 million metric tonnes in 2018 (Ghana Chamber of Mines, 2018; 2019). The substantial increase in manganese production in 2017 was largely attributable to rising global demand. The sector was able to increase output as a result of substantial capital investments made by the Ghana Manganese Company (GMCL) after its Australia-based parent company, Consolidated Minerals (Consmin), was acquired by a subsidiary of China's Ningxia Tianyuan Manganese Industry (TMI) in a May 2017 deal. In 2017, the Ghana Revenue Authority (GRA) recognised Ghana Manganese Company as the third-largest taxpayer (Ghana Chamber of Mines, 2018).

Risk for trade mis-invoicing

Transfer pricing risks due to multinational firms' international trade operations: The company's foreign ownership presents a risk for IFFs because of the transfer pricing risks associated with foreign ownership of firms. Consmin (Consolidated Minerals), a Jersey-based company owns 90% of the company, while the government of Ghana owns 10%. In 2017, Consmin was acquired by China Tian Yuan Manganese Limited, a subsidiary of Ningxia Tian Yuan Industry Co., Ltd. The comparison of Ghana's exports of Manganese with China's imports of Managanese show that the reported exports from Ghana are only half of the reported imports of China which could be indicative of trade mis-invoicing.

4.3 ESTIMATES OF TRADE MIS-INVOICING

This section presents the estimates of trade mis-invoicing for the selected gold, cocoa beans, cocoa paste, bauxite, and manganese exports using the methodologies and data explained earlier. The analyses presented in this section are based on export trade between Ghana and various partners, hence, the estimates are general rather than specific to a particular trading partner. Overall, the estimates show an economically significant undervaluation of some of the commodities.

4.3.1 Estimates of Trade Mis-invoicing in Gold (HS 7108.13.1000&7108.12.0000)

Table 4:1 Undervalued and Overvalued Exports-Gold (HS 7108.13.1000&7108.12.0000)

Year	Free-market Price Filter: Minus 10% of Benchmark Prices* (USD, Million)	Free-market Price Filter: Plus 10% of Benchmark Prices* (USD, Million)	Partner Country Trade Gaps (USD, Million)
2011	222.8	2.0	-5,145
2012	544.5	14.5	-4,115
2013	514.7	23.1	-2,010
2014	205.5	13.4	-1,447
2015	78.9	7.4	142
2016	1,195.4	1.9	909
2017	1,067.4	4.2	-1,312
Mean	547.0	9.5	-1,854
Total	**3,829.1**	**66.6**	**-12,977**

Data Source: Ghana Revenue Authority (GRA); Metal Focus Limited; United Nations Comtrade Database (accessed:December 2020) *The benchmark prices are estimated based on the heterogeneity nature of gold doré exported which are gold – silver splits; 100 - 0%, 96 – 4%, 86 – 14%, 81 – 19%, and 67 – 33%.

Notes: Gold is semi-manufactured; a combination of two export types mis-classified in the GRA data as gold bullion (HS:7108.13.1000) and unwrought gold, non-monetary including gold plated with platinum (HS: 7108.12.0000). Free-market reference price is the daily gold bullion price from London Bullion Market Association (LBMA) ($/t oz).

Negative numbers indicate over-invoicing while positive numbers indicate under-invoicing for the PCTG methodology.

Estimates of mis-invoiced exports: Using the lower bound of the arm's length price range as described in the methodology, it is estimated that USD 3.8 billion exports are undervalued. This constitutes approximately 11% of the total value of gold exported (USD 35.6 billion). The top five destination countries for these undervalued gold exports are India (USD 2.0 billion), South Africa (USD 659.3 million), United Arab Emirates (USD 457.7 million), Switzerland (USD 343.4 million) and Portugal (USD 133.5 million). Their respective percentage share of the total value of gold exported within the study period is approximately 5.5%, 1.9%, 1.3%, 1.0% and

0.4%. Finally, the total estimated tax base erosion from Ghana due to the undervaluation of gold exports is USD 957.3 million.

Estimates of Overvalued Exports: Similarly, using the upper bound arm's length range, it is estimated that total overvaluations of gold exports between 2011 and 2017 equal USD 66.6 million. Relative to the total value of gold exports, overvaluation seems negligible, at approximately 0.2%. Top five destination countries that overvalued Ghana's gold doré exports are South Africa (USD 31.8 million), Switzerland (USD 22.7 million), The Netherlands (USD 9.7 million), United Arab Emirates (USD 1.4 million) and India (USD 0.8 million). The over-valuation could be differences in the assay values of gold exported.

Comparison with Trade Gap Estimates for Partner Countries: In addition, the more prevalent partner-country trade gaps are calculated based on asymmetries between Ghana's exports and the imports reported by its trading partners using annual product-level data from the UN COMTRADE database. The overall results indicate that reported Ghanaian exports exceed what the rest of the world reported as imports from Ghana between 2011 to 2017, i.e. export over-valuation, which is contrary to the price filter estimates for the same period. These conflicting results are primarily driven by missing imports data in the UN COMTRADE database from significant destinations for Ghanaian gold, including South Africa, Switzerland and United Arab Emirates. For example: according to the UN COMTRADE database, South Africa reported no imports of gold from Ghana between 2011 and 2017. However, in the data provided by Ghana Customs, it is reported that Ghana exported USD 4.4 billion of gold to South Africa during this period.

4.3.2 Estimates of Trade Mis-invoicing in Cocoa Beans (HS: 1801.00.1100)

Table 4:2 gives the estimated magnitudes of undervaluation and overvaluation of cocoa beans for the period 2011 – 2017.

Table 4.2: Undervalued and Overvalued Exports – Cocoa Beans (HS: 1801.00.1100)

Year	**Free-market Price Filter: Minus 20% (USD, Million)**	**Free-market Price Filter: Plus 30% (USD, Million)**	**Partner Country Trade Gaps (USD, Million)**
2011	24.4	3.8	503
2012	8.5	7.9	339
2013	1.4	21.6	361
2014	57.4	12.0	139
2015	2.2	7.0	-915
2016	9.0	47.0	262
2017	23.8	15.4	13
Mean	18.1	16.4	100
Total	**126.6**	**114.7**	**703**

Data Source: Ghana Revenue Authority (GRA); United Nations Comtrade Database (accessed: December 2020)

Notes: Cocoa beans are superior quality raw beans (HS: 1801.00.1100). Free-market price is the London Futures Price (US$/MT).

Negative numbers indicate over-invoicing while positive numbers indicate under-invoicing for the PCTG methodology.

Estimates of undervalued exports: Despite the unique marketing characteristics of Ghana cocoa beans exports, it is estimated that about USD 126.6 million worth of cocoa beans was undervalued between 2011 and 2017 (Table 4:2). This equals about 1.0% of the total value of cocoa beans exported (USD 12.6 billion) which appears to be a small proportion but equals an economically significant gross amount. The top five countries that undervalued cocoa beans exported from Ghana are Estonia (USD 45.7 million), The Netherlands (USD 14.7 million), Germany (USD 9.7 million), China (USD 9.5 million), and Belgium (USD 8.8 million). Their corresponding percentage share of total cocoa beans exports are 0.4%, 0.1%, 0.08%, 0.08% and 0.07%. Although undervaluation in percentages appears small, revenue loss is not negligible. There is an estimated tax base erosion of USD 31.6 million. The under and over-valuation observed could be as a result of the methodology used.

Estimates of overvalued exports: The overvalued cocoa beans exports are quite similar to the undervaluation estimates. For example, the estimated overvalued amount of cocoa beans is USD 114.7 million, or 0.9% of total exports over the entire study period (Table 5). The top five destination countries that overvalued cocoa beans from Ghana are Malaysia (USD 26.0 million), The Netherlands (USD 18.7 million), Brazil (USD 15.9 million), and the United States of America (USD 11.5 million), and Japan (USD 7.0 million).

Comparison with partner country trade gap estimates: In addition, an estimate of partner-country trade gaps between Ghana's reported exports of cocoa beans and its trading partners' reported imports from Ghana is generated. Overall, the findings indicate that reported Ghanaian exports are significantly lower than the reported imports by the rest of the world from Ghana, i.e. export under-valuation. These estimates of undervaluation are significantly higher than what

was estimated using transaction-level export data. The hypothesis is that these differences are primarily driven by the entrepot trade effect in international trade statistics, whereby the exporting country records an intermediate transit country or shipping hub as the final destination of their exports. However, the products are re-exported from the transit country to the final destination, which reports them as imports from the source country. This is a significant feature of the international trade in cocoa beans, which are usually purchased and stored for multiple years before being shipped to their final destination.

4.3.3 Estimates of Trade Mis-invoicing in Cocoa Paste (HS: 1803.20.0000).

The annual and total undervaluation and overvaluation estimates of cocoa paste are given in Table 4:3.

Estimates for undervalued exports: The estimates indicate that the amount of undervalued cocoa paste is USD 130.5 million (or 7.2% of the total export value) between 2011 and 2017. Although endogenously determined, the interquartile range filter provides better abnormal pricing estimates. The lack of benchmark prices makes it unfeasible to estimate the arm's length price range using commodity market prices. This undervaluation could be attributed to the different cocoa paste/mass products combined to generate the estimates (COCOBOD Personnel Feedback, Stakeholder Meeting, 2019).

Another reason is the high number of multinationals operating in the sector, which increases risks for trade and transfer mispricing in the sector (Kwaramba et al., 2016). The top five countries that undervalued cocoa paste from Ghana are Spain (USD 46.2 million), Bulgaria (USD 36.9 million), The Netherlands (USD 13.5 million), Turkey (USD 5.4 million) and Russia (USD 3.3 million);

with a percentage share of total exports as 2.5%, 2.0%, 0.7%, 0.3% and 0.2% respectively. The total tax base erosion due to the overall undervaluation estimated is USD 32.6 million.

Estimates for undervalued exports: The overvaluation of cocoa paste amounts to approximately USD 59,1 million, or approximately 3.2% of the total export value of cocoa paste. The first five countries that overvalued cocoa paste are The Netherlands (USD 13.2 million), Turkey (USD 8.3 million), Bulgaria (USD 5.9 million), United States of America (USD 4.6 million) and United Kingdom (USD 4.0 million).

Comparison with partner country trade gap estimates: In addition, partner-country trade gaps estimations are done for cocoa paste exports from Ghana and the results are reported in Table 4:3. Significant data misreporting is recorded in product-level trade statistics for cocoa paste by Ghana Customs which does not allow for reliable interpretation of the observed trade gaps. Transaction-level data from Ghana Customs shows that all export transactions for cocoa paste, cocoa butter and cocoa powder have been recorded under the tariff category of cocoa paste despite being allocated to distinct tariff categories. This leads to incomparability with the import statistics of its trading partners. Overall, this case highlights the strong limitations of estimating trade mispricing using aggregate trade data in the case of developing countries which limited statistical capacity and misreporting.

Table 4.3: Undervalued and Overvalued Exports – Cocoa Paste (HS:1803.20.0000)

Year	Rolling Interquartile Range Filter: Below 25th pctle (USD, Million)	Rolling Interquartile Range Filter: Above 75th pctle (USD)	Partner Country Trade Gaps (USD, Million)
2011	2.7	0.2	48
2012	7.7	4.1	-
2013	11.8	4.5	26
2014	33.7	19.1	-401
2015	24.9	14.9	-393
2016	18.4	7.7	-
2017	31.3	8.6	-258
Mean	18.6	8.4	-195
Total	**130.5**	**59.1**	**-977**

Data Source: Ghana Revenue Authority (GRA); United Nations Comtrade Database (accessed: December 2020)

Notes: Cocoa paste includes wholly and partly defatted (HS: 1803.20.0000).

Rolling Interquartile range is calculated for unit prices (USD per kg) using transaction-level data from GRA.

Negative numbers indicate over-invoicing while positive numbers indicate under-invoicing for the PCTG methodology.

4.3.4 Estimates of Trade Mis-invoicing in Bauxite (HS:2606.00.0000*)*

Table 4:4 Undervalued and Overvalued Exports – Bauxite (HS:2606.00.0000)

Year	Interquartile Range Filter: Below 25th pctle (USD, Million)	Interquartile Range Filter: Above 75th pctle (USD, Million)	Partner Country Trade Gaps (USD, Million)
2011	0.03	1.81	7
2012	1.17	0.72	-22
2013	0.27	2.81	21
2014	17.15	1.11	32
2015	22.15	0.19	23
2016	0.01	3.77	41
2017	-	-	55
Mean	6.79	1.74	22
Total	**40.77**	**10.42**	**157**

Data Source: Ghana Revenue Authority (GRA); United Nations Comtrade Database (accessed: December 2020)

Notes: Bauxite (HS: 2606.00.0000). Interquartile range is calculated for unit prices (USD per kg) using -level GRA data.

Negative numbers indicate over-invoicing while positive numbers indicate under-invoicing for the PCTG methodology.

Estimates for undervalued exports: The estimates indicate that the amount of undervalued bauxite is USD 40.77 million (or 18.9% of the total export value) between 2011 and 2017. Although endogenously determined, the interquartile range filter provides better estimates of trade mis-invoicing where the lack of benchmark prices makes it not feasible to estimate the arm's length price range using commodity market prices. The undervaluation could be attributed to the risk of transfer pricing from the multi-national company operating in the sector.

Estimates for overvalued exports: Overvaluation of bauxite is approximately USD 10.42 million, constituting roughly 4.7% of the total value of bauxite exported.

Comparison with partner country trade gap estimates: In addition, partner-country trade gap estimations are done for bauxite exports from Ghana and the results are reported in Table 4:4 Seventy-four percent of Ghana's total exports are undervalued according to the PCTG method (approximately USD 157 million). This may be the result of trade gaps and inaccurate reporting, as the export and import data from the UN COMTRADE database appears to list different countries. The Netherlands and the United Kingdom, for instance, appear on the list of countries that import bauxite from Ghana but not on the list of countries to which Ghana exports bauxite, whereas Angola and Gabon appear on the list of countries to which Ghana exports bauxite but not on the list of countries that import bauxite from Ghana. In addition, there may be trade gaps because some major trading partners, such as China, are missing years from the statistics. In contrast, 18 percent of total reported exports are overvalued according to the PCTG method (approximately USD 22 million).

4.3.5 Estimates of Trade Mis-invoicing in Manganese (HS: 2602.00.0000)

The annual and total undervaluation and overvaluation estimates of manganese are presented in Table 4:5.

Table 4.5: Undervalued and Overvalued Exports – Manganese (HS: 2602.00.0000)

Year	Interquartile Range Filter: Below 25th pctle (USD, Million)	Interquartile Range Filter: Above 75th pctle (USD)	Partner Country Trade Gaps (USD, Million)
2011	0.13	0.15	267
2012	2.14	0.22	139
2013	0.79	0.32	153
2014	0.45	0.10	117
2015	0.18	0.14	50
2016	0.10	18.28	80
2017	1.38	0.13	136
Mean	0.74	2.76	135
Total	**5.17**	**19.34**	**942**

Data Source: Ghana Revenue Authority (GRA); United Nations Comtrade Database (accessed: December 2020)

Notes: Manganese ores and concentrates (HS: 2602.00.0000). Interquartile range is calculated for unit prices (USD per kg) using transaction-level data from GRA.

Negative numbers indicate over-invoicing while positive numbers indicate under-invoicing for the PCTG methodology.

Estimates of undervalued exports: The estimates indicate that the amount of undervalued manganese is USD 5.17 million (or 0.65% of the total export value) between 2011 and 2017. Given the nature of manganese trade, which is mainly bilateral, it is not possible to use benchmark prices to estimate trade mis-invoicing. The interquartile range price filter is used to generate the estimates. Although endogenously determined, the interquartile range filter provides better estimates of trade mis-invoicing when it is not possible to estimate the arm's length price range using commodity market prices.

Estimates of overvalued exports: Overvaluation of manganese is approximately USD 19.34 million, constituting roughly 2.4% of the total value of manganese exported.

Comparison with partner country trade gap estimates: In addition, partner-country trade gaps estimations are done for manganese exports from Ghana. The total trade gaps reported amount to USD 942 million. This is due to the huge gaps observed between the volume of exports and imports reported. For example, the amount of exports to China reported from Ghana in the UN COMTRADE data is only half of the total imports reported from China under imports from Ghana. Furthermore, some of the countries that Ghana exports manganese to, such as Australia, Romania, and the United Kingdom, are not on the list of countries that import manganese from Ghana, and some of the countries that import manganese from Ghana, such as Bulgaria, Slovakia, and Vietnam, are not on the list of countries that Ghana exports manganese to. It is possible that the huge asymmetries reported could be as a result of data inconsistencies.

4.4 DETERMINANTS OF TRADE MIS-INVOICING

This section provides some regression analysis of potential drivers of abnormal pricing in exports of gold from Ghana. The analysis is in the form of descriptive statistics and regression analysis. The regression analysis is done using Ordinary Least Squares (OLS) and Random Effects. Quantile regressions are also conducted as a robustness check.

4.4.1 Descriptive Statistics

Table 4.6 contains the descriptive statistics of the variables used for the regression analysis. Due to the high values of the variables showing overvaluation, undervaluation and current account balance, the log values are reported in this table. A table showing the actual values is included in Appendix 2.

Table 4.6 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Undervaluation (Log)	463	11.536	4.457	-5.297	20.554
Overvaluation (Log)	356	11.116	3.2	-5.297	16.566
Current Account Bal (Log)	373	24.012	1.813	17.736	26.466
Corruption	784	58.622	20.02	23	92
Inflation	773	3.443	5.148	-1.667	58.933
Tax Differential	560	0.019	0.081	-0.08	0.3
Interest Rate	496	3.999	7.578	-12.857	41.76
GDP Growth	784	2.713	2.742	-10.945	15.816
Transfer Pricing Risk	596	3.032	0.802	0.787	4.049
Transfer Pricing Rank	596	0.638	0.291	0.017	1

4.4.2 Correlation Analysis

The correlation table below shows that the correlation between the various variables is less than 0.5. The correlation between Transfer Pricing Risk and Transfer Pricing Rank is 0.961 so the two variables are used in two different regressions because of the high correlation between them.

Table 4.7 Correlation Table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)Undervaluation	1.000									
(2) Overvaluation	0.084	1.000								
(3) Current Account	0.143	0.087	1.000							
(4) Corruption	-0.082	0.096	0.114	1.000						
(5)Inflation	0.107	-0.064	-0.110	-0.480	1.000					
(6) Tax Differential	0.074	-0.015	0.132	0.181	-0.133	1.000				
(7) Interest Rate	0.019	-0.030	0.076	-0.151	-0.081	0.269	1.000			
(8) GDP Growth	-0.017	-0.061	0.096	-0.113	-0.168	0.017	-0.109	1.000		
(9) Transfer Pricing Risk	-0.008	0.071	0.048	-0.377	0.181	0.418	0.025	0.084	1.000	
(10) Transfer Pricing Rank	0.015	0.099	0.150	-0.344	0.148	0.386	0.068	0.104	0.961	1.000

4.4.3 Regression Analysis

The regression analysis uses the identified variables to estimate the drivers of trade mis-invoicing in commodity exports from Ghana. The regression is an unbalanced panel data regression for 2011 to 2017. The estimated regression models are Ordinary Least Squares (OLS) and Random Effects (RE). The Hausman (1978) test was conducted to determine the appropriate regression to be chosen between the Random Effects Model and the Fixed Effects Model. The test statistic for all the regressions were not significant at 1%, implying that the Random Effects model is preferred over the Fixed Effects model. The results of the Hausman test are shown in the Random Effects regression table and in Appendix 1.

Table 4.8 Ordinary Least Squares (OLS) Regression

VARIABLES	Overvaluation with TPRisk	Overvaluation With TPRank	Undervaluation with TPRisk	Undervaluation with TPRank
Current Account Balance	1.300***	1.126**	0.686**	0.735**
	(0.470)	(0.430)	(0.333)	(0.323)
Corruption	0.0217	0.000644	-0.000160	0.0124
	(0.0412)	(0.0344)	(0.0309)	(0.0274)
Inflation	-0.841***	-0.852***	0.0305	-0.000583
	(0.226)	(0.212)	(0.172)	(0.170)
Tax Differential	-44.07***	-44.90***	0.546	-5.088
	(13.76)	(12.21)	(11.15)	(10.44)
Interest Rate	0.302	0.250	-0.163	-0.104
	(0.303)	(0.274)	(0.215)	(0.207)
GDP Growth	-0.782***	-0.819***	-0.530***	-0.581***
	(0.220)	(0.206)	(0.174)	(0.173)
Transfer Pricing Risk	3.470***		-0.283	
	(0.950)		(0.731)	
REER	-0.0606	-0.0636	0.0784**	0.0801**
	(0.0457)	(0.0433)	(0.0350)	(0.0349)
Transfer Pricing Rank		11.32***		0.970
		(2.369)		(1.924)
Constant	-22.18*	-12.91	-10.89	-14.21*
	(12.59)	(10.19)	(9.039)	(7.770)
Observations	79	79	85	85
Prob>F	0.0009	0.0000	0.0018	0.0017

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.9 Random Effects Regression

VARIABLES	Overvaluation with TPRisk	Overvaluation with TPRank	Undervaluation with TPRisk	Undervaluation with TPRank
Current Account Balance	1.300***	1.126***	0.686**	0.735**
	(0.470)	(0.430)	(0.333)	(0.323)
Corruption	0.0217	0.000644	-0.000160	0.0124
	(0.0412)	(0.0344)	(0.0309)	(0.0274)
Inflation	-0.841***	-0.852***	0.0305	-0.000583
	(0.226)	(0.212)	(0.172)	(0.170)
Tax Differential	-44.07***	-44.90***	0.546	-5.088
	(13.76)	(12.21)	(11.15)	(10.44)
Interest Rate	0.302	0.250	-0.163	-0.104
	(0.303)	(0.274)	(0.215)	(0.207)
GDP Growth	-0.782***	-0.819***	-0.530***	-0.581***
	(0.220)	(0.206)	(0.174)	(0.173)
Transfer Pricing Risk	3.470***		-0.283	
	(0.950)		(0.731)	
REER	-0.0606	-0.0636	0.0784**	0.0801**
	(0.0457)	(0.0433)	(0.0350)	(0.0349)
Transfer Pricing Rank		11.32***		0.970
		(2.369)		(1.924)
Constant	-22.18*	-12.91	-10.89	-14.21*
	(12.59)	(10.19)	(9.039)	(7.770)
Observations	79	79	85	85
Prob>F	0.0002	0.0000	0.0005	0.0005
Hausman test, χ^2	5.031	6.765	6.5	8.184
P-value	0.754	0.562	0.591	0.416

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tables 4.8 and 4.9 document the regression results from the Ordinary Least Squares (OLS) and the Random Effects regression, respectively. The results confirm each other.

Due to the simultaneous nature of the relationship between the two variables, however, these results should be interpreted with caution.

Regarding overvaluation, it is observed that the Current Account Balance exhibits a positive correlation with both Transfer Pricing Risk and Transfer Pricing Rank in relation to overvaluation. This relationship is statistically significant. Our results are contrary to Patnaik et al 2012 who expect an inverse relationship between the Current Account and trade mis-invoicing. However, we hypothesise that the Current Account Balance could incentivise countries to over-value exports from Ghana.

However, Inflation, the Tax Differential, GDP Growth, Transfer Pricing Risk and Transfer Pricing Rank all exhibit a negative but statistically significant relationship with overvaluation. The constant also shows a negative and significant relationship with overvaluation when Transfer Pricing Risk is used. Marur (2019) hypothesizes that Higher GDP growth is associated with a lowering trade mis-invoicing which these results confirm. It is expected that improvements in the condition of the partner country will diminish the incentive to mis-invoice. Due to the simultaneous nature of the relationship between the two variables, however, these results should be interpreted with caution. The results for inflation are in line with Kellenberg and Levinson 2018, who expect inflation to have a negative relationship with trade mis-invoicing because of firms' having incentives to use trade mis-invoicing to move capital. The results of the Tax Differential deviate from Marur (2019), who find that the tax differential has a positive relationship with trade mis-invoicing. However, that study also finds that in some circumstances the tax differential rate has a negative relationship with trade mis-invoicing as this study finds.

For undervaluation, it was observed that Current Account Balance and the REER have a positively significant relationship with undervaluation while GDP growth has a negative but statistically significant relationship with undervaluation. The constant shows a negative and significant relationship with undervaluation when Transfer Pricing Rank is used. Kwaramba et al. (2016) found that a high value of exchange rate signals a high level of illicit financial flows which confirms the results that the REER has a positive relationship with undervaluation. Similarly, as earlier indicated, a positive relationship is expected between the Current Account Balance and trade mis-invoicing. Also, Marur (2019) indicates a positive relationship between trade mis-invoicing and GDP growth.

4.4.2 Robustness Checks: Quantile Regression

The study goes further to estimate a quantile regression as a robustness check for the earlier regressions done. Quantile regression is a highly versatile statistical modeling approach because it uses a general linear model to fit conditional quantiles of the response without assuming a parametric distribution.

The purpose of this thesis was to examine the value chain of specific export commodities from Ghana in order to identify the risks for international financial flows (IFFs) in those commodities, measure trade mis-invoicing in Ghana's commodity exports using both the Partner Country Trade Gap Method and the Price Filter method and estimate the determinants of trade mis-invoicing in these commodities. This was performed at the commodity level, which is uncommon for studies of this type.

Quantile regression is an alternative regression technique used when the key assumptions of linear regression are not met, there are outliers in the data, the residuals are not normal, there is an increase in error variance with increase in outcome variable, or to estimate the median or any quantile (Koenker & Hallock, 2001; Yu et al., 2003). In general, quantile regression results confirmed the results obtained from the OLS and Random Effects regressions although there are some deviations.

Within the quantile regression for overvaluation with Transfer Pricing Risk, a negative relationship between overvaluation and inflation are observed within the 50th and 75th quantiles. Although a negative relationship was observed with inflation in the OLS and Random Effects regressions, the quantile regression clarifies that the relationship only exists within specific quantiles. Similarly, the tax differential exhibits a negative relationship with overvaluation but within the 50th and 90th quantiles only while GDP growth exhibits a negative relationship with overvaluation in the 50th quantile. However, Transfer Pricing Risk exhibits a positive relationship with overvaluation within the 20th, 50th and 75th quantiles.

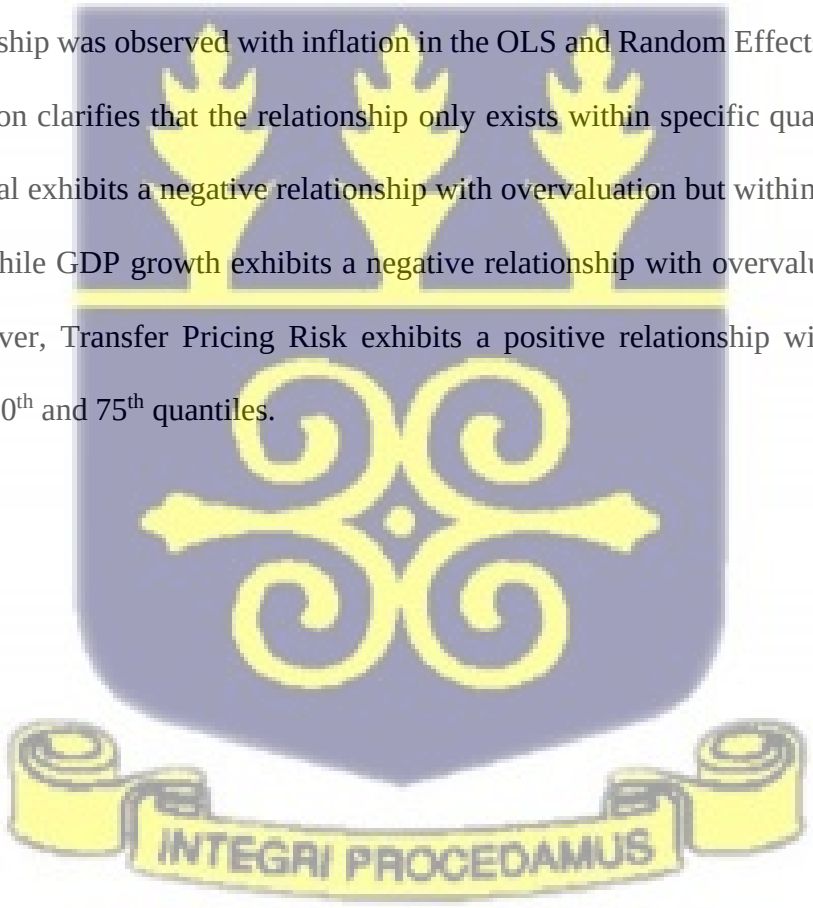

Table 4.10 Quantile Regression for Overvaluation using Transfer Pricing Risk

VARIABLES	(0.25 Quantile)	(0.5 Quantile)	(0.75 Quantile)	(0.9 Quantile)
Current Account Balance	0.343	0.760	0.456	-0.515
	(0.924)	(0.841)	(0.669)	(0.688)
Corruption	0.0530	0.0140	0.0236	0.0149
	(0.0566)	(0.0458)	(0.0475)	(0.0665)
Inflation	-0.441	-0.699**	-0.564**	-0.342
	(0.320)	(0.300)	(0.280)	(0.211)
Tax Differential	-32.85	-36.94**	-19.07	-18.69*
	(21.43)	(15.49)	(15.29)	(10.86)
Interest Rate	0.214	0.0827	0.183	-0.236
	(0.322)	(0.467)	(0.484)	(0.641)
GDP Growth	-0.463	-0.564**	-0.399	-0.00306
	(0.301)	(0.261)	(0.248)	(0.157)
Transfer Pricing Risk	3.085*	2.620*	1.843*	0.808
	(1.753)	(1.390)	(1.014)	(0.966)
REER	-0.0280	-0.0386	-0.0311	-0.0168
	(0.0813)	(0.0712)	(0.0610)	(0.0571)
Constant	-5.746	-8.195	0.628	27.29
	(21.43)	(20.31)	(15.10)	(16.41)
Observations	79	79	79	79

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In the quantile regression for overvaluation using Transfer Pricing Rank, the Current Account Balance shows a positive relationship in the 50th quantile while Transfer Pricing Rank exhibits a positive relationship with overvaluation in the 25th, 50^{th,} and 75th quantiles. Inflation has a negative relationship with overvaluation at the 25th quantile, while the tax differential exhibits a negative relationship in all quantiles. GDP growth shows a negative relationship at the 25th and 50th quantiles while the exchange rate shows a negative relationship at the 25th quantile.

Table 4.11 Quantile Regression for Overvaluation using Transfer Pricing Rank

VARIABLES	(0.25 Quantile)	(0.5 Quantile)	(0.75 Quantile)	(0.9 Quantile)
Current Account Balance	0.635	0.884*	0.459	-0.409
	(0.498)	(0.527)	(0.533)	(0.745)
Corruption	0.0729**	0.0173	0.00690	0.0127
	(0.0340)	(0.0325)	(0.0628)	(0.0933)
Inflation	-0.519***	-0.664***	-0.539*	-0.573
	(0.134)	(0.179)	(0.293)	(0.412)
Tax Differential	-44.36***	-33.92***	-29.71**	-22.28*
	(10.41)	(11.91)	(14.70)	(11.90)
Interest Rate	0.387	0.213	0.0719	0.163
	(0.245)	(0.301)	(0.459)	(0.630)
GDP Growth	-0.646***	-0.595***	-0.437	-0.261
	(0.180)	(0.193)	(0.330)	(0.476)
Transfer Pricing Rank	13.56***	9.301***	6.740***	4.593
	(2.346)	(1.601)	(2.149)	(3.950)
REER	-0.0509*	-0.0352	-0.0260	-0.0186
	(0.0264)	(0.0354)	(0.0565)	(0.0480)
Constant	-10.74	-10.44	2.305	24.66
	(13.95)	(11.78)	(13.66)	(23.98)
Observations	79	79	79	79

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Undervaluation was observed that under the current account balance has a positive relationship with undervaluation in the 25th quantile while GDP growth has a negative relationship with undervaluation in the 25th and 50th quantiles. The exchange rate has a negative relationship with undervaluation in the 25th quantile but a positive relationship in the 50th quantile.

Table 4.12 Quantile Regression for Undervaluation using Transfer Pricing Risk

VARIABLES	(0.25 Quantile)	(0.5 Quantile)	(0.75 Quantile)	(0.9 Quantile)
Current Account Balance	0.695*	0.497	0.273	0.350
	(0.349)	(0.322)	(0.662)	(1.020)
Corruption	0.0186	-0.0316	0.0602	-0.105
	(0.0295)	(0.0307)	(0.0772)	(0.101)
Inflation	0.0538	0.0313	0.463	0.337
	(0.132)	(0.168)	(0.338)	(0.357)
Tax Differential	0.923	2.346	4.143	-21.62
	(10.46)	(12.20)	(22.21)	(22.65)
Interest Rate	-0.103	-0.255	0.0668	-1.109
	(0.308)	(0.285)	(0.462)	(0.746)
GDP Growth	-0.584***	-0.633***	-0.192	-0.155
	(0.147)	(0.199)	(0.274)	(0.344)
Transfer Pricing Risk	0.230	-0.448	-0.951	-2.440
	(0.653)	(0.560)	(1.744)	(1.965)
REER	0.0870***	0.119***	0.0738	-0.0316
	(0.0306)	(0.0355)	(0.0463)	(0.0642)
Constant	-16.23	-7.555	-2.816	25.14
	(10.27)	(8.233)	(20.87)	(29.97)
Observations	85	85	85	85

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For undervaluation using Transfer Pricing Rank, it was observed that the current account balance has a positive relationship with undervaluation at the 50th quantile while the exchange rate has a positive relationship in the 25th and 50th quantiles. GDP growth has a negative relationship in the 25th and 50th quantiles while the constant shows a negative relationship in the 50th quantile.

Table 4.13 Quantile Regression for Undervaluation using Transfer Pricing Rank

VARIABLES	(0.25 Quantile)	(0.5 Quantile)	(0.75 Quantile)	(0.9 Quantile)
Current Account Balance	0.380	0.681**	0.418	0.633
	(0.296)	(0.299)	(0.686)	(0.831)
Corruption	0.0158	-0.0175	0.0618	0.0628
	(0.0400)	(0.0441)	(0.0602)	(0.0941)
Inflation	-0.182	-0.0765	0.173	0.239
	(0.194)	(0.196)	(0.286)	(0.389)
Tax Differential	-0.443	-2.929	0.703	-15.99
	(15.84)	(14.31)	(17.58)	(27.88)
Interest Rate	0.0539	-0.0747	0.235	-0.103
	(0.349)	(0.300)	(0.405)	(0.635)
GDP Growth	-0.744***	-0.642**	-0.417	-0.199
	(0.273)	(0.268)	(0.297)	(0.360)
Transfer Pricing Risk	2.425	0.371	-0.708	0.882
	(1.543)	(1.942)	(3.593)	(6.087)
REER	0.104***	0.106***	0.0893*	-0.00423
	(0.0331)	(0.0342)	(0.0459)	(0.0573)
Constant	-10.15	-13.46*	-9.576	-4.158
	(7.662)	(7.375)	(15.14)	(22.12)
Observations	85	85	85	85

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.5 CHAPTER SUMMARY

This section presented the value chain analysis and identification of risks for IFFs in the selected commodities. The chapter goes further to present and analyse the estimates of IFFs using both the Partner Country Trade Gap Method and the Price Filter Method. In addition, the section contains a regression analysis of the drivers of trade mis-invoicing in the export of selected commodities from Ghana.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the summary, conclusions, and recommendations of the thesis. It also outlines the contributions of the thesis to knowledge.

5.2 SUMMARY

The purpose of this thesis was to examine the value chain of specific export commodities from Ghana in order to identify the risks for international financial flows (IFFs) in those commodities, measure trade mis-invoicing in Ghana's commodity exports using both the Partner Country Trade Gap Method and the Price Filter method and estimate the determinants of trade mis-invoicing in these commodities. This was performed at the commodity level, which is uncommon for studies of this type. The commodities chosen were gold, cocoa, bauxite, and manganese. The estimates show high trade mis-invoicing, especially for gold, cocoa paste and bauxite. This is in line with the foreign ownership of these firms which tends to create incentives for multi-national transfer pricing abuses and other practices which may go contrary to the use of the arm's length principle.

The study analyses gold doré exports from Ghana, which incorporate a combination of gold, silver and impurities, including lead and arsenic, whose composition can vary depending on the source mine. The transaction-level export data are matched with mine-level information on the gold and silver content in their doré production.

The London Bullion Market Association (LBMA) daily spot prices for 99.9% pure, refined gold and silver are identified as the relevant benchmark price for Ghanaian exports. The mine-level purity information is combined with the commodity exchange prices for gold and silver to estimate the relevant benchmark price for gold doré exports from Ghana. Also, commodity experts estimate the variance in contractual pricing terms under normal business conditions to estimate the arm's length price range. The results indicate that Ghanaian exports are undervalued by approximately 11% of the total value of gold exported (USD 35.6 billion).

Due to the lack of accurate benchmark prices and comparability criteria, the interquartile range price filter is used to estimate the arm's length price range for exports of cocoa paste, bauxite and manganese.

The presence of international mining and trading firms in Ghana's liberalised gold sector can explain this overall finding of significant undervaluation. Typically, these firms are domiciled in jurisdictions where they benefit from lower effective corporate tax rates relative to Ghana, giving them an incentive to under-report their taxable income. For example one of the largest gold mining and exporting firm operating in Ghana is domiciled in Colorado, the United States of America, where the corporate tax rate equals 4.5% compared to 25% in Ghana.

Furthermore, the semi-processed gold doré production from Ghana is first exported to destinations with gold refineries which also usually offer tax incentives, including reduced tax rates and complete tax exemptions for precious metal imports. For example gold doré imports are exempt from Value Added Tax in Switzerland which is the world's largest gold refining country.

The results indicate that the total estimated tax base erosion from Ghana due to the undervaluation of gold exports is USD 957.3 million.

Next, the case of cocoa beans exports from Ghana that predominantly comprises superior quality fermented beans are analysed. Based on interviews with Cocoa Marketing Company (CMC) experts, the benchmark price for these exports is identified as the London International Financial Futures and Options Exchange (LIFFE) prices. Then information on the product-specific price premiums due to various certifications and transportation costs, which are normally included in reported Customs valuation, as well as expected variance in pricing terms under normal business conditions are included to estimate the arm's length price range. The results indicate that Ghanaian cocoa beans exports are undervalued by USD 126.6 million which represents 1.0% of the total export value of USD 12.6 billion between 2011 and 2017. The low magnitude of abnormal pricing in cocoa beans exports can be explained by the Government of Ghana's monopoly over cocoa bean exports from the country. Due to an absence of private actors in this partly liberalised cocoa sector of Ghana, the wholly state-owned Cocoa Marketing Company directly markets this commodity in the international markets and does not face economic incentives for trade mispricing.

Due to the lack of accurate benchmark prices and comparability criteria, the interquartile range price filter is used to estimate the arm's length price range for exports of cocoa paste, bauxite, and manganese.

The results indicate that 7.2% of the total export of cocoa paste (USD 1.8 billion) was undervalued i.e. found below the 25th percentile of the per unit price distribution of the product.

Despite the limited nature of this methodology, the relatively high undervaluation of cocoa paste exports represents a significant risk for illicit outflows via transfer mispricing. Unlike the Ghanaian state monopoly over cocoa bean exports, private traders and multinational firms are allowed to manufacture and export cocoa products, including cocoa paste, cocoa powder and cocoa butter. These exporting firms face economic incentives for tax-motivated profit shifting by engaging in export undervaluation of their international sales, usually to affiliated marketing firms operating under a common ownership structure.

The estimates indicate that the amount of undervalued bauxite is USD 40.77 million (or 18.9% of the total export value) between 2011 and 2017, while the amount of undervalued manganese is USD 5.17 million (or 0.65% of the total export value) between 2011 and 2017. Overvaluation of manganese is approximately USD million, constituting roughly 2.4% of the total value of manganese exported.

Also, the price filter estimates are compared with the more commonly used partner-country trade gaps based on asymmetries between Ghana's exports and the imports reported by its trading partners in the rest of the world.

Using annual product-level data from Ghana Customs and the United Nations COMTRADE database, the study identifies significant asymmetries between reported Ghanaian exports and imports of gold, cocoa beans, cocoa paste, bauxite and manganese.

Using annual product-level data from Ghana Customs and the United Nations COMTRADE database, the study identifies significant asymmetries between reported Ghanaian exports and

imports of gold, cocoa beans, cocoa paste, bauxite, and manganese. In the case of gold, the trade gaps indicate that reported Ghanaian exports exceed what the rest of the world reports as imports from Ghana between 2011 to 2017, i.e. export over-valuation. This is contrary to our price filter estimates for the same period which indicate significant undervaluation in gold exports. However, an investigation of the aggregate trade data highlights that the observed trade gaps are primarily driven by missing imports data in the UN COMTRADE database from significant destinations for Ghanaian gold, including South Africa, Switzerland and the United Arab Emirates.

In the case of cocoa beans, the estimated trade gaps indicate that reported Ghanaian exports are significantly lower than the reported imports by the rest of the world from Ghana. The estimated magnitude of undervaluation is significantly higher than what is estimated using transaction-level export data. The hypothesis is that the that drives these differences in international trade statistics, whereby the exporting countries record the destination as the intermediate shipping hub from where commodities are then re-exported to the final destination. This is a significant feature of the international trade in cocoa beans, which can be purchased and stored for multiple years before being marketed and shipped to the final destination.

Then it is observed that significant data misreporting in product-level trade statistics for cocoa paste by Ghana Customs does not allow for estimating trade gaps. Ghana Customs records all export transactions for cocoa paste, cocoa butter and cocoa powder under the tariff category of cocoa paste, leading to incomparability with the import statistics of its trading partners. Overall, this comparison highlights the strong limitations of applying this methodology in the case of developing countries with poor statistical capacities and misreported trade data.

In addition, a regression analysis is used to examine the determinants of trade mis-invoicing using variables such as current account balance, transfer pricing risk, transfer pricing rank, inflation and the tax differential.

It is observed that contrary to the literature and there is a positive relationship with the current account balance and over-valuation. Similarly, in a deviation from the literature, there is a negative relationship between over-valuation and the tax differential. However, as expected, a negative relationship is observed between GDP Growth, Transfer Pricing Risk, Transfer Pricing Rank and Inflation. These imply that improvements in the macro-economic conditions of countries tend to reduce the incentive for over-valuation.

For undervaluation, it was observed that under the current account balance and the REER have a positive relationship with undervaluation while GDP growth has a negative relationship with undervaluation. The findings for the current account balance and the exchange rate confirm the literature, while the finding on GDP growth deviates from the literature.

A quantile regression was also run as a robustness check. Overall, the quantile regression results confirm the results obtained from the OLS and Random Effects regressions.

5.3 CONCLUSION

Ghana, as a resource-rich developing nation, expects to earn much revenue from its natural resources to fund socio-economic growth. However, trade mis-invoicing undermines the ability of the natural resource sector to contribute to growth.

The first goal of this study was to analyse the commodity value chains for some of Ghana's most significant export commodities: cocoa, gold, bauxite and manganese using a rigorous, interdisciplinary approach. The study identified that the operations of multinational companies represent a high risk for trade mis-invoicing.

The next goal was to estimate trade mis-invoicing in the selected commodities using the Price Filter Method with transaction level data from the Ghana Revenue Authority and the Partner Country Trade Gap (PCTG) method using data from UN COMTRADE. Finally, the study analyzed the determinants of trade mis-invoicing using regression analysis. The results of this study confirm that trade mis-invoicing is an urgent concern for Ghana.

During the study, it was observed that the data capture process for export commodities leads to several errors due to ignorance on the part of some actors involved in the data capture process. For instance, it was observed that the generic term Gold Bullion is used for different types of gold exported from Ghana. This is a potential source of revenue loss for the country.

It was also observed that different institutions involved in the commodity value chains do not share information thereby creating situations where disparate data is collected for different reasons rather

than having an integrated system that will ensure harmonisation. This situation could potentially lead to a loss of revenue for the state.

5.4 CONTRIBUTIONS TO KNOWLEDGE

This study makes some useful contributions to knowledge. This current study is the first to estimate trade mis-invoicing from Ghana using multiple commodity exports and using transaction level data from the Ghana Revenue Authority from 2011 to 2017.

Additionally, the study makes use of the method of extensive commodity research to understand the commodities studied and to identify the risks for IFFs in those commodities. This extensive qualitative research serves as the means for identifying applicable benchmark price series and defining the arm's length price range after accounting for the expected level of price deviations. In the few previous studies that used price filter analyses, arbitrary criteria are used to set arm's length price range.

Another novelty of this study is that it generates estimates of trade mis-invoicing using the generally accepted Partner Country Trade Gap (PCTG) method at a commodity level for exports of gold, bauxite, manganese and cocoa beans and cocoa paste from Ghana. These estimates are also compared with the estimates generated from the Price Filter Method and both are analysed.

In addition, the study contributes new evidence based on administrative microdata to analyse the possible tax revenue losses due to trade mis-invoicing, which could be indicative of the magnitude of IFFs in Ghana.

The study further contributes to the trade mis-invoicing literature by utilising the estimates of trade mis-invoicing generated to analyse the determinants of trade mis-invoicing. This is important because many of the previous studies on trade mis-invoicing made use of estimates from the Parter Country Trade Gap (PCTG) Method to analyse the determinants of trade mis-invoicing. Hence, the use of transaction level estimates to analyse the determinants of trade mis-invoicing is quite novel.

Another important contribution of this study is in respect of the Sustainable Development Agenda with a focus on SDG 16.4 (curb IFFs) and 17.1 (improve domestic revenue mobilisation). These are very key considerations for developing countries that have been reported to be losing funds through IFFs.

The study also makes a significant contribution to policy formulation. A better appreciation of the issues regarding IFFs is necessary for providing policy prescriptions for improving domestic revenue mobilisation in developing countries. This current empirical study provides a good basis for doing that.

5.5 RECOMMENDATIONS

One of the study's recommendations is the need for relevant training for officials of the Customs Division of the Ghana Revenue Authority and all other individuals and organisations engaged in the capture of export data in Ghana. This is because of the gaps and errors observed in the data. Export data is critical for our development as a nation, and thus the same kind of attention paid to import data should be paid to export data.

In addition, there is a need for the Customs Division of the Ghana Revenue Authority to provide the UN COMTRADE database with the requisite data especially for the years where there is missing data. This is to ensure that estimates of trade mis-invoicing generated are not a result of trade discrepancies but are measuring trade mis-invoicing or other forms of IFFs.

Further policy recommendations include the need to enhance the data capabilities of the different institutions exporting those goods, increased cooperation between different institutions in those sectors in order to harmonise the data collected, and constant improvement in staff skills. Information and communication technology tools, in particular computers, related software and access to vital databases, must also be updated to match those of private sector actors in order to enable the monitoring of tax assessments and payments.

Regulators may also consider applying the investigation methodology based on price exchanges and statistical benchmarks as a way of risk-based customs, tax and transfer price audits.

In addition, policymakers will need to prioritise the development of institutional expertise to map, control and block the sources of the resulting tax base erosion from Ghana due to trade mis-invoicing.

Finally, Civil Society Organisations (CSOs) may also need to collaborate more with other state institutions to research further into the area.

5.6 LIMITATIONS AND DIRECTIONS FOR FURTHER RESEARCH

The thesis was limited to five of Ghana's export commodities. Further studies could look at estimating trade mis-invoicing in more commodities such as petroleum. In addition, although the thesis offers strong results and a wide range of implications for regulatory authorities, policy makers and companies, future studies could evaluate the selected techniques, methods and methodology used. Finally, future studies could review the effect of trade mis-invoicing on various aspects of the economy such as foreign direct investment or the financial sector.

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APPENDICES

APPENDIX 1: RESULTS OF HAUSMAN TESTS

Hausman Test for Overvaluation: Transfer Pricing Risk

Hausman (1978) specification test

	Coef.
Chi-square test value	5.031
P-value	0.754

Hausman Test for Overvaluation: Transfer Pricing Rank

Hausman (1978) specification test

	Coef.
Chi-square test value	6.765
P-value	0.562

Hausman Test for Undervaluation: Transfer Pricing Risk

Hausman (1978) specification test

	Coef.
Chi-square test value	6.5
P-value	0.591

Hausman Test for Undervaluation: Transfer Pricing Rank

Hausman (1978) specification test

	Coef.
Chi-square test value	8.184
P-value	0.416

APPENDIX 2: DESCRIPTIVE STATISTICS

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Overvaluation	356	583283.05	1425684.8	0.005	15655485
Undervaluation	463	8322992.9	56931896	0.005	844300000
Current Account Balance	756	3580000000	113000000000	-4600000000000	312000000000
Corruption	784	58.622	20.02	23	92
Inflation	773	3.443	5.148	-1.667	58.933
Tax Differential	560	0.019	0.081	-0.08	0.3
Interest Rate	496	3.999	7.578	-12.857	41.76
GDP Growth	784	2.713	2.742	-10.945	15.816
REER	588	95.775	11.834	69.417	129.954
Transfer Pricing Risk	596	3.032	0.802	0.787	4.049
Transfer Pricing Rank	596	0.638	0.291	0.017	1

APPENDIX 3: ENDOGENEITY TEST

Endogenous-test 1

Hansen J statistic (overidentification test of all instruments): 0.392

Chi-sq(2) P-val = 0.8218

-endog- option:

Endogeneity test of endogenous regressors: 1.442

Chi-sq(1) P-val = 0.2298

Regressors tested: GDPGrowth

Instrumented: GDPGrowth

Included instruments: InflationRate CorruptionIndicator taxdiff InterestRate tpr lnCAB REER

Excluded instruments: L.GDPGrowth L2.GDPGrowth L3.GDPGrowth

Endogenous 2-test 2

Hansen J statistic (overidentification test of all instruments): 4.022

Chi-sq(2) P-val = 0.1339

-endog- option:

Endogeneity test of endogenous regressors: 0.143

Chi-sq(1) P-val = 0.7057

Regressors tested: GDPGrowth

Instrumented: GDPGrowth

Included instruments: InflationRate CorruptionIndicator taxdiff InterestRate TransferPricingRank lnCAB REER

Excluded instruments: L.GDPGrowth L2.GDPGrowth L3.GDPGrowth

Endogenous 3-test 3

Hansen J statistic (overidentification test of all instruments): 3.966

Chi-sq(2) P-val = 0.1377

-endog- option:

Endogeneity test of endogenous regressors: 0.556

Chi-sq(1) P-val = 0.4559

Regressors tested: GDPGrowth

Instrumented: GDPGrowth

Included instruments: InflationRate CorruptionIndicator taxdiff InterestRate tpr lnCAB REER

Excluded instruments: L.GDPGrowth L2.GDPGrowth L3.GDPGrowth

Endogenous 4-test 4

Hansen J statistic (overidentification test of all instruments): 2.647

Chi-sq(2) P-val = 0.2662

-endog- option:

Endogeneity test of endogenous regressors: 0.564

Chi-sq(1) P-val = 0.4528

Regressors tested: GDPGrowth

Instrumented: GDPGrowth

Included instruments: InflationRate CorruptionIndicator taxdiff InterestRate TransferPricingRank lnCAB REER

Excluded instruments: L.GDPGrowth L2.GDPGrowth L3.GDPGrowth