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The Financialisation of Commodity Markets: The Case of Copper in Zambia

Dale Mudenda[*], Maio Bulawayo[*1] and Manenga Ndulo[*]

**University of Zambia, Department of Economics, Lusaka, Zambia.*
[1]Corresponding author: bulawayo. maio@yahoo. com

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Abstract: Empirical evidence shows increasing financialisation of commodity markets. The process of financialisation of commodity markets has resulted in many institutional investors treating primary commodities such as copper as an important part of their investment portfolio. Usingexports and stock price data of Zambia's key mining and trading firms, this paper investigates the extent to which these are associated with the global copper prices. Ganger-causality tests are used to test for the possible association among these variables. The study finds indications of positive associations between share prices and commodity prices. We find a strong bi-directional causality between commodity prices and share prices, and between share prices and export values. However, variations in export volumes and global copper consumption are not associated with changes in share prices. The significant causal relationship between global copper prices and share prices of a leading foreign mining sector investor implies the need for fiscal and mining policies that reduce the county's exposure to shocks in international financial markets.

1. INTRODUCTION

Since the early 2000s, there has been a major transformation of the global financial architecture and commodity markets. There have beenincreased linkages between financial markets and commodity markets. Intermediaries include institutional investors that have previously not engaged in large commodity investments. This process has been referred to as the 'financialisation' of commodity markets which Mayer (2009) defines as the process of increasingly treating primary commodities as

an alternative asset in order to diversity their investment portfolio, mitigate risk and maximise their returns. Consequently, commodity prices are increasingly influenced by factors other than their demand and supply.

Many studies have discussed this phenomenon, especially after the collapse of the Bretton Woods monetary and financial system in the early 1970s (Maizels, 1994; Nissanke, 2011). The link between financial and commodity markets was strengthened in the late 1980s by the collapse of the international commodity agreements; designed to minimise volatility in commodity prices and export earnings. Since then, there has been a greater inclusion of primary commodities in investors' portfolio for both risk management and speculative purposes (Basu & Gavin, 2011; UNCTAD, 2011).

Thefinancialisation of commodity markets has increased volatility of commodity prices and export earnings, in ways that do not reflect commodity supply and demand dynamics (Nissanke, 2012). For many commodity-dependent developing countries, the increased volatility of commodity prices and instability of export earnings has had many adverse effects. These include: worsened balance of payments and public debt positions (UNCTAD, 2010), reduced foreign exchange receipts, unstable fiscal revenues (Ebeke & Ehrhart, 2012) and low economic growth (van der Ploeg & Poelhekke, 2009; Krishna & Levchenko, 2013); reinforcing the poverty traps that exist in these countries.

Most Sub-Saharan African countries are connected to world trade through the export of primary commodities. It is estimated that exports of primary commodities account for almost 60% of total merchandise exports in 28 out of 38 African countries (UNDP Regional Bureau for Africa, 2016). In Zambia, the dependence on the export of primary commodities, particularly copper, is even more pronounced; accounting for over 75 per cent of foreign exchange earnings in 2017 (CSO, 2017).

Financialisation of global copper trade implies that Zambia is a *de facto* participant in unpredictable commodity markets. Furthermore, the increasing presence of Zambian mining giants such as the Anglo-Swiss giant Glencore and Vendata Resources PLC in the production, purchasing and marketing of copper reflects the increasing financialisation of the global copper trade.

Financialisation may explain apparent discrepancies between the per unit value of copper exports reported by the exporting country (Zambia), those reported in the 'intermediating' country (such as Switzerland)and those reported by the'final'

importing country (such as China). Put differently, the per unit value of copper exports varies depending on where theyare tracked: at the exporting country level, the 'intermediating' country level or the 'final' importing country level (after accounting for the cost of logistics such as transportation). This study highlights the trends in copper exports since 2000, as reported by Zambia, and key 'intermediating' and importing actors. Most importantly, it highlights the role that increasing financialising along the copper GVC plays in explaining discrepancies in reported per unit copper export values.

Knowledge of the extent to which commodity markets are financialised is important for the design of general fiscal policies. However, empirical research aimed at analysing this phenomenon in developing countries remains scarce. It is not clear whether changes in financial markets affect commodity exports. Further little is known on the extent to which share price movements of commodity producers and sellers influences exports from developing countries. The main objective of this study is to investigate whether thereexists a link between copper prices and financial market dynamics such as stock price movements. Drawing on literature on financialisation, global value chains, derivative markets and asset pricing, the study focuses on the share price movements of Glencore and Vendata Resources PLC – key players in the Zambian copper industry.

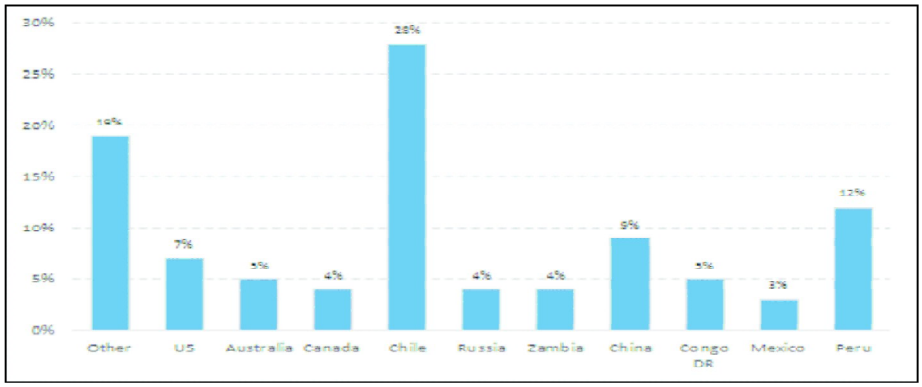
The rest of the paper is structured as follows. Section 2 looks at the structure of the Zambian copper industry. Section 3 looks at the trading of copper. Related literature on financialisationis reviewed in section 3. Section 4 gives the methodological framework. Sections 5 and 6 discuss the empirical results and conclude, respectively.

2. STRUCTURE OF THE ZAMBIAN COPPER INDUSTRY

2.1. Copper Resources and Production

Zambia has 6 per cent ofthe world copper resources. It is estimated to have 2. 8 billion tonnes of resources at existing mines; much of which are in the Copper belt and North-Western Provinces. Approximately 40 per cent of the country is not mineral-surveyed (Nathan Associates, 2015). Zambian mines have substantial mineral resources with different degrees of resource utilization. Some mines still need to invest in developing their ore reserves so as to promote the longevity of their operations.

Figure 1: Global Copper Production by Main Producers



Source: United States Geological Survey (USGS) Minerals Yearbook, 2017

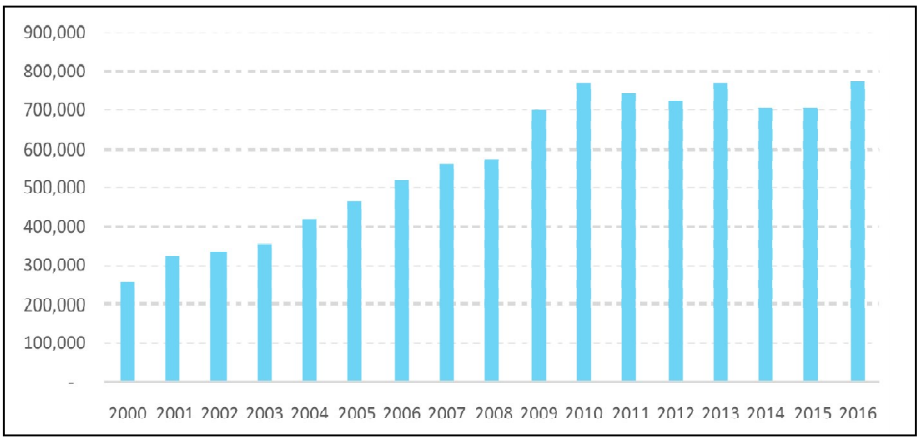
In 2016, Zambia was ranked the second biggest copper producer in in Africa, after the Democratic Republic of Congo. Globally, it ranked seventh (United States Geological Survey, 2017); accounteing for 4 per cent of the global production (see Figure 1). The largest producers were Chile (28 per cent) followed by Peru (12 per cent) and China (9 per cent).

Comparatively, Zambian mines have a high unit cost, especially the underground mines on the Copperbelt. The open pit mines in the North-Western Province have lower unit costs. These are heavily mechanized and benefit from economies of scale. There is a high prevalence of outsourcing of core business activities in the sector; done through the use of contractors (ZRA, 2014). Outsourcing increases opportunities for value addition in the sector.

Zambia's copper production and exports significantly increased from US$474 million in 2000 to almost US$ 7. 7 billion in 2014 (CSO, 2017). The increase was largely driven by a combination of thecopper price recovery stimulated by the increased demand for copper ore from China, and increased production from the mines aftertheir privatization in the late 1990s. Copper production rose consistently from 2000 to 2010; after which there was a slight fall in production during the periods 2010-2012, and 2013-2015 (see Figure 2).

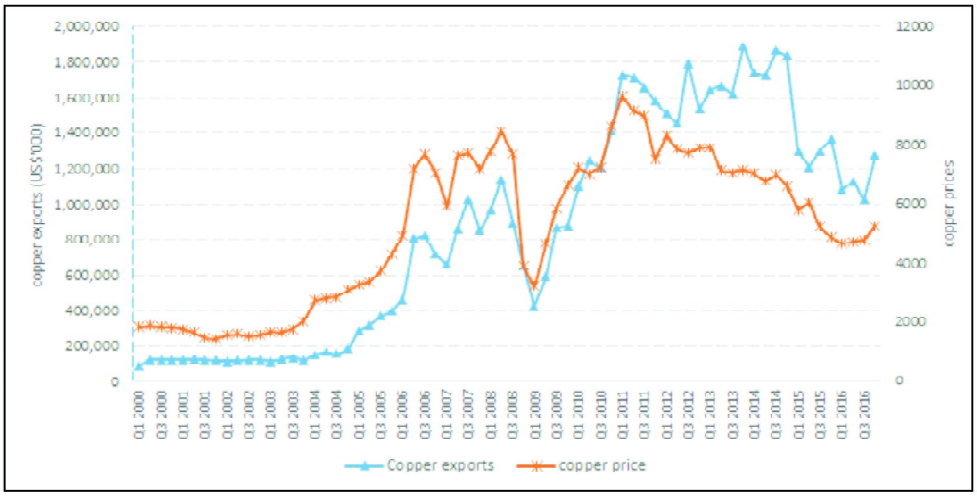
Copper production and exports have been influenced by dynamics in the copper prices. During years when prices are high, Zambia produced and exported more copper. As displayed in figures 2 and 3, the decline in copper production and exports between 2013 and 2015 is largely explained by a fall in global copper prices (Credit Rating Agency, 2016), and uncertainty surrounding the mining tax regime (Sikamo, Mwanza and Mweemba, 2016).

Figure 2: Zambia's Copper Production, 2000-2016



Source: Central Statstics Office (CSO), 2017

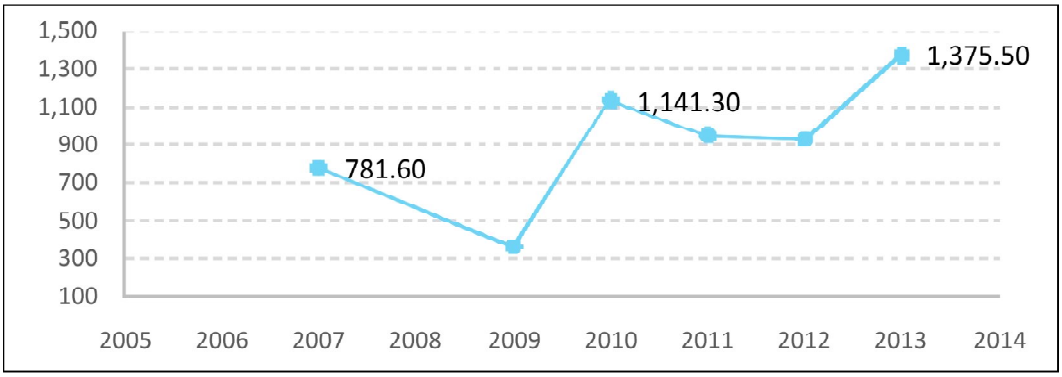
Figure 3: Trend in Zambian Copper Exports and Copper Prices



Source: Constructed by Authors from CSO database

Increased copper production has also been attributed to the increased foreign direct investment (FDI) inflows to the mining sector following the liberalization of the economy in the 1990s (Hampwaye, Kaleng's and Siame, 2015). Figure 4 shows the FDI inflows into the Zambian mining sector between 2007 and 2013. The slump in copper output between 2010 and 2012 (figure 4) was associated with a correspondingdrop in mining FDI; showing aclose link between copper production and mining sector FDI inflows.

Figure 4: Foreign Direct Investment Inflows to the Mining Sector, 2006-2013 (US$ millions)



Source: COMESA Comstat database, 2017

2.2. Ownership Structure and Emergence of Financialisation

During the colonial era, copper mines in Zambia were privately owned. However, the State nationalised themunder the umbrella of the Zambia Consolidated Copper Mines (ZCCM)in 1969. The State became the majority shareholder (60.3 per cent) with Anglo-American Corporation being theminority shareholder (27.3 per cent) (Bostock and Harvey, 1973). Copper prices remained favourable up to the 1975 global recession which saw the collapse of the copper prices.

During the 1980s and 90s, the State made insignificant investments in the re-capitalisation of the mines. Faced with a deteriorating economy, most of the income from the mines was spent on social sectors. Between 1991 and 2000, the State set out to privatise the mines; drastically changing the ownership structure, from a predominantly State-owned to the private sector. However, the State remained a minority shareholder in all mines as depicted in Table 1 below.

The privatisation of the mines saw an influx of FDI inflows. The major investors are subsidiaries of firms such as Metorex, Equinox and First Quantum from Canada and India. These are followed by Switzerland, Australia and China. These countries are represented by firms like Glencore, Vedanta and China Non-Ferrous Metal Mining Group (Fessehaie, 2012). New entrants comprised commodity traders like Glencore and Vedanta that are largely commercial traders. These investors are also involved inthe production and processing of copper as well as intermediaries in the value chains. They sell their output at refinery stage –often as cathodes and anodes at world prices as set on metal exchanges such as the London Metal Exchange and the

Table 1: Structure of State Shareholding in Mines

Mines	*Investor*	*Year of Acquisition*	*Corporate structure*	*Mining Assets*
Kansanshi Copper Gold (Plc)	First Quantum minerals Ltd (Canada 79.4%), ZCCM IH (20. 6%)	2001	Listed on LSE, TSX	Kansashi
Konkola Copper Mines Plc	Vedanta Resources, India (79.4%), ZCCM IH (20.4%)	2004	Listed on LSE	Nchanga, Konkola, Nampundwe, Chililabombwe
Mopani Copper Mine Plc	Glencore International AG, (Switzerland (73. 1%), First Quantum Minierals Ltd, Canada (16. 9%), ZCCM IH (10%)	2000	Private equity	Nkana, Mufulira
Luanshya Minies	CNMC (85%), ZCCM IH (15%)	2009	SOE	Luanshya, Mulyanshi
Chambishi Mines (NFC Africa Mining Co	CNMC (90%), ZCCM IH (10%)	1998	SOE	Chambishi
Chambish Metals	CNMC (85%), ZCCM IH (15%)	2009	SOE	Chambish Smelter, slag dumps
Lumwana Copper Project	Equinox minieals Ltd Canada/Australia (79. 4%), ZCCM IH (15%)	1999	Listed ASX, TSX	Lumwana
Bwana Mkubwa	First Quantum minerals Ltd (Canada 79. 4%), ZCCM IH (20. 6%)	1997	Listed LUSE, TSX	SX-EW plans

Source: Fessehaie (2012)

Shanghai Metal Exchange (Fessehaie, 2012). The integrated pricing of metals provides a quick conduit through which global shocks, including financialisation of commodities affect domestic copper outputs and share prices of investors.

The integration of commercial commodity traders in the global copper trade and production has led to the embracing of copper as an alternative asset in investors'

asset portfolio. This is likely to affect the investors' share prices and copper prices. Thus, there is need to investigate the link between copper prices and the share prices of Vedanta and Glencore—major players in the Zambian copper industry.

2.3. The Copper Trade

Zambia's Copper Exports: Stylised Facts

An examination of the trade patterns show some stylised facts that include: first, it is concentrated in copper exports; and second,the copper exports have little value addition, often shipped in cathode form. Third, Zambia's copper exports are concentrated with Asian countries, often as final destination from re-exports by arbitrageurs.

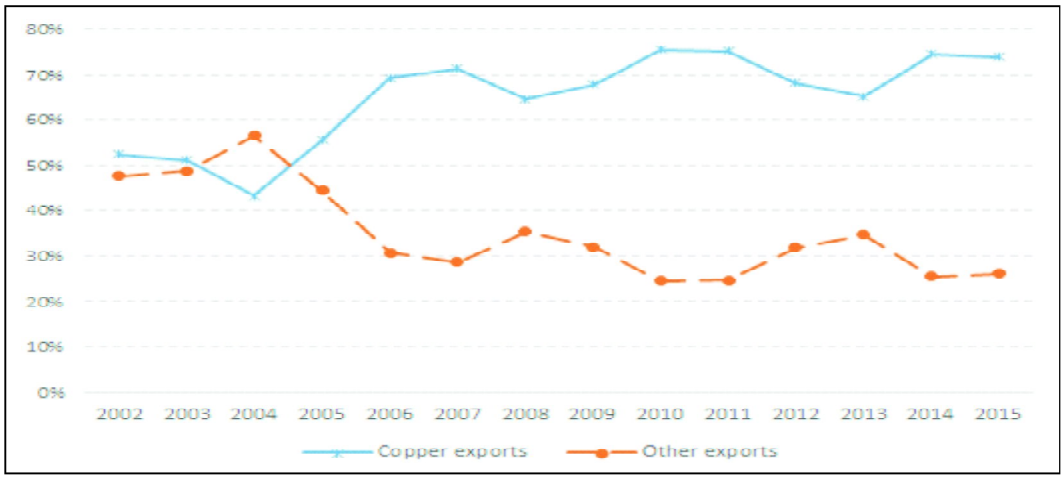
Since the early 2000s, Zambia experienced increased investment in the existing mines. New mines were opened in the North-Western Province. Copper has since remained the largest single export commodity for Zambia growing at an annual average of 18.2 per cent. Its exports increased from US$500.7 million in 2002, accounting for about 55 per cent of total exports, to US$7,210.8 million in 2014 accounting for 74 per cent of Zambia's foreign exchange earnings (see Figure 5).

The direction of copper exports has changed over time. During the 1990s, most exports went to Asia (Japan, South Korea, Malaysia, Pakistan, Emirates and Saudi Arabia). During the 2000s, there was a surge of exports to the UK and later to Switzerland as the major export destination; reflecting the increasing role of Swiss copper traders. This shift was paralleled by increased exports to China (Dobler and Kesselring, 2017).

It is important to note that most of the reported copper exports do not physically reach Europe. However, Zambia classifies its exports according to the last known destination. If copper is exported to an unknown destination, e. g. stockpiled in a warehouse, the buyer country is indicated, instead of the final destination country (Kesselring and Dobler, 2017).

Table 2 displays the export destination of the copper, as reported by Zambia. In 2015, about two-thirds of the copper exports were concentrated with Switzerland, China and South Africa respectively. The Chinese market has been the fastest growing destination at an average of 104 per cent followed by Switzerland at 43. 5 per cent per annum. Substantial amounts of copper is also exported to other fast growing Asian East and Pacific countriessuch as Thailand, India and Malaysia.

Figure 5: Share of Copper in Zambia's Exports



Source: Constructed from COMTRADE database

Table 2: Copper Exports by Country or Region (2002-2016) (US million)

Year	*2002*	*%*	*2010*	*%*	*2014*	*%*	*2015*	*Annual Growth rate (2002-2015)*
Switzerland	27.0	5.4	3332.2	61.5	4236.0	58.7	3006.4	43.5
China	0.1	0.0	1296.6	23.9	1719.6	23.8	987.7	104.2
South Africa	114.5	22.9	267.2	4.9	194.8	2.7	186.9	3.9
United Kingdom	300.7	60.1	105.3	1.9	63.8	0.9	15.7	–10.5
Sub-Saharan Africa	57.0	11.4	41.3	0.8	71.4	1.0	65.4	1.6
Europe & Central Asia	0.6	0.1	72.3	1.3	49.7	0.7	6.0	36.7
Asia (East and Pacific)	0.6	0.1	40.0	0.7	746.5	10.4	866.0	65.6
Others	0.1	0.0	262.4	4.8	128.9	1.8	19.3	66.0
Total	500.7	100	5417.5	100	7210.8	100	5153.4	21.0

Source: Constructed from COMTRADE database

Table 3 presents the copper trade flows based exporting and importing country reports, and the discrepancy in reporting measured by the degree of possible mis-reporting. Discrepancies can be due to diversions enroute, re-export of goods, differential time lags in reporting, use of multiple exchange rates, valuation, transit shipments, differences in commodity classification and valuation procedures, and illicit activities such as smuggling and false invoicing and possible miss-invoicing by traders to maximise profits (Buehn and Eichler, 2011). The extent of mis-reporting is given the following formula, in equation (1):

$$misrep = \frac{\text{zam exp to } i - i \text{ import from zan}}{zam \exp \text{to } i} \quad (1)$$

Table 3: Variation in Trade Flow Data between the Exporter and Importers (2002 -2015)

	Zambia's exports			*Partner reports*			*Extent of miss reporting*	
Year	*2002*	*2010*	*2015*	*2002*	*2010*	*2015*	*2002*	*2015*
Switzerland	27	3332.2	3006.4	0	0	0.0014	100%	100%
China	0.1	1296.6	987.7	19	2415	1595	–24117%	–61%
South Africa	114.5	267.2	186.9	20	168	97	83%	48%
United Kingdom	300.7	105.3	15.7	0	19	1	100%	94%
Sub-Saharan Africa	57	41.3	65.4	4	112	170	93%	–160%
Europe & Central Asia	0.6	72.3	6	6	45	310	–863%	–5027%
Asia (East and Pacific)	0.6	40	866	121	525	630	–18859%	27%
Others	0.1	262.4	19.3	144	1522	1955	–	10046%
Total	500.7	5417.5	5153.4	314	4805	4758	37%	8%

Source: Constructed from COMTRADE database

A number of observations can be made. First, the Zambia reported export data overstate what partner countries show. For example, in 2015, trading partners reported substantially lower copper imports compared to declared exports. Second, country statistics between Zambia and partner country vary significantly. While source data show that Switzerland is the largest destination of the copper, the mirror figures are insignificant. This reflects the role of financial intermediaries in investing and trading copper that is re-routed to other countries representing a 100 per cent mis-reporting. During the same year, China reported higher copper imports than Zambia's reported exports. Finally, in contrast to the source reports, substantial exports are also reported in Europe and Central Asia; indicative of the complex nature of trade in commodities in the presence of many intermediaries that trade in futures markets and institutional investors.

Table 4 displays Zambia's export market for manufactured copper wires, tubes and pipes. The trade in these manufactures is relatively concentrated to regional markets for electricity power generation and distribution and construction, particularly South Africa, Kenya and Tanzania. Significant exports of manufactured copper products to readily far markets in Asia is constrained by logistical challenges including

transport costs; that narrow the profit margins making them uncompetitive. Additionally, investors outside the mining sector face high prices of raw materials.

Table 4: Market Destination for Copper Manufactures - Wires, Tubes and Pipes (US$, 000)

	2002	*%*	*2005*	*%*	*2010*	*%*	*2014*	*%*	*2015*	*%*
South Africa	12,182.60	63.4	55,867.60	67.4	111,244.30	72.1	55,619.50	59.6	30,349.90	48.6
Kenya	3,574.30	18.6	10,898.20	13.2	20,329.30	13.2	14,530.40	15.6	13,108.00	21
Tanzania	1,023.30	5.3	4,266.40	5.1	9,034.30	5.9	8,427.90	9	7,321.80	11.7
Botswana	45.1	0.2	632.6	0.8	8,027.20	5.2	9,723.50	10.4	8,170.20	13.1
India	Na	na	8,365.90	10.1	na	Na	176.4	0.2	na	na
Uganda	161.3	0.8	888.9	1.1	400.1	0.3	593.6	0.6	796.6	1.3
Switzerland	Na	na	Na	na	2,074.20	1.3	952.4	1	547.4	0.9
Zimbabwe	532.3	2.8	606.9	0.7	na	Na	231.2	0.2	na	na
Malawi	272.1	1.4	636.6	0.8	404.8	0.3	na	na	95.5	0.2
Grand Total	19,212	100	82,859	100	154,186	100	93,307	100	62,457	100

Source: Constructed from COMTRADE database

2.4. The Marketing of Zambian Copper

There are large trading houses involved in the marketing of copper. The major companies are Swiss: Glencore, Louis Dreyfus Company, Mercuria and Trafigura. Their Chinese counterparts are Founder Commodities and Maike. Switzerland is the world's largest commodity trading hub – accounting for more than half of the global trade for metals (Leins, 2017a). Copper trade is mainly done over-the-counter, through confidential private bilateral contracts(Leins, 2017b).

As already noted, the copper traded in Switzerland rarely ever reaches Switzerland (Leins, 2017a:4). Swisstraders dominated by Glencrore and Trafiguraact as intermediaries; linking producers to consumers. Copper is directly shipped to the respective counter party (Leins, 2017a, p. 5). Copper is bought at the mine gate and transported to a port and shipped to the buyer. Zambian copper is normally shipped from the ports of Durban, Dar–es-Salaam, Walvis Bay, Lobito and Mombasa (Leins, 2017a, p. 5). Zambian copper is usually sold by the mines and the smelters through off-take agreements 'at the mine gate', for periods from one to fifteen years (Dobler and Kesselring, 2017). The price quoted is basedeither onthe London Metal Exchange (LME) or the Shanghai Metal Exchange, but no concrete pricing contracts are published.

3. RELATED LITERATURE REVIEW

Several studies have shown a strong correlation between global output-gap and the global commodity indices (Inamura, Kimata, Kimura, and Muto, 2011). Further evidence suggests that the traditional correlation between global output gap and commodity prices is exacerbated by the changes in the way traders treat commodities (Mayer, Rathgeber, and Wanner, 2017). First, the commodities are treated as both consumption financial assets. Treated as financial assets, investors consider the current demand, future supply-demand balances and other speculative factors. Market investors have used commodity investments as substitutesfor traditional equity investments to hedge against investment risk.

The increasing financialisation of commodity markets is also reflected in the close correlation between commodity price and financial market dynamics. Xiong (2014) finds evidence of increasing return correlation between emerging markets' equity index and commodity prices. Similarly, other scholars such as Silvennoinen and Thorp (2010) also note the significant correlationbetween commodity and equity returns. These correlations have increased significantlysince the 2007/2008 global financial crisis(Silvennoinen and Thorp, 2010; Creti, Joets, and Mignon, 2013).

Henderson, Pearson, and Wang (2012) also provide evidence of the strong link between 'financial' commodity investments and commodity futures prices. Using a dataset of commodity-linked notes (CLNs), the study showed that hedging trades significantly impacted commodity futures prices.

Granger causality tests havebeen popular in determining the causal dynamics between commodity futures trades and primary commodity prices. For example, the IMF (2008), applying Granger-causality tests, found a significant causal relationship between commodity futures prices and various measures of investors' position changes. To determine the effects of index trading on futures prices of grains on the Chicago Board of Trade, Gilbert (2010) found a significant causal effect of index-based investments on soybean prices, but found little evidence for other grains such as maizeand wheat. Using a similar methodology, Gilbert (2008) found evidence that index investments in agricultural commodity markets had significant impact on food prices.

However, the majority of the studies that applied Granger-causality testshave found no significant causal relationship among the two variables. For example, Mathur, Kaicker, Gaiha, Imai and Thapa (2013) found very weak evidence to support the

view that financialisation of commodity markets has a significant effect on commodity prices. Instead, the study emphasised the importance of demand-supply dynamics in explaining commodity price movements. Similarly, Capelle-Blancard and Coulibaly (2011) found no causality between index-based positions and twelve grain, livestock and other soft commodity futures prices. Other studies that found no significant causal relationship between index trading and commodity prices include Irwin *et al.* (2009), Amann, Lehecka and Schmid (2011), Stoll and Whaley (2010), and Mayer *et al.* (2017). Despite their popularity, Cheng and Xiong (2014) have criticised the use of standard Granger-causality tests to assess the effect of the financialisation of commodity markets on commodity prices because they often give inconclusive results. Other scholars such as Grosche (2011) have criticised them for their failure to incorporate informational efficiency of markets, and account for key determinants of financial trading activity. Despite theselimitations, this study applied Granger-causality analysis in the context of a vector auto regressive (VAR) framework for a number of reasons. Firstly, it makes use of a structural economic model that allows the incorporation of fundamental demand and supply factors as well as future expectations on these factors. Secondly, the framework allows for the isolation of the relative impacts of fundamental supply and demandfactors, and financial market dynamics on primary commodity prices (UNCTAD, 2009).

Other methodologies used to investigate the relationship financial market dynamics and commodity prices include variants of the VAR model. Sadorsky (1999) (unrestricted VAR model), Papapetrou (2001), and Park and Ratti (2008) and Ederer, Heumesser and Staritz(2016) (multivariate VAR analysis) all found evidence of a significant relationship between commodity price and financial market dynamics.

4. METHODOLOGY AND DATA

4.1. Methods

The study explores the possibility of commodity markets financialisation by testing for the effect of share price fluctuations on Zambian copper exports. To achieve this, the non-linear autoregressive distributed lag (NARDL) model and the ganger causality approaches are used. The baseline analytical framework postulates the following (equation (2)):

$$\ln X_t = \alpha + \beta_1 Sh_{pri} + \beta_2 Cu_{prices} + \sum_{i=3}^{n} \beta_i S_t + \in_t \qquad (2)$$

where X_t is the logarithm of copper export, Sh_{price} is the stock market share price of key commercial producers and traders of Zambian copper. Its coefficient can be postive or negative depending on the asymmetrical effect of either a rise or fall in share prices. Theoretically, we expect an increase in copper exports after a fall in share prices as an alternative investment asset and vice versa. Cu_{prices} is the global price of copper and its coefficient is expected to be positive. S_t represents other controls that are key drivers of copper exports such asglobal copper stocks/demand, oil prices and alternative stock market prices such as interest rates.

The effect of the changes in share price can be differentiated into two variables, one taking positive partial changes and the other negative, taking the negative partial changes in the share price. Thus, we decompose the change in stock share price into their partial sum of positive and negative changes and estimating the nonlinear version of the ARDL model (equations (3) and (4)):

$$PSH_{price_t} = \sum_{j=1}^{t} \Delta Sh^{+}_{price_j} = \sum_{j=1}^{t} \max(\Delta Sh_{price_j}, 0) \tag{3}$$

$$NSH_{price_t} = \sum_{j=1}^{t} \Delta Sh^{-}_{price_j} = \sum_{j=1}^{t} \min(\Delta Sh_{price_j}, 0) \tag{4}$$

Shin, Yu, and Greenwood-Nimmo (2014) use the combination of equations (3) and (4) to convert the linear ARDL model into a NARDL model expressed as follows (equation (5)):

$$\begin{aligned} \Delta \ln X_t = {} & \alpha + \phi \ln X_{t-1} + \gamma^{+} Sh_{pri_{t-1}} + \gamma^{-} Sh_{pri_{t-1}} + \beta_2 Cu_{prices_{t-1}} + \\ & \sum_{i=3}^{n} \Delta Sh_{t-1} + \sum_{i=0}^{t} (\theta_t^{+} \Delta Sh_{price_{t-i}} + \theta_i^{-} \Delta Sh_{price_{t-i}}) + \in_t \end{aligned} \tag{5}$$

Equation (5) is tested for cointegration using the bounds test. After cointegration, the long run effects is tested by normalising the coefficients of $Sh_{pri_{t-1}}{}^{+}, Sh_{pri_{t-1}}{}^{-}$ and the other dependent variables. The negative effects of $Sh_{pri_{t-1}}{}^{+}$ and $Sh_{pri_{t-1}}{}^{-}$ are as expectedin the symmetrical model. The results are symmetrical if the coefficient of these variables carry similar signs; otherwise, they are asymmetrical.

Further, the causal association among the variables in the empirical is tested using the ganger causality methodological framework similar to Mayer *et al.* (2017). In the standard Granger-causalityin the context of a VAR framework, the following equations (6 and 7) are estimated:

$$Cu\_p_t = \alpha + \sum_{i=1}^{m} \gamma_i Cu_{prices_{t-i}} + \sum_{j=1}^{n} \beta_j X_{t-j} + \varepsilon \quad (6)$$

$$X_t = \alpha + \sum_{i=1}^{m} \gamma_i X_{t-i} + \sum_{j=1}^{n} \beta_{j-} Cu_{prices_{t-j}} + \varepsilon_t \quad (7)$$

where P_t is the quarterly logarithmic price of copper on the LME. The Xdenotes a vector of variables in logarithmic quarterly proxies of financialisation variables. Among these are the share prices of institutional investors, local production values, local export values, the global copper volumes, the interest rates (LIBOR). The α represents the intercept while ε_t is the error term.

The null hypothesis is that each of the proxies for trading activity or source of financialisation does not Granger-cause copper prices and vice versa. This optimal lag-structure was chosen based on the Schwarz's standard information criterion.

4.2. Data

The Granger causality analysis used quarterly data prices of copper, the domestic copper exportvalues and copper production. These data were obtained from the Bank of Zambia database. Other data that were obtained include copper consumption values, copper stocks at major trading centres, in particular LME, the LIBOR and the WTI quarterised oil price. These were obtained from the St. Louis Federal Reserve economic database. The data are for the period 2000Q1 to 2016 Q4. However, the share prices of Vedanta were only available from2004Q1 to 2016Q4, while Glencore share prices were available from 2011Q2 to 2016Q4.

Table 5: Summary Statistics

	Maxim	*Mean*	*SD*	*Minim*	*Skewness*	*Kurtosis*	*Shapiro-Wilk Test*
log price of copper	9.18	8.39	0.62	7.26	–0.62	1.85	0
log vendata share prices	7.49	6.54	0.62	5.22	–0.43	2.23	0.019
log glencore share prices	6.05	5.55	0.37	4.59	–1.28	3.65	0.001
log oil prices	4.82	4.03	0.49	3.02	–0.28	1.84	0.002
log cop exp value (Zambia)	21.36	20.15	1.06	18.34	–0.5	1.61	0
log cop prod (tons) Zambia	12.24	11.81	0.36	10.97	–0.67	2.23	0
log exp (tons) Zambia	12.56	11.84	0.77	6.91	–3.94	25.5	0
LIBOR	6.35	2.97	2.24	0.39	0.08	1.3	0
log global cons	15.86	15.28	0.26	14.88	0.22	1.97	0.008
log aver share price	7.49	6.39	0.66	5.22	–0.02	2	0.056

Source: Computed by authors

Table 5 shows the summary statistics of the logarithmic copper prices and the vector of causal variables used in the analysis. The pattern of volatility as captured by the standard deviation are mixed. Looking at the distributional properties, most of the variables exhibit some form of negative skewness. Except for Zambian copper exports, all other variables have a kurtosis of less than 3. Consequently, there is evidence of non-normality in the distribution based on the battery of Shapiro-Wilk test.

Table 6 shows the pairwise correlations between variables. The correlations of two thirds of the pairs are statistically significant at 5 per cent level, implying the possibility of co-movements among the variables. The significant correlations range from 0.286 between the LIBOR and the oil prices to 0.95 between the copper prices and domestic exports of copper. Most of the high correlations are observed in the changes in the price of copper and investment flows as proxied by changes in the share prices; indicating some level of financialisation. However, correlations do not show the possibility of causality which was tested using the Granger causality tests.

Table 6: Simple Correlations, 2000 -2016 (Price of Copper and Other Variables)

	log price of opper	*log exp (tons) value*	*log cop exp cons*	*log global prices*	*log vendata share*	*log glen-core share prices*	*log oil prices*	*log stocks LME*	*LI BOR*
log price of copper	1								
log exp (tons) Zambia	0.870*	1							
log cop exp value (Zambia)	0.948*	0.926*	1						
log global cons	0.321*	0.369*	0.375*	1					
log vendata share prices	0.850*	0.2579	0.605*	0.005	1				
log glencore share prices	0.8762*	–0.4125	0.669*	-0.291	0.878*	1			
log oil prices	0.931*	0.753*	0.862*	0.255*	0.776*	0.776*	1		
log stocks LME	–0.253	0.227	–0.0903	0.4157*	0.4257*	0.2985	–0.24	1	
Libor	0.503*	–0.661*	–0.685*	–0.287*	–0.1237	–0.124	0.3582	0.4098*	1

Notes: * shows statistical significance at 5% level
Source: Computed by authors

5. EMPIRICAL RESULTS

The results of the estimations are presented in this section. It is divided into two subsections. The first examines time series properties of our time series and the estimations from the NARDL model. The second subsection looks at the granger causality tests.

5.1. Time Series Properties and NARDL Results

Time series data is often plagued with a unit root or non-stationarity problem. The Augmented Dickey Fuller (ADF) test was used to test for the existence of a unit root (see Table 7). All the variables have unit roots are not stationary in levels since their t-statistics are less than the critical values. However, they become stationary at first difference.

Table 7: Time Series Properties of the Variables

	Levels with Trend		*First Difference*	
	Test Statistic	*5% critical value*	*Test Statistic*	*5% critical value*
Log copper prices	–1. 56	–3.49	–5.60***	–2.92
log glencore share prices	–2.61	–3.5	–5.26***	–2.93
log vendata share prices	–2.5	–3.5	–4.70***	–2.93
log copper exp value	–0.84	–3.49	–7.14***	–2.92
log exp (tons) Zambia	–1.667	–3.485	–15.68***	–2.917
LIBOR	–2.36	–3.485	–4.307***	–2.917
log oil prices	–1.937	–2.917	–6.783***	–2.917
log London stocks	–2.483	–4.135	–4.463***	–2.924

Note: *** implies significance at 1% level.
Source: Computed by Authors

TheNARDL technique does not require the variable to be integrated of the same order but that all variables be integrated with a degree less than two (Shin *et al.*, 2014). The used lag length of the NARDL model is chosen based on the Schwarz information criterion. The results for the short- and long-run asymmetry are presented in Tables8– 10. The detailed regression output is in appendix 1. The interest is in the association between share prices, exports and copper prices.

The significant relationship between the copper exports and share prices of key investors and marketing firms in the country suggests the possibility of financialisation in the commodity markets. Table 8 show that an increase in Vendata share prices

resulted in higher copper exports. However, the increase in Gencore share prices was associated with declines in copper exports. Overall, the movement in share and copper prices do not have an asymmetric effect on the copper exports as shown in Table 9.

Table 8: Empirical Results –NARDL

Dependent variable log copper exports			
Variables		*Variables*	
LCopperexp value(–1)	–0.949***	DLCopperexp value(–1)	0.122
	(0.190)		(0.171)
LCu_price+(–1)	1.980***	DCu_price+	1.030***
	(0.593)		(0.267)
LCu_price–(–1)	–0.936	DLCu_price+	–0.869
	(0.871)		(0.562)
LlogVend_share +(–1)	1.069**	DCu_price–	–0.449
	(0.501)		(0.399)
LlogVend_share –(–1)	0.698	DLCu_price–	0.123
	(0.413)		(0.513)
LlogGlen_share +(–1)	–1.159**	DlogVend_share +	0.215
	(0.460)		(0.385)
LlogGlen_share –(–1)	0.0490	DLlogVend_share +	–0.388
	(0.172)		(0.290)
LLibor+ (–1)	–0.445*	DlogVend_share –	0.314
	(0.218)		(0.271)
LLibor– (–1)	0.194*	DLlogVend_share –	–0.247
	(0.106)		(0.284)
		DlogGlen_share +	–0.0113
			(0.403)
		DLlogGlen_share +	0.751**
			(0.296)
		DlogGlen_s–are +	0.0510
			(0.104)
		DLlogGlen_share –	–0.0137
			(0.104)
		DLibor+	–0.123
			(0.262)
		DLLibor+	–0.583***
			(0.175)
		DLLibor–	0.150
			(0.113)
		DLLibor–	–0.0205
			(0.0714)

logVcr_oil	0.160
	(0.199)
logLond_stocks	–0.156**
	(0.0576)
Constant	19.20***
	(3.502)
Observations	50
R–squared	0.923
F–test 4.583	
Prob > F	0.00194

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Computed by authors

Table 9: Asymmetry Statistics

	Long-run effect [+]			*Long-run effect [–]*		
Exog. var	*coef.*	*F-stat*	*P > F*	*coef.*	*F-stat*	*P > F*
log copper prices	2.086***	23.94	0.00	0.98	1.045	0.318
log glencore share prices	–1.222**	6.187	0.021	–0.052	0.08484	0.774
log vendata share prices	1.126*	4.227	0.052	–0.735	2.343	0.141
	Long-run asymmetry			*Short-run asymmetry*		
		F-stat	*P > F*		*F-stat*	*P > F*
log copper prices		6.071**	0.022		0.417	0.525
log glencore share prices		8.398***	0.009		1.35	0.258
log vendata share prices		1.006	0.327		0.1101	0.743

Source: Computed by authors

The model passes all the diagnostic tests for serial correlation (Breusch/Pagan heteroskedasticity test), autocorrelation (Portmanteau test) normality of errors (Jarque-Bera test) and model specification (Ramsey test) (see Table 10). Overall, the NARDL model fits very well with an F test that is significant at one per cent level.

5.2 Granger Causality Tests

We focused on the price and exports of copper and changes in the share price that are indicative of investor flows. This possibility of causality among the variables is tested using the Granger causality testperformed for the data in levels and in the first difference.

Table 10: Results for Diagnostic Tests

Model diagnostics	*Stat.*	*P-value*
Portmanteau test up to lag 23 (chi2)	27.95	0.22
Breusch/Pagan heteroskedasticity test	0.61	0.43
Ramsey RESET test (F)	0.63	0.6
Jarque-Bera test on normality (chi2)	0.09	0.96
Cointegration test statistics:	t_BDM = – 4.987	
	F_PSS = 4.5830	

Source: Computed by authors

Table 11 shows the unidirectional causality of all other variables on price. We find Granger causality in four of the six variables under investigation at five per cent level. On the global level, the results show that the changes in global oil prices and the LIBOR are closely linked to changes in the copper prices. This is broadly consistent with available literature on financialisation. However, in contrast to existing literature, we fail to find causality in global copper consumption on the changes in copper prices in the second lag structure although there is a bidirectional causality with stocks at LME.

Table 11: Granger Causality Analysis of the Impact of Changes in Covariates on Copper Prices

Variables	*chi2*	*p-value*
log global cons	3.27	0.195
log glencore share prices	23.70	0.000
log vendata share prices	0.30	0.859
log cop exp value (Zambia)	7.44	0.024
log exp (tons) Zambia	1.68	0.432
LIBOR	6.36	0.042
log oil prices	14.35	0.001
ALL	181.00	0.000

Notes: Granger causality is tested by Wald criterion. Granger causality is tested under the null hypothesis that changes in covariates to not influence changes in the global prices

Source: Computed by authors

The granger causality test for changes in Glencore share prices and the LME copper price in Table 12 show a strong linkage. This is in contrast to changesin Vedanta investment flows that fail to show Granger causality.

Global consumption and the volumes of Zambia's exports do not influence the Glencore share prices. However, the changes in the copper prices and export values Granger causethe movements in the investment flows by Glencore. These are statistically significant at less than five per cent level. Furthermore, movements in glencore share prices Granger cause the exports of copper from Zambia.

Table 12: Granger Causality Analysis of the Impact of Changes in Covariates on Glencore Share Prices

	Chi2	*P-value*
log global cons	3.90	0.142
log vendata share prices	35.98	0.000
log price of copper	33.18	0.000
log cop exp value (Zambia)	17.36	0.000
log exp (tons) Zambia	0.64	0.726
Libor	16.27	0.000
log oil prices	5.40	0.067

Notes: Granger causality is tested by Wald criterion. Granger causality is tested under the null hypothesis that changes in covariates to not influence changes in the global prices

Source: Computed by authors

Similar results are obtained for the Vedanta share prices, which are influenced by the copper price movements, the volumes of copper exports Glencore investment flows (see Table 13). This result gives rise to some evidence that the movements in financial assets of investors in the Zambian copper mines have some impact on trade flows and thus profitability of the companies and welfare of host countries; reinforcing findings of increased financialisation of the commodity markets.

Table 13: Granger Causality Analysis of the Impact of Changes in Covariates on Vedanta Share Prices

Variables	*chi2*	*p-value*
log global cons	0.098	0.952
log glencore share prices	26.58	0.000
log price of copper	22.61	0.000
log copper exp value (Zambia)	2.47	0.290
log exp (tons) Zambia	13.44	0.001
Libor	4.34	0.114
log oil prices	2.29	0.318

Notes: Granger causality is tested by Wald criterion. Granger causality is tested under the null hypothesis that changes in covariates to not influence changes in the global prices

Source: Computed by authors

The results also show that share prices granger cause export prices (see Table 14).

Table 14: Granger Causality Analysis of the Impact of Changes in Covariates on Copper Export Exports

Variables	*chi2*	*p-value*
log glencore share prices	4.769	0.038
log price of copper	2.666	0.264
log vendata share prices	10.25	0.006
Libor	4.490	0.106
log oil prices	2.553	0.279

Source: Computed by authors

The outcome in general shows strong linkages among the covariates. Although this outcome may not be explained by some unspecified third variables, it is reasonable to expect that the increased role of commercial investors in the commodity market is integrating the local copper market in the global values chains, which are highly financialised.

6. CONCLUSION

Our evidence suggests that Zambia's copper trade is complicated by the existence of intermediaries. The industry is fully integrated within the global value chain. There is very little diversification and value addition and the prospects are limited. However, alternative policies such as developing cluster industries to support the mining sector and moving resource rents from the mining sector to develop alternative industries in the economycan be pursued. Furthermore, this study has investigated how changes in traders' net positions and indicated by share prices (proxy for investment flows) and other determinants such as copper prices may influence each other.

The results from the NARDL estimation revealed statistically significant but non-asymmetric association in the movements in copper exports and changes in share prices. Using the Ganger-causality tests and the simple pair-wise correlations, we find some indications of financialisation. In particular, there is bidirectional Granger causality between the global copper prices and Glencore share prices. The policy implication of these results lie in government's design of its fiscal and mining policies. The causal relationship between global copper prices and share prices of a

Table 15: Bidirectional Granger Causality Tests

Variables	*(1) ln_co_ price*	*(2) log production Zambia*	*(4) log value_ exports*	*(5) Log global cons*	*(6) log vandeta share*	*(7) Log glencore_ share*	*(8) log oil_price*	*(9) log stocks_ LME*
Log price	0.174	2.036***	2.119***	3.672***	2.017***	0.718	2.873***	4.375**
	(0.356)	(0.524)	(0.786)	(0.772)	(0.220)	(1.464)	(0.248)	(0.767)
log production Zambia	–0.195*	0.340**	0.318	1.063***	0.623***	0.792	0.450***	2.002***
	(0.118)	(0.173)	(0.260)	(0.255)	(0.0727)	(0.484)	(0.0820)	(0.254)
log value_ exports zambia	0.390**	–0.723***	–0.837**	–1.690***	0.420***	0.915	0.00744	–1.018***
	(0.159)	(0.234)	(0.351)	(0.345)	(0.0981)	(0.654)	(0.111)	(0.342)
log global cons	–0.114	0.369***	0.367**	0.00935	–0.783***	–0.201	–0.546***	0.392**
	(0.0725)	(0.107)	(0.160)	(0.157)	(0.0447)	(0.298)	(0.0504)	(0.156)
log vandeta share	0.0526	–0.733***	–1.069***	–1.504***	–0.423***	0.467	–0.935***	–1.027***
	(0.163)	(0.241)	(0.361)	(0.355)	(0.101)	(0.672)	(0.114)	(0.352)
log glencore_share	–0.220***	–0.510***	–0.379***	–0.0279	–0.798***	–0.858***	–0.689***	–0.0238
	(0.0576)	(0.0849)	(0.127)	(0.125)	(0.0356)	(0.237)	(0.0401)	(0.124)
Log oil_ price	0.219**	0.534***	1.170***	0.0675	0.380***	0.127	0.848***	–0.766***
	(0.109)	(0.161)	(0.242)	(0.237)	(0.0675)	(0.450)	(0.0761)	(0.236)
Log stocks_ LME	0.0462	–0.137**	0.0450	0.126	0.372***	–0.0357	0.589***	–0.926***
	(0.0468)	(0.0689)	(0.103)	(0.101)	(0.0289)	(0.192)	(0.0326)	(0.101)
Constant	15.44***	–11.38	–3.525	–15.90	–6.101**	3.507	–30.14***	–80.18***
	(5.033)	(7.411)	(11.12)	(10.92)	(3.106)	(20.70)	(3.503)	(10.85)
Observations	21	21	21	21	21	21	21	21

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

leading foreign mining sector investor implies the need for fiscal and mining policies that reduce the county's exposure to shocks in international financial markets. However, we find no bidirectional causality between Vedanta share pricesand the global copper prices. Moreover, the share prices of Zambia's institutional investors do not Granger cause the global consumption.

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DECLARATION OF CONFLICTING INTERESTS

The authors declare that they have no competing interests.

References

Amann, S., Lehecka, G. and Schmid, E. (2011). *Does speculation drive agricultural commodity spot prices?* Vienna: Institute of Sustainable Economic Development.

Baldwin, R. (1965). *Economic development and export growth.* California: University of California Press.

Basu, P. and Gavin, W. T. (2011). What explains the growth in commodity derivatives? *FederalReserve Bank of St. Louis Review*, 93(1), 37-48.

Bostock, M. and Harvey, C. (1972). Economic independence and the Zambian copper. New York: Praeger Press.

Buehn, A. andEichler, S. (2011). "Trade misinvoicing: the dark side of world trade", *The World Economy,* 34(8). Retrieved from: https://doi. org/10. 1111/j. 1467-9701. 2011. 01375. x

Capelle-Blancard, G. and Coulibaly, D. (2011). *Index trading and agricultural commodity prices: A Granger causality analysis.* Paris: Centre d'Etudes Prospectiveset d'Info Internationales.

Cheng, I. and Xiong, W. (2014). "Financialisation of commodity markets", *Annual Review of Financial Economics*, 6, 419–441.

Credit Rating Agency (2016). *2015 Economic review and outlook*. Lusaka: Credit Rating Agency.

Creti, A., Joets, M. and Mignon, V. (2013). "On the links between stock and commodity markets' volatility", *Energy Economics,* 37, 16-28.

CSO (2017), *International trade statistics.* Lusaka: CSO.

Dobler G. and Kesselring, R. (2017). *Value works fact sheet no. 4*. Basel: Swiss Network for International Studies.

Ebeke, C. and Ehrhart, H. (2012). "Tax revenue instability in sub-saharanafrica: consequences and remedies", *Journal of African Economies*. 21(1), 1-27.

Ederer, S., Heumesser, C. andStaritz, C. (2016). "Financialisationand commodity prices–an empirical analysis of coffee, cotton, wheat and oil", *International Review of Applied Economics,* 30(4), 462-487.

Fessehaie, J. (2012). *The dynamics of Zambia's copper value chain*. Ph.D. Cape Town: University of Cape Town.

Gilbert, C. L. (2008). *How to understand high food prices.* Trento: University of Trento.

Gilbert, C. L. (2010). *Commodity speculation and commodity investment*. Commodity Market Review, 2009-2010. Rome: FAO.

Grosche, S. (2011). *Limitations of granger causality analysis to assess the price effects of financialisation of agricultural commodity markets under bounded rationality*. Bonn: University of Bonn.

Hampwaye, G., Kaleng'a, W. and Siame, G. (2015). *Regional mineral value chains: implications for Zambia's copper sub-sector industrialization-oriented beneficiation.* In: Regional industrialization, and regional integration. TIPS Annual Forum,14-15 July 2015, Johannesburg.

Henderson, B. J., Pearson, N. and Wang, L. (2012). *New evidence on the financialisation of commodity markets*. Presented at: 22nd Annual Derivatives and Risk Management Conference. Retrieved from: https://ssrn. com/abstract=1990828

IMF (2008). *Global financial stability report*. Washington, DC: International Monetary Fund.

Inamura, Y., Kimata, T., Kimura, T. and Muto, T. (2011). "Recent surge in global commodity prices–impact of fianncialisation of commodity markets and globally accommodative monetary conditions," *Bank of Japan Review,* 2011-E-2.

Irwin, S. H., Sanders, D. R. andMerrin, R. P. (2009), "Devil or angel? The role of speculation in the recent commodity price boom (and bust)", *Journal of Agricultural and Applied Economics*, 41(2), 377-391.

Kesselring, R and Dobler, G. (2017). *Why is copper going from Zambia to Switzerland and where are the Swiss hiding it?* Presentation at the Value Works Workshop: Effects of Financialisation along the Copper Value Chain Workshop. Lusaka: September, 6. Palm View Lodge.

Korinek, J. (2013). *Mineral resource trade in Chile: contribution to development and policy implications*. OECD Trade Policy Papers, No. 145, OECD Publishing. Retrieved from: www. //dx. doi. org/10. 1787/5K4bw6twpf24-en

Krishna, P. and Levchenko, A. (2013). "Comparative advantage, complexity, and volatility,"*Journal of Economic Behaviour & Organization*, 94, 314-329.

Leins, S. (2017a). *Switzerland's role in commodity trading*. *Value works fact sheet no. 5*. Basel: Swiss Network for International Studies.

Leins, S. (2017b). *The work of physical traders*. Presentation at the Value Works Workshop: Effects of Financialisation along the Copper Value Chain Workshop. Lusaka: September, 6. Palm View Lodge.

Maizels, A. (1994). "The continuing commodity crisis of developing countries. *World Development*", 22(11), 1685–95.

Mayer, J. (2009). *The financialisation of commodity markets and commodity price volatility.* In Trade and Development Report 2009. Geneva: UNCTAD.

Mayer, H.G., Rathgeber, A.W. and Wanner, M. (2017). "Financialisationof metal commodity markets: does futures trading influence spot prices and volatility," *Resources Policy,* 53, 300-316.

Nissanke, M. (2011). *Commodity markets and excess volatility: sources and strategies to reduce development impacts.* Amsterdam: Common Fund for Commodities.

Nissanke, M. (2012). "Commodity market linkages in the global financial crisis: excess volatility and development impacts. *Journal of Development Studies*", 48(6), 732-750.

Mathur, K., Kaicker, N., Gaiha, R., Imai, K. S. and Thapa, G. (2013). *Finacialisationof food commodity markets, price surge and volatility: new evidence.* Discussion Paper Series. Kobe: Kobe Univeristy.

Nathan Associates (2015). *How can Zambia increase the fabrication of copper products? Dispelling the myth that domestic production of copper is an advantage.* Final Report. Prepared for the Jobs, Prosperity and Competitiveness Project. World Bank, African Development Bank and DFID.

Papapetrou, E. (2001). "Oil price shocks, stock market, economic activity and employment in Greece. *Energy Economics*", 23(5), 511–532.

Park, J. and Ratti, R. A. (2008). "Oil price shocks and stock markets in the U. S. and 13 European countries", *Energy Economics*, 30, 2587–2608.

Sadorsky, P. (1999). "Oil price shocks and stock market activity", *Energy Economics*, 21, 449-469.

Shin, Y., Yu, B. andGreenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in Honor of Peter Schmidt,* pp. 281-314. New York. Springer.

Sikamo, J., Mwanza, A. and Mweemba, C. (2016). Copper mining in Zambia–history and future", *Journal of the Southern African Institute of Mining and Metallurgy,* 116(6), 491-496.

United States Geological Survey (2017). *Minerals yearbook–copper.* Retrieved from: https:// minerals. usgs. gov/minerals/pubs/commodity/copper/mcs-2017-coppe. pdf

Silvennoinen, A. and Thorp, S. (2010). *Financialisation, crisis and commodity correlation dynamics.* Research Paper 267, Quantitative Finance Research Centre, University of Technology Sydney.

Stoll, H. R. and Whaley, R. E. (2010). Commodity index investing: speculation or diversification. Nashvile: Vanderbilt University.

UNCTAD (2009). *Trade and development report, 2009: The financialisation of commodity markets.* Geneva: UNCTAD.

UNCTAD (2010). *The least developed countries report 2010: towards a new international development architecture for LDCs.* Geneva: UNCTAD.

UNCTAD (2011). *Price formation in financialized commodity markets*. Geneva: UNCTAD. Retrieved from: http://unctad. org/en/docs/gds20111_en. pdf.

UNDP Regional Bureau for Africa (2016). *Primary commodity booms and bust: emerging lessons from Sub-Saharan Africa*, New York: UNDP.

Van der Ploeg, F. and Poelhekke, S. (2009). *The volatility curse and financial development: revisiting the paradox of plenty*. Oxford: Oxford Centre for the Analysis of Resource Rich Economies (OxCarre).

World Bank (2017). *Economic diversification: a priority for action, now more than ever.* [Online] Retrieved from: blogs. worldbank. org/psd/economic-diversification-priority-action-now-more-ever

Xiong, W. (2014). *The financialisation of commodity markets.* NBER Reporter. Issue 2. Cambridge, Mass. : National Bureau of Economic Research (NBER).

Zambia Revenue Authority (ZRA) (2014). *Minerals value chain monitoring project (MVCMP) baseline study report.* Lusaka: ZRA.

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