Mine Suppliers:
Understanding backward linkages in Kitwe, Zambia

Anja Benshaul-Tolonen* and Paula Fernandez Musso

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Abstract

The integration of domestic firms into the mining global value chain (GVC) can bolster local economies, yet the scale and impact of these linkages remain largely unknown. This study examines the mining value chain in Kitwe, a key mining hub in Zambia's Copperbelt. Ten years of official government VAT data on domestic purchases and imports reveal that while mine suppliers have a stronger presence in the Kitwe import market than other local firms, both their domestic and international demand for goods and services are influenced by changes in the international copper price. In addition, our cross-sectional firm survey indicates mine suppliers are older, larger, and more likely registered with tax authorities. The majority of surveyed firms expressed strong interest in entering the mining GVC but reported that competition, low demand and lack of network connections constrained them from achieving their desired level of engagement. We suggest policy efforts ensure optimal backward linkages between local firms and mines to foster resilient, non-resource-dependent growth and maximize VAT, tariff, and income tax revenue.

Keywords: Mining; Copper Mining; Global Value Chains; Backward Linkages; Zambia; Africa

*Notes: Corresponding author Anja Benshaul-Tolonen, Barnard College, Columbia University, atolonen@barnard.edu. Paula Fernandez Musso, Barnard College, Columbia University. All errors are our own. We are grateful for the support from John Mulenga, Jonathan Msoni, Ian Mwiinga, Benjamin Shawa, Shahrukh Wani, and Twivwe Siwale. We are exceptionally grateful to Edward Miguel and Nicholas Swanson at UC Berkeley who generously helped collect the data, the Uptick survey team. Research assistance was provided by Camila Fernandez, Smiti Modhurima, Julia Neely, Reda Shaikh and Ibshita Chowdhury. UC Berkely Committee for Protection of Human Subject protocol number 2023-08016599. University of Zambia Biomedical Research Committee REF. No. 4466-2023.

1 Introduction

Zambia, a country abundant in minerals and metals such as gold and emeralds, boasts a vibrant mining industry. Copper alone generates 80% of export earnings and accounts for about 14% of the national GDP (Sikamo et al., 2016; African Development Bank, 2019). As an integral part of key global economic sectors such as electrical infrastructure, transportation, and construction, copper has been industrially mined for over a century in Zambia's Copperbelt Province (Hu and Gu, 2024; Mulder et al., 2024). The country plans to further boost its copper production in the coming decades to meet the growing global demand, projected to triple by 2040 due to the green energy transition's heavy reliance on copper (Mulder et al., 2024). In recent years, the Copperbelt Province has experienced an influx of new developments, further complemented by greenfield investments in the neighboring Northwestern Province.

Despite its economic significance, the mining industry has long been criticized for operating as an enclave, with a heavy reliance on pre-established supply chains and ultimately limited integration into the local and domestic economy (Girvan and Girvan, 1970; Weldegiorgis et al., 2021). The confirmed presence of limited and weak backward linkages from the mining industry to domestic firms disproportionately affects small and medium enterprises (SMEs), hindering their ability to enter the mining global value chain (GVC) (Morris et al., 2011). This challenge is particularly prevalent in low- and middle-income countries like Zambia. In the face of an expected 'boom' in global copper demand and a reinvigoration of the Zambian copper mining industry, it is imperative to understand the local linkages and the constraints to deeper economic integration of the copper mining sector. This study set out to shed light on the larger mining value chain by focusing on Kitwe, a mining-centered city in the heart of the Zambian Copperbelt, and exploring the interactions between mines and domestic firms. Kitwe was selected for its strategic location near the majority of Zambia's large copper mines, and its role as a central hub for the country's mining industry, including emerald mining[1].

To gain insights into the economic landscape, we began by analyzing two extensive tax datasets

[1]The firm study conducted in Kitwe is part of a larger research initiative regarding industrial opportunities in the Copperbelt from the International Growth Centre, London.

from the Zambia Revenue Authority (ZRA) restricted to Kitwe: (i) domestic transactions between firms, and (ii) imports. Both datasets capture transactions at the monthly level during the period from late 2013 to late 2022. We categorize firms as either a (i) mine supplier, or (ii) non-mine supplier, with the former defined as firms that sold at least one good or service to one or more Zambia Extractive Industries Transparency Initiative (ZEITI) registered mining firm in Zambia within the data period.

Time series analysis of ZRA data reveals a similar trend in domestic procurement and imports between mine and non-mine suppliers. However, while non-mine suppliers account for a larger share of the local economy, this is not reflected in imports, where mine and non-mine suppliers each account for roughly half of the total import value. The over-representation of mine suppliers in import share, compared to their smaller contribution to domestic procurement, may highlight the current reliance on imports in the mining industry and the potential opportunities for domestic development and value addition. Moreover, the results suggest that firms supplying to mining companies are more integrated regionally and internationally[2].

Detailed regression analysis with over 62 thousand observations confirms that mine suppliers are responsive to changes in the international copper price. A one unit increase in the copper price is associated with a 0.537 million ZMW increase in domestic purchases among mine suppliers, equivalent to a 30% increase from the average firm's demand in a month. Similarly, using a dataset of over 22 thousand import observations, we find that the same increase in the copper price results in a 0.425 ZMW increase in import value among mine suppliers, equivalent to a 15% increase from the mean across all firms. The copper price does not correlate with domestic purchasers or imports among non-mine suppliers. While mine suppliers have a stronger presence in the Kitwe import market than other local firms, both their domestic and international demand for goods and services are influenced by changes in the international copper price.

To provide greater nuance, we conducted a cross-sectional survey targeting firms in Kitwe that met two criteria: (i) have at least one full-time employee, and (ii) operate from a permanent structure. Firms supplying the mining industry were found to be older, larger and more likely to be

[2]We do not have their export records to explore differences in exports across the two types of firms.

registered with local authorities, underscoring the competitive advantage of more established firms in accessing the mining GVC. We do, however, recognize there may be a dynamic process whereby firms entering the GVC become more productive and ultimately formalize. Additionally, the majority of surveyed firms expressed a strong interest in entering the mining GVC but cited several constraints that hindered their desired level of engagement. These barriers include competition, low demand, and lack of network connections. Furthermore, over 20% of firms who regularly sold to mining firms listed corruption and bribery as a constraint.

Resource-dependent countries like Zambia ultimately face a double-edged sword. Local and domestic firms may seek deeper integration into the mining GVC, aiming to leverage the positive effects such integration has on firm performance, including boosting revenue growth, profits, export capacity, and employment opportunities (Alfaro-Urena et al., 2019; Amiti et al., 2024; Barrios et al., 2011; Javorcik, 2004). At its optimal level, procurement driven by backward linkages maximizes VAT, tariffs, and income tax, thereby boosting government revenue that can be directed toward the countries critical needs, such as healthcare. However, the financialization of the global copper trade intrinsically ties Zambia to the volatility of commodity prices, thus the government must ensure that the local economy is robust to fluctuations in the copper mining industry and international copper price (Mudenda et al., 2018). Deepening the linkages between local firms and the mining sector risks increasing the vulnerability to fluctuations in the mining sector (Weldegiorgis et al., 2021), potentially putting these two policy recommendations at odds with each other. We must consider whether these two aforementioned policy goals can be met concurrently: Are backward linkages to the mining industry able to serve as a springboard for fostering resilient, non-resource dependent firm growth? Country-level evidence generally suggests that this type of diversification is elusive (Ross and Werker, 2024). Further research is needed to divulge the opportunities and challenges facing local suppliers.

2 Global value chains and backward linkages in Zambia

Foreign direct investment (FDI) by multinational corporations (MNCs) generates substantial economic spillovers (Barrios et al., 2011); however, their nature depends on the sector and level of economic development in the host country. When directed towards local suppliers, foreign capital from MNCs can promote integration into the GVC. Studies find that firms integrated into multinational supply chains experience substantial growth in sales, workforce, and assets, highlighting the positive impact of inclusion into larger, established networks (Alfaro-Urena et al., 2022). Although the mining sector has been identified as a key opportunity for firms—in particular SMEs in Africa—to increase local economic capture in an extractive, export-driven industry, mineral-based value chains have received little research attention (Fessehaie, 2012b).

Zambia, the seventh-largest copper producer in the world and second-largest in Africa (Kolala and Dokowe, 2021), is a case worth studying. After independence in 1964, the landlocked country experienced high levels of local procurement in the mining sector due to Import Substitution Industrialization (ISI), despite diminishing copper production. Following a dramatic drop in the international price of copper, post-privatization of the mining sector and the abandonment of ISI in 1991 led the local procurement to plummet, hampering inclusive economic growth (Lombe, 2018). Privatization further complicated efforts to strengthen backward linkages in Zambia's copper mining sector, as liberalization strengthened original equipment manufacturers (OEMs) and their subsidiaries, decreasing local demand and increasing competition (Caramento, 2020; Nsupila, 2016). Additionally, the 2008 financial crisis directly affected Zambian mining firms, forcing them to re-organize their supply chain, with local, small-scale suppliers being the first to be cut, further exasperating the already weak backward linkages (Fessehaie, 2012a).

Fessehaie et al. (2015) found that the mining sector in Zambia procures goods and services for a value of US $2-4 billion annually. In 2012, only a small share of the procurement of Zambian mines was from firms that were overseas based (15.8%), and the lions share by firms that were locally registered subsidiaries of foreign firms (79.8%), with the rest defined as "wholly local", with Zambian citizens and residents as owners (4.4%) (Fessehaie et al., 2015). The third category,

however, does not constitute "truly local", which is commonly defined by domestic origin of the goods. Nevertheless, domestic value creation, rather than ownership by local suppliers, is now perceived as a more critical factor for development (Kragelund, 2017). Domestic value creation remains an important issue in Zambia: by 2017, an estimated 84% of goods and services were locally procured (the rest imported), although only 13% were classified as "true local procurement", referring to goods manufactured in Zambia, or provided by firms with Zambian ownership (African Development Bank, 2019)[3]. Similar low levels of "true local procurement" have been reported throughout Africa. In South Africa, 75-90% of inputs to Platinum Metal Groups (PMG) producers are sourced locally, though the "true local" value addition of finished goods is often much lower, ranging from 5-20% (Lydall, 2009).

Local content policies (LCPs) have been a popular tool to realize some of the potential and combat the perceived "enclave" nature of mines and stimulate domestic value creation. LCPs may, among other things, set minimum targets for multinational firms for local procurement of goods and services, the hiring and training of citizens, and contribute to infrastructure projects (Ba and Jacquet, 2022)[4]. LCPs in the extractive sector are not a new policy tool: Norway regulated its oil industry in the 1970s to include targets for hiring of domestic workers and technology transfer (Ramdoo, 2018). While Norway, with an educated workforce and low levels of corruption, managed to turn LCPs into economic growth, the same policies can result in inefficiencies in countries with weak institutional capacity, high levels of corruption (Ba and Jacquet, 2022), and significant elite capture (Hansen et al., 2016). In fact, a study of LCPs in West Africa found that while three West African countries had adopted LCPs, there was a lack of monitoring and enforcement (Ba and Jacquet, 2022), hindering policy efficiency. Another critique of LCPs is that they create "mining-centric" local economies, highly susceptible to volatility in the mining sector. These supply chains, shaped by LCPs, are often heavily dependent on the specific demands of mining companies, which are subject to fluctuations in global commodity prices and market dynamics. This dependence undermines efforts to build resilient, diversified economies that can withstand external shocks

[3]Other sources cite even lower estimates of share of goods and services purchased from Zambian owned firms, with 2.1% quoted in Ross and Werker (2024).

[4]The definition of local varies across countries: Local can refer to the geographic area surrounding an extractive industry, the region, or the country (Ba and Jacquet, 2022))

(Weldegiorgis et al., 2021).

In Zambia, LCPs were incorporated into the Mines and Mineral Act of 1995, with the most recent notable amendment made in 2015. The 2015 amendment introduced a *preference* for suppliers and service agencies based in Zambia and owned by Zambian citizens. However, mistrust between the government and mining firms, stemming from an unstable tax regime, hindered collaboration from the mines in respecting local content initiatives (Kragelund, 2017). These "soft" LCPs, which rely on compliance through "win-win" outcomes or "shared value creation", are insufficient to cultivate backward linkages (Caramento, 2020). Rather, "hard" LCPs, such as tariffs, taxes, and pricing policies designed to favor domestically produced goods, are crucial for the integration of local firms (Ovadia, 2016). Nevertheless, "hard" LCPs may be poorly received by mining firms that prioritize both quality and pricing.

Tax-data and survey findings suggest original equipment manufacturers (OEMs) and their Zambian subsidiaries continue to account for a large share of the mining industry's demand. Previous literature has identified OEMs as large, established multinational firms (e.g., Sandvik, Atlas Copco, SKF, Boart, Longyear, Barloworld, Komatsu, Murray and Roberts and FLS Midth) that possess a competitive advantage due to their advanced technological capabilities, strong buyer relationships and ability to offer discounts (Fessehaie, 2012a; Nsupila, 2016). The market power of OEMs can be largely attributed to the absence of policies designed to support Zambian suppliers in entering the GVC and enhancing value addition (Kragelund, 2017).

Recently, the entry of Micro, Small, and Medium Enterprises (MSMEs)—accounting for 97% of businesses, 88% of employment, and 70% of GDP (Mwamba et al., 2022)—into the high-value global value chain for mining has been lauded once again as an opportunity for the sector to drive sustainable growth and poverty abatement in Zambia (Kanyinji and Tembo, 2019b; African Development Bank, 2019). In order to do so, targeted, research-based policies must be introduced. Up to this date, limited studies on Zambian firms found a wide variety of constraints that hinder firms' competitiveness and prevent them from entering the global value chain: from access to technology, credit, and managerial know-how, to legal and tax framework relating to licensing,

product standards, and tax compliance (Chisala, 2008; Fessehaie, 2012b)[5]. Published research on 15 years of firm data from Africa showed that these constraints are far from unique to Zambian firms or mine suppliers, but represent obstacles faced by SMEs across the continent in generating growth, attracting investment, and increasing exports (Bigsten and Söderbom, 2006). More specifically, business managers report financing as the leading constraint to firm growth, alongside corruption, infrastructure, and inflation (Bigsten and Söderbom, 2006).

2.1 The geography of mining

A large literature seeks to understand the economic and geographic footprint of large-scale mines. The effects can be examined at three levels: (i) the macro level, encompassing impacts on, for example, national accounts, government spending, exchange rates; (ii) the district level[6], focusing largely on the redistr ibution of mining taxes and royalties to sub-national areas; and (iii) the local level, referring to the immediate vicinity of the mines.

At the local level, there has been extensive empirical research with an eye towards identifying causal effects of the mining sector in Africa in the last decade. Generally the sector has been characterized as hyper-localized, with spillovers typically concentrated within 20 to 30 kilometers of the mine. These effects include impacts on employment and income (Aragón and Rud, 2013; Kotsadam and Tolonen, 2016; Lapeyronie and Szedlacsek, 2025; Mamo et al., 2019; Wilson, 2012), agricultural output (Aragón and Rud, 2016), health (Benshaul-Tolonen, 2019; Von der Goltz and Barnwal, 2019), and political economy, particularly in relation to corruption and conflict (Axbard et al., 2021; Berman et al., 2017; Knutsen et al., 2017). The local level literature is summarized in Cust and Poelhekke (2015), including studies that examine copper mines.

A recent paper focusing on green energy transition minerals—copper among them—in Africa between 2000 and 2020 found evidence for local economic impacts within 20 kilometers of a new

[5]Recent empirical evidence from Zambia revealed fluctuations in local procurement, highlighting the vulnerability of the economy to business cycles. Benshaul-Tolonen (2024) found, using dyadic data on VAT-registered transactions, that international copper price fluctuations drive changes in copper production in Zambia, and mining firms' local procurement. A difference-in-difference analysis shows that firms entering a large copper mine supply network experience a boost in terms of revenue.

[6]A study from Peru found that mining districts experience higher levels of consumption (Loayza and Rigolini, 2016), while research from Chile revealed that the backward linkages from copper mining are predominantly concentrated in the capital (Atienza et al., 2021).

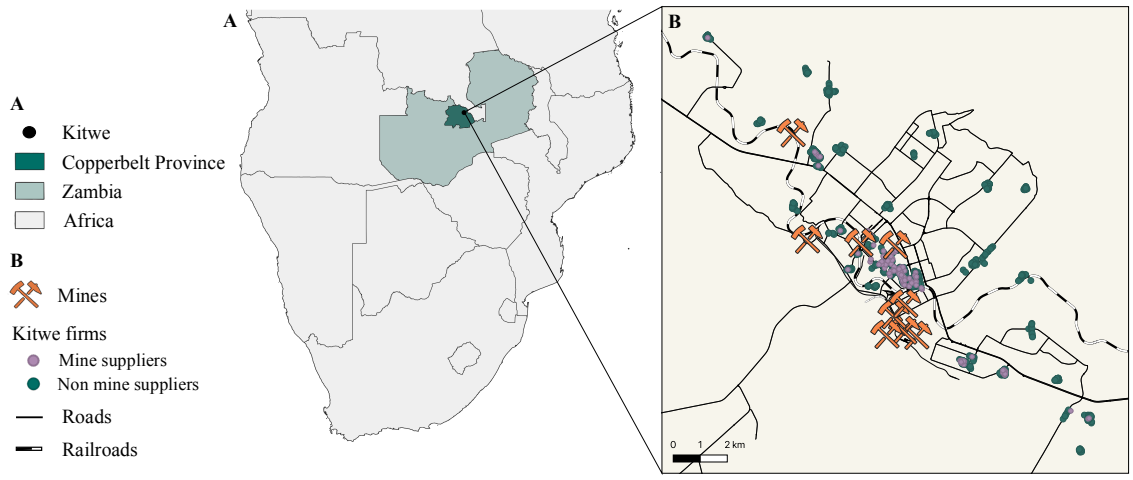


Figure 1: A. Map of Southern Africa. B. Map of Kitwe, Copperbelt Province, Zambia, Showing Mine Locations and Firm Distribution (Including Mine and Non-mine Suppliers)

mine, although the level of economic growth is heterogeneous with local institutions (Lapeyronie and Szedlacsek, 2025). Two papers specifically focus on copper mining in Zambia, and identify that the copper booms led to increased living standards and economic activity (Lippert, 2014), as well as reduced sexual risk taking behavior (Wilson, 2012). Additionally, a geographic analysis of constraints among mine suppliers across nine countries showed that the tradable sector faces greater challenges in the absolute proximity of mines ($<$ 20km), compared to areas further away (21-150 km). These challenges include significant pressure on infrastructure, and restricted access to inputs in the immediate vicinity of mines (De Haas and Poelhekke, 2019).

This literature clearly identifies local spillovers, therefore, busting the enclave theory as a myth. However, if the enclave theory is to be understood in relative terms—is the mining industry integrated into the local economy relative to the size of the mining industry?—the literature does not yet provide a clear answer.

We contribute to the sub-national understanding of backward linkages by our strategic focus on Kitwe: a city situated in the heart of the Copperbelt Province, central to Zambia's hub-and-spoke road network and distanced from Lusaka's difficult roads that restrict access to Angola and the Democratic Republic of Congo (Mulder et al., 2024). Kitwe (Figure 1A) is tactically located

near major copper mines in the region; within the city are Mopani Copper Mine and Konkola Copper Mine, while additional mines, such as Chambishi and NFC, are located in the surrounding vicinity. The restricted area for emerald mining is located approximately 50 kilometers south of Kitwe. Figure 1B shows the city of Kitwe, highlighting main roads, railways, and mines, such as mine shafts—several are located within the city boundaries—as well as mining headquarters.

3 Panel data on domestic and international transactions for firms in Kitwe

3.1 Data

Building upon research on the local procurement of the mining industry in Zambia (Benshaul-Tolonen, 2024), we use data from the ZRA on VAT and import transactions to shed light on firm behavior in Kitwe. To do so, we first identify companies that sold to a mining firm at least once between late 2013 and late 2022 (with a transaction included in the VAT dataset), and classify them as mine suppliers. Mining firms are identified using a comprehensive list from ZEITI. The largest firms in this dataset are 10 large-scale copper producing mines, in addition to two large emerald mines (located near Kitwe), along with numerous medium- and small-scale mining operations. Second, we identify firms that are located in Kitwe according to the public records, as indicated by their address[7]. Using the same exhaustive list of mines and quarrying firms from ZEITI, we exclude all firms registered as mines and quarries.

We retain a sample of 1,516 unique firms registered in Kitwe (Table 1). Of these firms, 35.9% ever supplied a mining firm. Mine suppliers in Kitwe transact with 132 unique mining firms, out of a total of 216 mining firms that are registered with ZEITI. The large copper mines account for the highest number of transactions with Kitwe firms, particularly those located in or near Kitwe, such as Mopani Copper Mine and Konkola Copper Mine. Additionally, Kitwe firms engage with

[7]We identify the address of a firm from the VAT transaction data, where the purchaser's address is recorded. Therefore, we will only end up with firms in our final dataset that ever purchased from another Zambian firm within the time period 2013-2023, and who was, at that time, registered in Kitwe.

Table 1: Summary statistics Import and VAT datasets for firms in Kitwe

	mean	sd	min	max	N
Domestic VAT transaction dataset					
Mine supplier	0.359				1,516
Monthly procurement value (pre-tax, mil)	1.868	21.065	0.000	1770.511	62,941
Monthly procurement value mine suppliers (pre-tax, mil)	1.471	6.366	400.282	837	19,558
Import transaction dataset					
Mine supplier	0.388				1,264
Monthly import value (pre-tax, mil)	2.883	11.538	0.000	667.334	22,443
Monthly import value mine suppliers (pre-tax, mil)	3.621	14.693	0.000	524.557	8,819

Notes: Currency is in Zambian Kwacha. All values are adjusted for inflation using the December 2023 Consumer Price Index (CPI). Domestic VAT and import transaction datasets span from December 2013 to October 2022.

emerald mines and limestone companies.

Appendix Table 5 shows that the largest sectors, based on the number of recorded transactions, are wholesale and retail trade, manufacturing, and professional, scientific and technical activities, followed by mining and quarrying. 69,823 transactions are categorized as related to mining and quarrying, representing 6.32% of transactions.

Next, we identify 1,264 unique companies located in Kitwe who also import goods and services from abroad, 38.8% of which are categorized as mine suppliers (as indicated by the domestic VAT firm-to-firm dataset) (Table 1). Mining and quarrying related imports stand for 10,656 import transactions, representing 2.8% of transactions (Appendix Table 5). Imported goods or services directed to the mining industry which are not classified as a mining-related product (e.g., food for employees) are not included in the aforementioned number. In addition, direct imports by mines are excluded from these statistics.

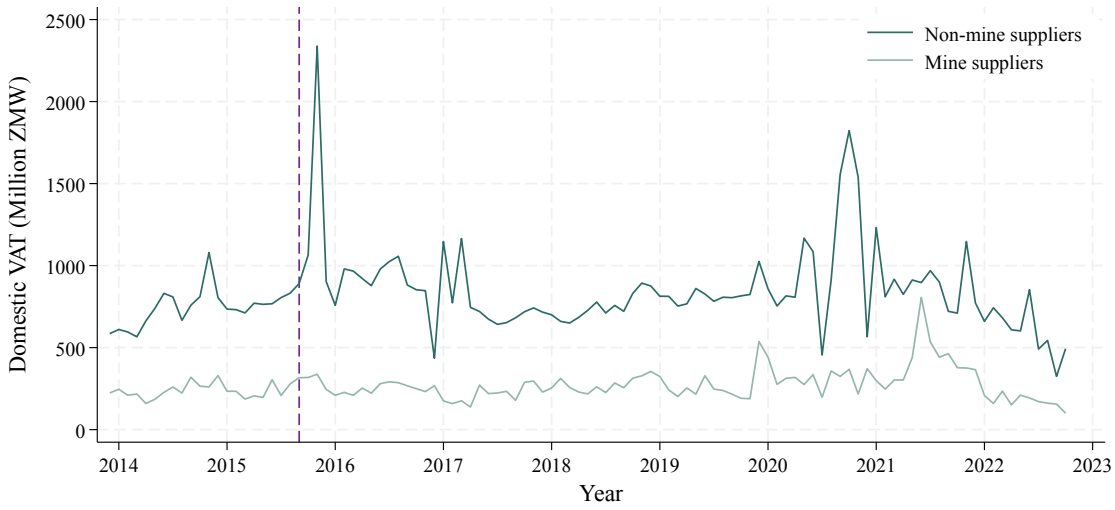


Figure 2: Domestic Procurement by Mine Suppliers and Non-Mine Suppliers in Kitwe

Notes: The figure shows monthly domestic procurement in millions of ZMW, split by firms that are categorized as mine suppliers and non-mine suppliers. Purchasing firms are classified as local to Kitwe if their registered address is in Kitwe. The transacting partner (supplier) can be located anywhere in Zambia. The dashed vertical line indicates the timing of implementation of the Zambian local procurement policy.

Table 1 shows that approximately one third of the firms in Kitwe can be categorized as mine suppliers. Figure 2 shows that these firms make up a substantial part of the local economy through procuring domestic goods and services; however, they still constitute a smaller share of the local economy compared to non-mine suppliers. Because these are dyadic supplier-purchaser identified transactions, the mine and non-mine suppliers here are actually purchasers. The actual suppliers in these transactions can be located anywhere in Zambia, not just Kitwe. Interestingly, the time trends for mine suppliers and non-mine suppliers in Kitwe follow similar paths over time, with the exception of a few notable outliers.

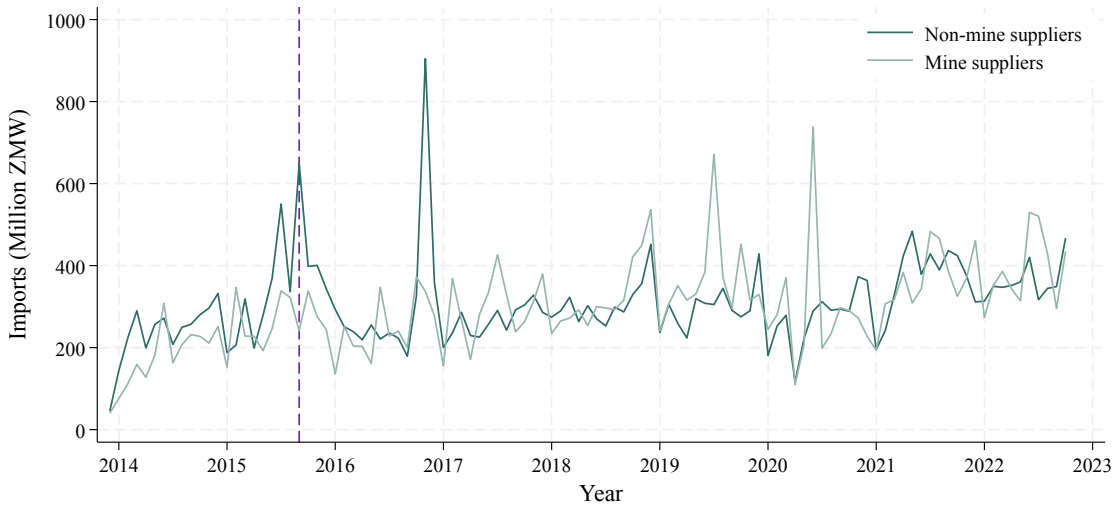


Figure 3: Imports by Mine Suppliers and Non-Mine Suppliers in Kitwe

Notes: The figure shows monthly imports in millions of ZMW, split by firms that are categorized as mine suppliers and non-mine suppliers. The dashed vertical line indicates the timing of implementation of the Zambian local procurement policy.

For imports, the patterns are different. In fact, importing firms who are mine suppliers and located in Kitwe, have on average similar levels of imports (in million ZMW, inflation adjusted) than firms who are not classified as mine suppliers (Figure 3). This means that mine suppliers are overrepresented in imports relative to their domestic footprint explored in Figure 2. This may be partly explained by mine suppliers simply importing goods for the mining industry due to the pressure from the LCPs mandating domestic sourcing of goods and services. The difference may also stem from firms entering the GVC becoming more established and internationally oriented.

The vertical dashed line indicates the time of implementation of the latest change in LCP which took place in 2015. In Figure 2, there is no clearly visible change in procurement before and after the policy implementation. In Figure 3, by 2016, the small differences in levels between mine and non-mine suppliers observed before the policy was implemented seem to disappear, suggesting that the policy may have shifted some imports directly from the mines to mine suppliers.

3.2 How the copper price drives local demand: Regression analysis

Next we use our two datasets on domestic transactions and imports of firms located in Kitwe to understand how their demand changes with fluctuations in the mining industry. We model changes in copper mining intensity using the international copper price. Figure 4 shows that the copper price varied significantly in the study period, with two significant periods of price increases: (i) 2016-2018 and (ii) 2020-2022. Previous research has shown a strong correlation between the international copper price, Zambian copper production, domestic demand from mining firms (Benshaul-Tolonen, 2024), and the local Zambian economy (Wilson, 2012; Lippert, 2014).

An advantage of this model is that the copper price is exogenous to the Kitwe economy, thus an interaction effect model can be used to understand how the copper price drives local demand changes. A potential concern is that the international copper price is determined by the Kitwe economy, meaning that any effect identified in a regression model suffers from reverse causality–that is, the Kitwe economy drives the international copper price. This is unlikely for several reasons: (i) While the Kitwe economy is integral to the Zambian mining industry, the Zambian copper production hovers around 4% of the global production and may not be a price setter (Barry, 2019); (ii) We exclude mining companies from the analysis, so while copper mining companies' behavior may affect the international copper price, it is highly unlikely that local suppliers to the copper mines drive the international copper price; (iii) The copper price is driven by a range of complex factors, plausibly orthogonal to the Kitwe economy, including fundamentals factors like supply and demand of copper, as well as non-fundamentals factors such as copper as an asset and financial speculation (Guzmán and Silva, 2018).

We estimate the following regression model:

$$\begin{aligned} PurchaseValue_{imys} = & \\ & \beta_0 + \beta_1 MineSupplier_i + \beta_2 CopperPrice_{imy} \\ & + \beta_3 MineSupplier_i \times CopperPrice_{imy} \\ & + \theta_m + \kappa_y + \gamma_s + \epsilon_{imys} \end{aligned} \tag{1}$$

Where subscript i stands for firm, and we include fixed effects m for month, y for year and s

for sector. We use robust standard errors and cluster at year-month level. The main coefficients of interest are MineSupplier, CopperPrice and the interaction between said two.

Figure 4: Copper prices

Looking at the VAT data, we confirm that mine supplier status is negatively associated with domestic purchases (Table 2, Panel A, columns 2 and 3); that is, a mine supplier, on average, purchases less from domestic firms than a non-mine supplier in a month, when controlling for year, month and sector fixed effects. In general, the copper price does not drive demand for firms in Kitwe, as given by the coefficient for "copper price" (column 3). The last column (4) includes the interaction effect between mine supplier and the copper price, allowing for a heterogeneous effect of the copper price on such firms. While mine supplier is associated with a negative effect on domestic purchases, the interaction effect is positive and statistically significant. The interpretation is that the copper price has a strong effect on mine suppliers' demand for goods and services: A one unit increase in the monthly copper price (equivalent to roughly 1/3 of its mean), is associated with a 0.537 million ZMW increase in domestic procurement of mine suppliers, in the same month. This is equivalent to a roughly 30% increase from the average monthly procurement value of a firm in Kitwe. Adding an additional time lag for the copper price (column 5) generates coefficients with

Table 2: Fluctuations in demand from local firms with the international copper price

	(1)	(2)	(3)	(4)	(5)
Panel A					
	Monthly average domestic purchase value				
Mine supplier	-0.577***	-0.721***	-0.721***	-2.317***	-2.417***
	(0.072)	(0.076)	(0.076)	(0.385)	(0.399)
Copper price (USD)			-0.076	-0.236	-0.557*
			(0.184)	(0.205)	(0.328)
Mine supplier × Copper price				0.537***	0.429
				(0.130)	(0.355)
Copper price (USD) lag t-1					0.447*
					(0.251)
Mine supplier × Copper price (USD) lag t-1					0.138
					(0.374)
Observations	62,941	62,921	62,921	62,921	61,408
R-squared	0.000	0.035	0.0345	0.0345	0.0350
Mean copper price (USD)			3.019	3.019	3.019
Mean purchase value (ZMW, mil)	1.821	1.821	1.821	1.821	1.821
Mean purchase value (ZMW, mil) mine suppliers	1.471	1.471	1.471	1.471	1.471
Panel B					
	Monthly average import value				
Mine supplier	1.216***	0.926***	0.925***	-0.352	-0.528
	(0.132)	(0.109)	(0.109)	(0.513)	(0.565)
Copper price (USD)			0.030	-0.134	-0.434
			(0.198)	(0.193)	(0.342)
Mine supplier × Copper price (USD)				0.425***	0.039
				(0.159)	(0.343)
Copper price (USD) lag t-1					0.538
					(0.339)
Mine supplier × Copper price (USD) lag t-1					0.463
					(0.392)
Observations	22,443	22,429	22,429	22,429	21,169
R-squared	0.003	0.015	0.015	0.016	0.015
Mean copper price (USD)			3.010	3.010	3.010
Mean monthly import value (ZMW, mil)	2.883	2.883	2.883	2.883	2.883
Mean monthly import value (ZMW, mil) mine suppliers	3.621	3.621	3.621	3.621	3.621
Year FEs	No	Yes	Yes	Yes	Yes
Month FEs	No	Yes	Yes	Yes	Yes
Sector FEs	No	Yes	Yes	Yes	Yes

Notes: Standard errors, clustered by year-month, are reported in parentheses. Monthly average domestic purchase value and import value represent the total monthly domestic purchases and imports by firms, respectively. The values are adjusted for inflation using the consumer price index and are cleaned of major outliers. 'Mine supplier' is a binary value equal to one if a firm sold at least one good or service to one or more mining firms in Zambia registered with ZEITI between 2013 and 2021, as reported to tax authorities. The monthly copper price comes from investing.com and is in USD. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Statistical significance levels are robust to using wild cluster bootstrapped standard errors following Cameron et al. (2008).

the same directionality, but without statistical significance.

We then turn to the import dataset. First, mine supplier status is positively associated with imports, controlling for year, month and sector FE. Second, the interaction effect of mine supplier and price drives a lot of the demand changes in imports by mine suppliers (Columns 4-5). This means that local firms who are linked to mines respond strongly to changes in the international copper price. Higher copper prices leads to such mines importing more, while concurrently driving greater procurement of goods and services from Zambian firms. A one unit increase in the monthly copper price is associated with a 0.425 million ZMW increase in the import value of mine suppliers, equivalent to a roughly 15% increase in the average monthly import value by firm.

The copper price has large, statistically significant, and contemporaneous effects on firms in Kitwe that are connected with mining firms. An increase in the international copper price affects both local demand and imports levels, highlighting the existence of backward linkages and integration of local firms into the mining network. Nevertheless, a major limitation to this analysis is that not all mining firms located near Kitwe are involved in copper production. In fact, near Kitwe is the Ndola Rural Emerald Restricted Area, which contains both large and small emerald mines. Since there is no internationally traded price for emeralds, we are not able to conduct a similar analysis like that for copper. The failure to take the prices of other precious gems, minerals and metals into account risks biasing our estimates toward zero.

To better understand what these mine supplying firms look like, we collected a cross-sectional firm survey in Kitwe. The results are described in the following section.

4 Kitwe firm survey

For deeper insight into the constraints faced by domestic suppliers in Zambia's mining industry, we collected a structured survey from 1,055 firms in the city of Kitwe, in the Copperbelt. The module was collected between January and March 2024 as part of a research study undertaken by UC Berkeley and the International Growth Centre (IGC). The survey team visited different areas of Kitwe and followed a left hand rule to construct a random sample. The sample inclusion

criteria required that the firm have (i) a permanent structure from which it operates, and (ii) at least one full time employee. Thus, the inclusion criteria excludes most small and informal firms. Additionally, the sample may have underrepresented large firms due to lower response rates.

4.1 Baseline characteristics

The Zambian Ministry of Small and Medium Enterprise Development focuses on MSMEs in their national development policy report, highlighting their role in employment creation, poverty reduction, and inclusive growth. In fact, MSMEs account for 70% of Zambia's GDP and provide 88% of the country's employment (Ministry of Small and Medium Enterprise Development, 2023). Definitions of MSMEs vary, but Zambia has adopted a multifaceted definition including (i) annual turnover, (ii) total fixed investments[8], (iii) total number of employees, and (iv) legal status. We use the employment threshold—fewer than 10 employees for micro enterprises, 11 to 50 for small enterprises, and 51 to 100 for medium enterprises (Ministry of Small and Medium Enterprise Development, 2023)—to classify 89.9% of surveyed firms as MSMEs[9].

Moreover, out of the 1,055 surveyed Kitwe firms, 91.5% were registered, formal firms[10]. The level of registration among surveyed firms is high and not representative of the broader business landscape in Zambia, where approximately 70% of the economic activity occurs in the informal sector (Elgin et al., 2021). This discrepancy is likely a by-product of the survey's inclusion restrictions. The Zambia Business survey found that micro and small enterprises in urban areas are more likely registered (at a level of 21%) compared to in rural areas (3%) (Clarke, 2019).

Out of the 1,055 firms surveyed, 9.10% of firms regularly (0.9%) and occasionally (8.2%) sold to mining firms in the past 5 years. Among these, 82.92% reported regularly (66.67%) and occasionally (15.62%) selling to mining firms in the past 12 months. Of those firms who count mines as customers (mine suppliers) 12.66% did not sell anything to mines in the last year, and the remainder sold regularly (18.99%) or occasionally (68.35%). Across all firms, the average revenue from mining or

[8]The investment levels vary by sectors; for mining and quarrying the thresholds are higher.

[9]We lack access to additional firm characteristics that could help ensure accurate firm classification using a multifaceted definition.

[10]Registration can be with any agency; the city of Kitwe, Zambian Revenue Authorities or other.

Table 3: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Age of business	11.320	7.666	0	70	1,055
Registered business	0.915	0.279	0	1	1,046
Profits	69,480	711,607	70	20 mil	1,037
Full-time wage workers	5.545	26.820	0	800	1,055
Casual or daily-paid workers	1.691	3.821	0	90	1,055
Business owners is male	0.714	0.452	0	1	1,055
Micro Enterprise (<11 employees)	0.898	0.303	0	1	1,055
Small Medium Enterprise (<100 employees)	0.996	0.061	0	1	1,055
Did you sell to mining firms:					
... in the last 5 years?	0.091	0.288	0	1	1,055
... in the last 12 months	0.075	0.263	0	1	1,055
Revenue from mines or mining-related firms (%)	2.816	10.466	0	100	1,048
... Non-mine suppliers (%)	1.058	6.916	0	100	969
... Mine suppliers (%)	24.380	19.167	0	85	79
If you sold to mining firms in the last 12 months, how long were the contracts?					
... one-time purchase	0.506		0	1	79
... 1-6 months long	0.354		0	1	79
... 6-12 months long	0.063		0	1	79
... more than 1 year long	0.076		0	1	79
If you sold to mining firms in the last 12 months, what goods and services did you sell?					
...Catering and food services	0.025	0.158	0	1	79
...Cement	0.013	0.113	0	1	79
...Electrical services	0.038	0.192	0	1	79
...Food and beverages	0.089	0.286	0	1	79
...Lubricants, oils, and greases	0.127	0.335	0	1	79
...Machines, machine tools and spare parts	0.177	0.384	0	1	79
...Personal protective equipment	0.354	0.481	0	1	79
...Plant services	0.101	0.304	0	1	79
...Stationary and other office materials	0.076	0.267	0	1	79
...Tires and vehicles parts	0.177	0.384	0	1	79
...Transportation services	0.051	0.221	0	1	79
Other, specify	0.049	0.217	0	1	79
What is preventing you from selling more to the mines?					
No constraints apply	0.262	0.440	0	1	1,055
Not interested	0.041	0.198	0	1	1,055
Competition	0.224	0.417	0	1	1,055
Bribes and/or corruption	0.154	0.361	0	1	1,055
Government policies	0.024	0.152	0	1	1055
Lack of capacity and/or training	0.049	0.217	0	1	1,055
Lack of connections	0.383	0.486	0	1	1,055
Lack of supplies	0.172	0.377	0	1	1,055
Low demand from mining firms	0.264	0.441	0	1	1,055

mining-related firms was 2.816%. Among firms that we classify as mine suppliers in the last year, this percentage was 24.38%.

4.2 Geographic location of firms

The map in Figure 1B highlights the spatial distribution of business opportunities available to local companies in Kitwe, who may benefit from proximity to mine operations. In fact, Figure 1B shows a clear pattern: Mine suppliers, indicated by purple dots, are clustered near mines, while non-mine suppliers, indicated by green dots, are more geographically spread. Past research indicates that certain mines offer preferential treatment to suppliers located in geographic proximity (Nsupila, 2016).

4.3 Mine contract characteristics

Recurring and longer contracts with mining firms are suggested to (i) help suppliers plan for the future and make informed investments in the business, and (ii) enable purchasers to avoid fees, time delays and potential issues associated with new contracts (Fessehaie, 2012b). Figure 5 (left) shows the length of firms' contracts with mines. The majority of purchases were one-time transactions, with some contracts spanning a duration of 1 to 6 months. The right side of Figure 5 shows a distinctly different pattern for firms that report regularly selling to mining firms within the past year—fewer than 1% of total firms. The typical contracts are 1-6 months, followed by a contract length of 12 months or longer. This correlation between contract length and recurring orders indicates that some firms may face a hurdle when switching from occasional, short contracts, to recurring, longer contracts.

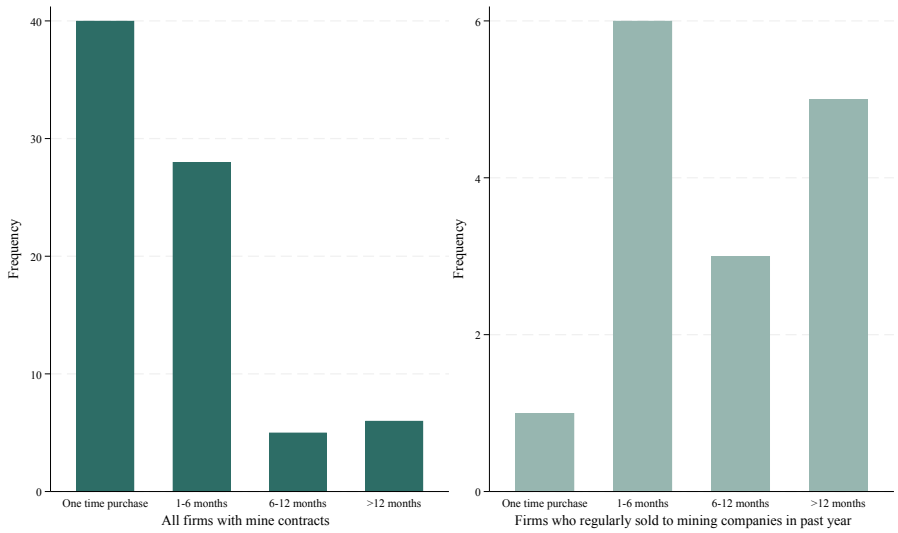


Figure 5: Mine Contract Length

An exploration of the types of goods and services firms sell to the mines reveals personal protective equipment to be the most common option, followed by tires/vehicle parts, machines/tools/spare parts, and lubricants and greases (Figure 6). Food and beverages are fairly common, while services related to food and catering are relatively uncommon.

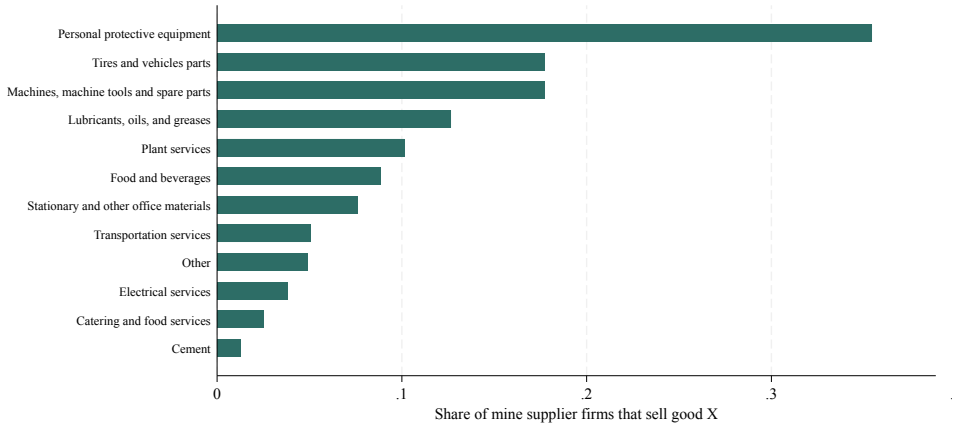


Figure 6: Goods and services sold to the mines

4.4 Constraints to entering the global value chain

Out of the surveyed firms, 71.5% wish to sell more to mining firms. Only 4.38% of firms who stated not to have had any mine contracts in the last 5 years, expressed that they were uninterested in entering the mining GVC. Firms that sold occasionally to mining firms in the past 5 years were the most likely to list at least one constraint (90.7%), compared to firms that regularly sold to mining firms (40%), and those that never sold to mining firms in the last 5 years (70.1%). This indicates that both firms with and without mining contracts desire more demand from mining companies, but are constrained by various factors that prevent them from penetrating the technical and high-skill sectors that mining firms source from (Ba and Jacquet, 2022). The results underscore inefficiencies in the Zambian copper mining sector: Although firms express a desire to join the GVC, and previous findings indicate that large copper producers like First Quantum Minerals favor supporting local businesses and fostering development opportunities, integration with the domestic economy remains weak (Wirth et al., 2016).

The existing body of literature maintains that local procurement is "low" (Fessehaie et al., 2015). We suggest this may largely stem from a significant level of unmet demand from firms seeking to break into the mining GVC. If it is indeed true that local firms are eager to form connections, attention must then turn to the barriers that suppress the development of strong backward linkages. Thus, we explored the constraints the firms listed as experiencing. Firms were allowed to select all constraints that hinder their ability to supply more goods and services to mines. Figure 7 shows that lack of connections is the most common constraint among all firms, followed by low demand and high competition. Our survey question did not distinguish between competition from other domestic firms and international firms. The right side of Figure 7 shows that firms who are mine suppliers also cite high competition and low demand as the main constraints, followed by lack of connections—despite being connected with at least one firm within the last year. Bribes and corruption, along with a lack of supplies, are commonly cited as reasons across both groups.

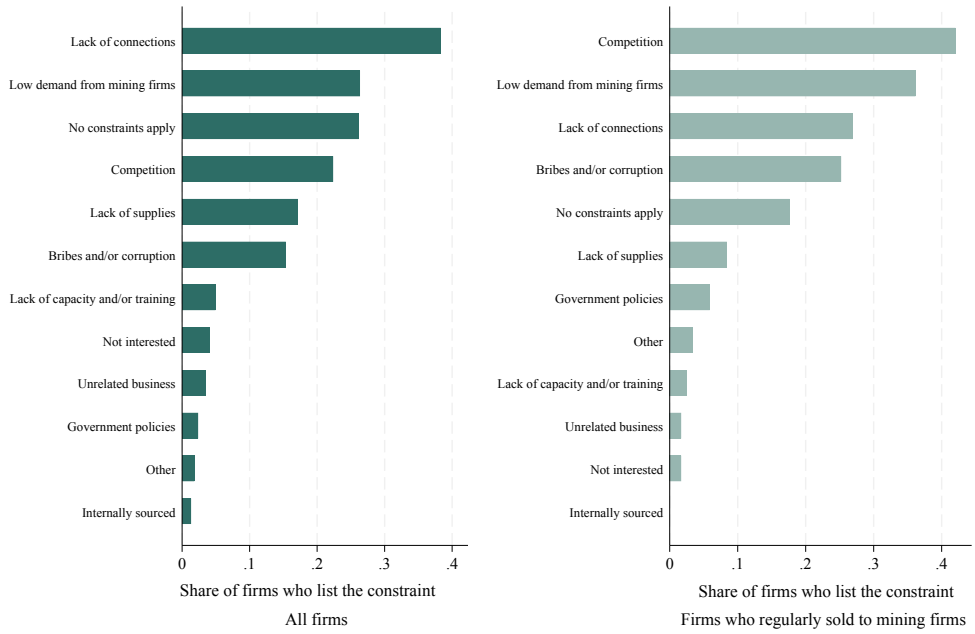


Figure 7: Constrains to supply to the mining industry

We contribute additional nuance to existing research on Zambia by exploring the obstacles to entering the mining GVC. Previous studies found that access to technology, credit, managerial know-how, standards, and taxes were major hurdles (Chisala, 2008; Kanyinji and Tembo, 2019b). In contrast, the respondents participating in our study laid emphasis on the competitiveness of the market, the low demand from mines, lack of connections, as well as bribes and corruption. The option "government policies", which can be taken to include both tax policies and regulations, was generally not listed as a constraint. In addition, we note an interesting contradiction: Mines in Zambia claim to have a hard time securing goods from local suppliers of the required quality and standards (Fessehaie et al., 2015; Kragelund, 2017) yet, few (7.11-7.29%) prospective mine suppliers—defined as those interested in joining the GVC but who did not sell to mines in the last 12 months or 5 years, respectively—reported lack of capacity or training as obstacles to securing mine contracts.

An open ended question allowed firm representatives to state their own reason. Only one firm

mentioned access to credit, while several mentioned the scale at which they operate, noting that mines prefer to procure in bulk or from larger companies. Although credit constraints were underreported, supply and capacity limitations could, in part, be alleviated by investments enabled through improved credit access. An analysis of the World Bank Enterprise survey in Zambia revealed that access to finance is one of the primary obstacles to firm growth in the Copperbelt Province and country as a whole (Mulder et al., 2024). Specifically, inadequate financing creates bottlenecks for MSMEs, preventing them from acquiring, maintaining, and attracting critical resources (Mwamba et al., 2022).

4.5 Agree/disagree statements

Lastly, we asked the firm representatives to answer seven agree or disagree statements relating to the mining industry (Figure 8). The respondents disagree that their firms are strongly dependent on copper mining firms[11], although they agree that the Zambian economy is heavily reliant on copper mining (average of 4.68 out of 5). That said, firms still strongly agree that copper mining firms should procure more domestic goods and services (average of 4.56 out of 5).

[11]We ask this question directly. Mine suppliers do not feel dependent on the mining industry. On a scale of 1 to 5, where 5 is strongly agree, their average is 2.83/5. Non-mine suppliers also do not feel dependent on mining firms with an average of 1.62/5.

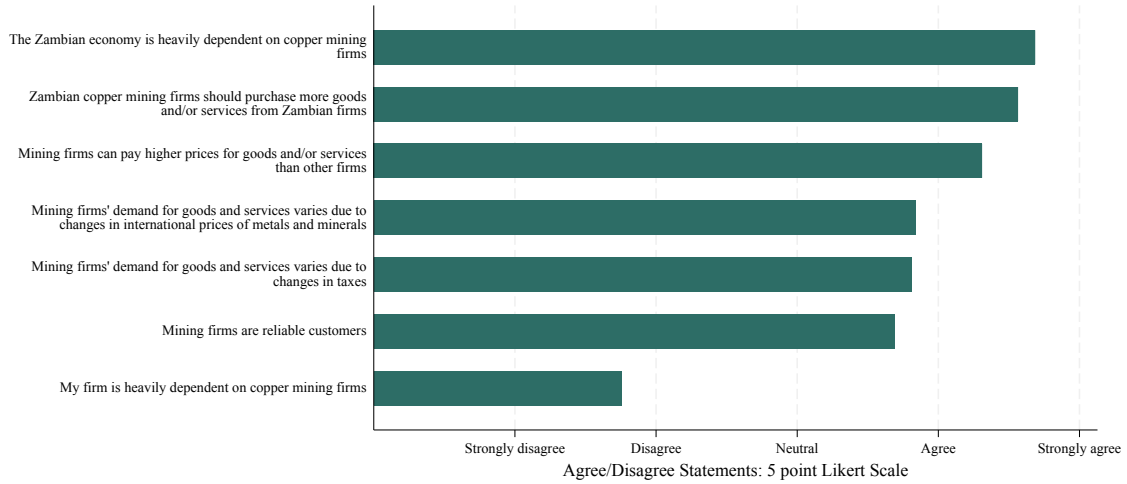


Figure 8: Agree and Disagree Statements: 5 point Likert Scale

Notes: Strongly disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly Agree (5).

4.6 Regression analyis

Next, we turn to regression analysis to explore the characteristics of mine suppliers, the proportion of their revenue derived from mines, and their profit margins. The regression results cannot be interpreted as causal; while we explore correlations between variables, the causative factor behind the correlations has not been determined[12]. The basic regression model can be described as:

$$\begin{aligned} MineSupplier_{is} = & \\ & \beta_0 + \beta_1 Age_i + \beta_2 MicroEnterprise_i + \beta_3 Credit_i + \beta_4 Registered_i + \beta_1 MaleOwner_i \\ & + \gamma_s + \epsilon_{is} \end{aligned} \tag{2}$$

Where i is the subscript for firm i, and γ_s represents sector fixed effects. We use robust standard errors. The outcome variable MineSupplier is binary and we use a linear probability model. The outcomes in columns 3 and 4—share revenue from mines in the last month and profits in the last month (in 10,000 Kwacha)—are continuous and we model the relationship using ordinary least

[12]For example, it may well be that being a mine supplier predicts the independent variables, such as firm age and number of full time employees, if being a mine supplier results in firm growth and longevity.

squares.

Table 4 shows that firms that are supplying to mines are older and have more full time workers. A male business owner is not associated with a change in the likelihood of having supplied at least one mine in the last 12 months. This is in contrast to previous research which found that women owners (who constitute 28.63% of surveyed owners) have a harder time entering the mining global value chain in Zambia (Kanyinji and Tembo, 2019b). A survey focusing on sustainability practices of SMEs supplying to four large copper mines (Kansanshi Mine, Konkola Copper Mines, Lumwana Mine and Mopani Copper Mine) found that 15.9% of owners were women (Choongo et al., 2016)[13], in contrast to 28.5% in our survey.

These results are all representing the extensive margin: if a firm is a mine supplier or not. We change the outcome variable to reflect an intensive margin: Share of revenue stemming from mines in the last month. We find that older firms report a higher share of their revenue in the last month stemming from mines: One extra year is associated with roughly a 10% increase in the mean of the outcome variable. Turning to profits, we do not find that being a mine supplier correlates with profits in the last month.

5 Discussion

5.1 Limitations

We explore three distinct sets of data from Kitwe, Zambia: (i) firm-level monthly VAT transaction data from Kitwe, (ii) firm-level monthly import data, and (iii) a cross-sectional firm survey conducted in 2024. While it is clear that these datasets cannot be used to make generalizations about Zambia as a whole, they should also not be interpreted as a comprehensive representation of the entire firm landscape in Kitwe. The tax and import data includes transactions by formally registered firms with tax identification numbers, while the firm survey required firms to have a permanent structure and at least one full time employee. These restrictions reduce the generalizability and representativeness of the results, as many firms—especially micro and small enterprises—may be

[13]The survey focused on SMEs with 10-250 employees, thus excluding micro enterprises.

Table 4: Determinants of mine supplier status and profits in the Kitwe survey data

	(1) Mine supplier Last 5 years	(2) Mine supplier Last 12 months	(3) Share Revenue Mines Last month	(4) Profits Last month (in 10,000)
Firm age (years)	0.010***	0.006***	0.228***	2.543
	(0.003)	(0.002)	(0.065)	(2.018)
Micro enterprise	-0.102*	-0.058	-1.193	-9.412
	(0.055)	(0.043)	(1.484)	(7.867)
Access to credit	-0.015	-0.016	-0.228	-3.560*
	(0.020)	(0.017)	(0.648)	(2.160)
Registered	0.059***	0.054***	1.235	-5.299
	(0.017)	(0.016)	(1.225)	(5.855)
Male owner	0.003	-0.000	0.587	-1.815
	(0.021)	(0.018)	(0.611)	(2.539)
Mine supplier (12 months)				21.534
				(16.503)
Constant	1.033***	0.0150	-0.168	-7.588
	(0.0655)	(0.0524)	(2.152)	(21.055)
N	1,046	1,046	1,046	1,028
Sector fixed effects	Yes	Yes	Yes	Yes
Mean of outcome variable	1.100	0.075	2.816	6.948

Robust standard errors in parentheses. In column 4, we lose 18 observations due to those firms reporting zero profits. All regressions control for sector fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

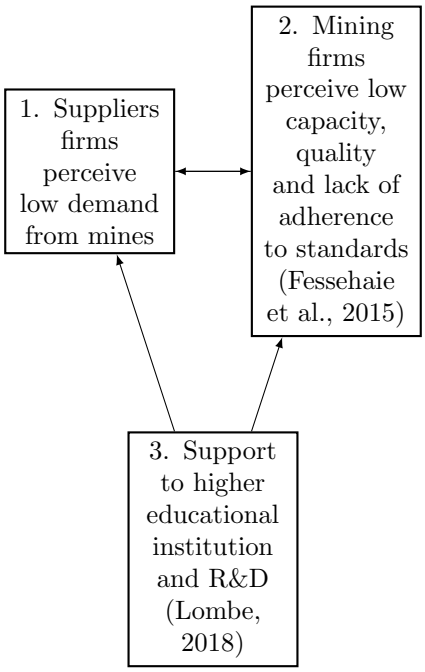
informal and unregistered, located in nearby rural areas, or lack a permanent structure (Mwamba et al., 2022). In fact, approximately 70% of Zambian firms are estimated to be informal (Elgin et al., 2021), with a significant over-representation in rural areas (Clarke, 2019). These rural firms face even steeper challenges trying to enter the mining GVC due to poor road infrastructure and prohibitive costs of electricity and electricity connectivity, all not captured in our data (Kanyinji and Tembo, 2019a).

Moreover, while Kitwe lies at the heart of the Copperbelt Province, the region is not only a hub for copper production, as its name suggests, but also rich in other valuable minerals. Notably, the Copperbelt Province is also home to the Ndola Rural Emerald Restricted Area, the site for Zambian emerald mining (Zwaan et al., 2005). The definition of mine supplier accurately includes all types of mines. However, the regression analysis using the international copper price does not consider price fluctuations in other important metals and minerals. Future analyses could incorporate the price of all relevant metals and minerals mined in Zambia, to better understand demand fluctuations in Kitwe. However, this is challenging due to the absence of a standardized global price for emerald, for example.

5.2 Policy discussion

Panel data covering 10 years of firm-level monthly domestic transactions and imports indicates that mine suppliers in Kitwe: (i) constitute roughly one-third of all local firms across various sectors and (ii) adjust their procurement of goods and services, both domestically and internationally, in response to fluctuations in the international copper price. These findings highlight the presence of backward linkages between the mining industry and domestic firms. While the significant share of mine suppliers across various sectors indicates the breadth of these linkages, the tax data does not capture their depth, defined as the extent and intensity of linkages (Fessehaie, 2012b). Our cross-sectional firm survey reveals strong interest among local firms to integrate into the GVC and expand their supply to the mining industry. However, they identify several key barriers such as lack of connections, low demand, competition, bribes and corruption, and lack of supplies. These results suggest the full depth of the backward linkages is not being fully realized.

Figure 9: Constraints to successful local content procurement



To stimulate demand from mines and achiever deeper backward linkages, it is crucial to understand the factors behind the low levels of procurement from the mining industry's perspective. Prior literature suggests mines often report a lack of scale, quality, and adherence to standards among local firms (Fessehaie et al., 2015). As long as these concerns from mines persist, LCPs are unlikely to result in significant real procurement. Instead, we hypothesize two undesirable outcomes: (i) continued reliance on imports from OEMs and their subsidiaries, which provide minimal value addition to the Zambian economy; and (ii) increased corruption, bribes and elite capture. Surveyed mine suppliers notably identified bribes and corruption as a greater obstacle to integrating into the copper mining GVC compared to non-mine suppliers. This disparity may reflect non-mine suppliers' greater willingness to engage in these practices, potentially as a means to facilitate their entry into the copper mining GVC.

The Zambian mining expert Lombe (2018) argued that the solutions lie in strengthening ed-

ucation and the research and development (R&D) environment (see Figure 9). He draws from a few examples; (i) South Africa, that became a regional dominant force for mining equipment and services due to an educated workforce and high-quality educational institutions, and (ii) Sweden, that was successful in generating innovation and patents, also in SMEs, through government support of R&D. In the face of advancements in education and R&D, local firms could provide goods and services of apt quality and standards, overcoming the barriers of low demand and competition. Concurrently, government regulation and financing must play a critical role in curbing bribes and corruption while enabling firms to scale effectively.

The million-dollar question lies in whether Zambia can and ought to radically increase spending on building globally competitive higher educational institutions when the government faces urgent policy needs in critical areas such as poverty and health care. Moreover, while the mining sector plays a vital role in the Zambian economy, the relatively small domestic market limits actors' ability to achieve economies of scale by solely servicing the local economy, pushing them to adopt an export-orientated approach early on. However, in international markets, Zambian firms face competition not only from well established players, such as South African firms, but also from low-cost, high-innovation competitors from China. Additionally, entering firms may encounter what the African Development Bank (2019) calls "unfair competition", arising from the dumping of goods, particularly those of Chinese origin, or through public turnkey projects involving Chinese firms. These challenges suppress export potential and raise concerns about whether Zambia can build the competitive advantage needed—through strategic investment—to establish a firm presence in the higher value-added segments of the mining GVC, thereby increasing the depth of backward linkages. If implemented diligently and successfully, enhanced and additional backward linkages would provide Zambia with a greater source of VAT, tarrifs and income taxes. Although derived from a depletable asset, these additional funds could be reinvested into other sectors, driving positive economic effects beyond the lifespan of mineral resources.

Lastly, while policies certainly ought to deepen backward linkages, furthering firm integration into the mining GVC and higher value-added sectors increases the vulnerability of the economy to price fluctuations. Stabilization funds, alongside economic diversification, could prove essential to

dampen the impacts of commodity price fluctuations (Liebenthal and Cheelo, 2020).

5.3 Conclusions

This paper strategically focused on the city of Kitwe, a key hub for the mining industry located in the heart of Zambia's Copperbelt region. Utilizing official tax records and collected cross-sectional survey data, this study explored the linkages between local firms and the mining industry, providing insights into the complexities of the region's mining value chain.

We began the analysis by leveraging data reported to the tax authorities (ZRA) on domestic firm-to-firm transactions and imports from Kitwe, spanning from late 2013 to late 2022. The results revealed 35% of firms in Kitwe are mine suppliers, thus forming part of the copper mining GVC. Furthermore, said mine suppliers maintain a low share of domestic demand, while accounting for approximately half of international demand. Subsequent regression analysis shows that while the copper price has a negligible independent effect on Kitwe firms as a whole, the demand for both domestic and international goods and services by mine suppliers is highly dependent on the copper market: a price increase in coppers leads to a higher average transaction value within the same month. Ultimately, this indicates a local multiplier effect for mine suppliers, but no such effect for Kitwe firms as a whole.

To gain a more qualitative perspective, we collected and analyzed cross-sectional survey data from 1,055 firm representative in Kitwe, offering insights into the factors influencing entry into the the mining supply chain and the enhancement of firms' participation within it. Surprisingly, we found that there is very high demand for entering the supply chain, with only 4.38% of companies stating that they are not interested. The respondents identified lack of connections, low demand, competition, and bribes and corruption as key obstacles hindering participation in the copper mining GVC.

With over a third of Kitwe firms integrated into the copper mining GVC, it is clear that the Kitwe copper mining industry generates significant local economic spillovers, challenging the enclave theory. However the current level may still reflect a suboptimal depth of backward linkages since the majority of firms ($> 95\%$) who are not involved in the mining GVC express a desire to integrate.

Increased procurement would undoubtedly lead to additional government revenue, generated from VAT, tariffs and income tax, which could lead to a trickle-down effect in other sectors. Due to the volatile nature of the mining sector, further research is required to determine whether additional backward linkages between local firms and mines are suitable for fostering resilient, non-resource dependent growth.

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6 APPENDIX

Table 5: Summary statistics sectors Kitwe domestic VAT and imports datasets

Sector	Total Count
Kitwe domestic VAT transaction dataset	
Public administration and defense; compulsory social security	628
Water supply; sewerage, waste management and remediation	2,031
Real estate activities	6,168
Transportation and storage	29,114
Other service activities	47,857
Mining and Quarrying	69,823
Professional, scientific and technical activities	112,200
Manufacturing	135,240
Other	203,637
Wholesale and retail trade; repair of motor vehicles and motorcycles	499,008
Total	1,105,339
Kitwe import transaction dataset	
Real estate activities	70
Water supply; sewerage, waste management and remediation	222
Transportation and storage	4,120
Mining and Quarrying	10,656
Other service activities	13,544
Professional, scientific and technical activities	32,462
Manufacturing	35,602
Other	78,018
Wholesale and retail trade; repair of motor vehicles and motorcycles	243,569
Total	418,290