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Local Employment Effects of Falling Copper prices: A Case study in the Copperbelt province of Zambia

Abstract. Zambia is heavily dependent on copper, and a typical example of a country subject to the natural resource curse. From 2011 until 2016, the copper price fell from around $9,900 to $5,660 per metric tonne (mt). In this thesis, we examine the relationship between the falling copper price and employment opportunities in the Copperbelt region of Zambia, both in the large mines and further down the supply chain, among the Zambian small and medium-sized enterprises (SMEs) active in the Copperbelt. We use regression analysis on panel-type employment data and questionnaire data, self-collected during a field study in April and May of 2017. We also use graphical visualisation of employment data and anecdotal evidence from interviews for contextual understanding and framing of our regression result interpretation. We find that the falling copper price reduces employment in the mines, and that the effect seems to be stronger for contract-style employees than permanently employed labourers. SMEs who have a larger share of mining clients are more likely to have reduced profits since the start of the copper price fall, but all SMEs across the Copperbelt have generally felt a downturn in their business. There seems to be a critical price point of around $4,000 to $5,000 per mt of copper when the employment starts to drop rapidly.

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1. Introduction

1.1 Background

Zambia is a landlocked country of 16.2 million people located in Sub-Saharan Africa. It is economically underdeveloped, with a GDP per capita of $1,178 in 2016 (World Bank, n.d). It is also included in the *United Nations Least Developed Country Index*, meaning that is it highly vulnerable to economic shocks and confronts structural impediments to sustainable development (United Nations, n.d). However, in recent history there has been reason for optimism as the economy has been producing positive growth figures since 1999, when the annual growth was at 4.65% (World Bank, n.d). The growth increased to a peak of 10.3% in 2010, at which it peaked and has since been slowing down, reaching a low of 2.92% in 2015.

The World Bank has further described how the entire Sub-Saharan Africa has experienced reducing economic activity over the last couple of years. In the 8th *Zambia Economic Brief report* (2016), they argue that the reduced economic activity is in turn caused by the weak global growth, which affects the region through reduced trade, rising costs of credit and low commodity prices. The credit costs are associated with the rampant rate of inflation. The inflation rate in Zambia was moving within an interval of 6 and 9% during the time between 2011 until the second half of 2015, at which it increased rapidly during a short time-span. At its peak in early 2016, the inflation rate rose above 23%. After that inflation sharply decreased to a level similar to previous times of between 5 and 7%.

The low commodity prices play a large part in the case of Zambia, as copper is the major exported good and the mining industry generates employment, investment and government revenue. The industry has its origins from the 1920s, when colonial settlers started to prospect the copper findings and get mining rights in the area, which is discussed in *Copper mining in Zambia - history and future*, by Sikamo, Mwanza and Mweemba (2016). This led to the emergence of new mining societies which grew into towns. The mining industry was established and competitive when the country gained independence in 1964 as a single-party state. The new government nationalized some of the mines, which eventually was merged into Zambia Consolidated Copper Mines (ZCCM) in 1982. In the book *Zambia, Mining and*

Neoliberalism, Fraser and Larmer (2010) describes how the profits of ZCCM was used to fund state endeavours on areas of national interest, such as education, infrastructure and basic amenities to the people.

However, due to lack of reinvestment in the mines themselves, production output decreased and costs rose. In 1991 the country got a new government, the Movement for Multiparty Democracy (MMD), after which it has remained in a democratic political system of multiple parties and regular elections. The new government made privatisation of the mines a priority. Privatisation resulted in an increase in new investments and the output of the mines started to rise once again, as discussed in an article by Ruffini (2006). He discusses the time that followed privatization with a higher price of copper, and how new investments in the sector were crucial to attract foreign direct investment and to increase copper output. However, another effect of privatisation presented by Lungu and Fraser (*For Whom The Windfalls?* 2007) was the casualisation of the mining labour force. Lungu and Fraser investigated the impact of privatisation on working conditions in terms of casualisation in 2007, and argued that privatisation led to emergence of fixed-term contracts with less job security and pensions. They also mention the difficulty of obtaining a clear number of how many people that work within the industry, given the many type and variations of contracts that have been initiated.

When it comes to the existing data on employees in the mines, the Zambian Central Statistical Office states in their Labour Force Survey for 2012 that 1.6% of the working age population worked within "*Mining and quarrying*", which is defined according to the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 4). The same number for 2014 was 1.41%, with a slight decrease in number of people employed in the industry and an increase in the total number of employed individuals (Labour Force Survey 2014). Even though this might appear as if the employment in the mining industry does not play a significant part in the Zambian economy, the sector is also contributing implicitly in many other areas. As much as 10% of the Zambian GDP is generated by the mining industry today (Sikamo, Mwanza and Mweemba, 2016) and the sector receives more than 80% of all foreign direct investment.

Furthermore, the proportion of the total Zambian labour force that is considered to have formal employment is rather small, meaning that the worker is "entitled to social security coverage and contract in addition to annual paid leave, or any such entitlement" (CSO, 2014). The total number of employed persons of all sectors in the country was 5,859,225 in 2014, and out of those only 629,626 were formally employed, which accounts for 10.75% (CSO, 2014). The report stated that a total number of 82,725 individuals were employed in "*Mining and Quarrying*", and out of these, 57,322 were formally employed, which is 69.29%. Thereby, even if the sector "*Mining and Quarrying*" has only around 70% in the formal labour force, it is still a significantly higher than the rate of formal employment in the total labour force.

1.2 Purpose of the study

Data from the Global Economic Monitor (World Bank) states that the international price of copper reached a top of $9,868 per mt in February 2011. In the following years it decreased, and in December of 2016 it had fallen to $5,660 per mt, which represents a decrease of 43%. This drop is commonly explained as a consequence of decreasing demand from China, also mentioned by the Zambian Chamber of Mines[1]. The context of Zambia and copper during this time period is thereby of great interest, since it represents a real life scenario of disadvantages from natural resource dependence.

Due to this dependence, Zambia is highly susceptible to idiosyncratic risk regarding global commodity prices, as the economic activity generated by copper production is ubiquitous in the Zambian society. On the other hand of the price mechanism, the supply, the Zambian influence is limited as the estimated national output of copper in 2016 is roughly 740,000 mt. This represents less than 5% of the total world output of 19,400,000 mt *(U.S. Geological Survey, 2017*). Thus the price is arguably exogenous with regard to how much copper Zambia alone manages to supply to the global market.

The purpose of this study is to investigate the effects of falling global copper prices on the local labour force in the Zambian copper mines and the local companies acting as suppliers and service providers to mines. Arguably the effects could appear in many different areas of society, but we think it is likely that the most direct and observable impact would be in the

[1] Meeting with Zambian Chamber of Mines, 6 April 2017, Lusaka

copper mining industry, in terms of employees in large mines and local businesses. For this reason, the study will be focused on those two areas.

The first area is the number of workers in the large mines present in the Copperbelt province of Zambia, which will be investigated by looking at labour statistics between 2011 and 2016. By observing these employment figures along with the price, we hope to say something about the general effects on number of mineworkers following lower prices. In addition, we hope to be able to compare the effect on permanent workers and temporary contractors in order to draw conclusions on how price changes affect them differently, which can be used to discuss problems of the historical casualisation in the mining labour force.

Employment was chosen both due to being quantifiable and realistically obtainable, and also because of its spillover properties. For example, retrenchments are undoubtedly affecting Zambian households on a local level, since retrenched workers can indirectly reflect a lost source of income to families. It could also be argued that the mine employees have a part to play in paying income taxes and social fees, since mining and quarrying represents a large size of formal employment, as previously mentioned. Another reason is that the ownership of the mines is an international and often quite complicated matter, whereas employment is a more explicit contributor to welfare among the local population. The last reason is especially significant as there is a widespread conception that the mining businesses are using the resource richness in Zambia for personal gain without giving anything real back to the people, and that they keep retrenching Zambian workers while the wealth generated by the mines leaves the country.

Furthermore, mining copper is a complicated and multifaceted industry when it comes to value chains, which may stretch wide from the local SMEs and labour in Zambia around to manufacturing and shipment all over the world, enabled by multinational mining conglomerates. These multinational mining businesses often operate with copper and many other minerals at the same time, and thus enjoy the benefits of diversification.

The second area of the study will extend into the effects of resource dependence in terms of the local small and medium sized companies that acts as suppliers of goods and services to the larger mines. By comparing how SMEs mainly doing business with mining customers are affected with SMEs who are more diversified we will investigate the next level in the value

chain of the copper industry and how it responds to shocks in terms of their profit, number of employees and the duration of the contracts they have with their clients. We define SMEs according to the staff headcount measurement presented by the European Commission (2003).

However, focusing on employment also poses challenges, as official employment time-series data in Zambia is limited, especially among SMEs. Despite this, the question is still arguably of interest, and if answered it could be of relevance to policy makers, businesses and other stakeholders in Zambia. The topic of falling copper prices is still limited in academia, and there is not a lot of available literature on the subject so far. Arguably more data and research is required to fully understand how Zambia will develop in terms of exposure to worldwide demand for its riches.

By looking at the effects of prices on both workers in large, internationally owned mines with the smaller local businesses, we hope to contribute with new perspectives on the problems of resource dependence that shows the situation for the people beyond the growth and decline in the national accounts.

1.3 Theoretical Framework

1.3.1 The Natural Resource Curse

Bigsten (2011) writes that the sustainability of growth in a country like Zambia is dependent on if the country develops a system with more advanced technology outside of the production of the particular natural resource. He further argues that the inability to successfully diversify the economy from natural resource dependence is a symptom of the so-called natural resource curse. The natural resource curse is the observation that economies with rich abundance of natural resources generally tend to perform badly in terms of growth and development, which has been proven empirically by Sachs and Warner (2001).

However, it is also proclaimed that resource endowment itself does not necessarily have to be negative for a country. Van der Ploeg (2011) illustrates how resource rich economies with good institutions, trade openness and investments in exploration technology are more likely to experience a resource blessing, while the curse tends to reveal itself in nations with low

rule of law, bad institutions, presidential democracy and a bad financial system. He further develops the case by looking at the negative genuine savings rate, which is the difficulty of resource rich developing countries to turn their natural resource wealth into other forms of wealth, such as physical capital, human capital and infrastructure. There are clearly two sides to the coin that is resource dependency, and how countries are affected by it depends on the combination of a number of factors.

Boos and Holm-Müller (2015) further looks at the genuine savings rate and also argues that Zambia is a clear example of a country that suffers from the natural resource curse. This is explained by an extreme dependence on copper exports and insufficient reinvestments from depletion of natural capital. They further argue that depletion of natural resources follow the world prices of copper, which rose rapidly in the 1990s due to increased demand from India and China.

The Dutch disease in the case of Zambia was investigated by Calì and Willem te Velde (2007). Following the boom in the first years of the 2000s, they argue that the increase in copper exports has been a key driver in real appreciation of the exchange rate. Their findings proved that this could have a negative effect on non-traditional exporting sectors, such as agriculture, that may offset positive effects on growth and an improved trade balance. They presented the solutions that these sectors had to become more competitive or face relocation, which would further increase dependency on copper as dominant export.

Nziramasanga (1981) used Zambia and copper price fluctuations to investigate the impact on the non-export sectors by looking at indicators such as growth rates and general price levels. Findings show that increase in prices of copper have a stimulative effect on the economy, but that it may have caused inflationary pressure.

1.3.2 Local mining communities

The local effects of mining has been studied by Fleming and Measham (2014). By looking at data from Australia they found that mining had a positive impact on accommodation and transport services, while there was no significant effect on manufacturing and agriculture. Further findings in the context of developed economies have been presented by Moritz, Ejdemo, Söderholm & Wårell (2017), in their paper "*The local employment impacts of*

mining: an econometric analysis of job multipliers in northern Sweden". The paper presented findings that the increase in mining jobs in a city in northern Sweden had a positive effect on number of non-mining jobs in the same region. However, the fundamental difference in institutions and governance may prove a cause for concern, as it could be inaccurate to assume these findings are applicable in Zambia. Arguably, more consideration should be taken to the differences in the stages of development the countries are in.

This local perspective on mining effects in the African context was investigated by Tolonen (2015), who used large household and survey data to investigate labour markets, women's empowerment and criminality in the context of large scale mining. When it comes to local labour markets Tolonen presented findings that illustrated how men in the local community shifted work from agriculture to skilled manual labour, while women switch from self-employment in agriculture to either a work in services or leaving the workforce entirely. Furthermore, she discovered that the effects were stronger in times of high commodity prices.

When it comes to finding labour statistics in Zambia, it poses challenges, given that there are no official time series labour market figures, which is discussed by the Zambia Institute of Policy Analysis and Research (ZIPAR). In the report *In the Eye of a Storm - The impact of the economic slowdown on the labour market in Zambia,* their way to obtain reliable data was to perform one business survey and one public opinion poll. This method enabled them to draw conclusions of how workers had experienced work losses and other labour related difficulties and also to see how the business representatives had reasoned in different workforce decisions.

2. Data

2.1 Field study in Zambia

In this study, a combination of a qualitative and quantitative method was used to investigate the relationship between copper prices and employment statistics in Zambia. Data collection was conducted during a field study located in Lusaka, the capital, and Kitwe, the largest city in the Copperbelt province, during the time period from 27 April to 22 May of 2017. The field study included secondary and primary data collection.

Secondary data was collected from online resources and through meetings with stakeholders in the government and in other organisations. The meetings served as both an opportunity to gather existing data, and also to ask semi-structured questions with the meeting participants, which provided valuable insights in the context of the Zambian copper mining industry.

Primary data was collected by performing a survey, where a questionnaire was distributed to a sample of SMEs in the Copperbelt. The suppliers responded to how a number of factors in their business had changed during the copper price fall. When performing the survey used for primary data collection in the Copperbelt, six respondents were selected for structured in-depth interviews, all of who had expressed interest to partake in this when filling out the questionnaire.

2.1.1 Secondary Data Collection

2.1.1.1 Online Resources

Web-based resources included the central bank, Bank of Zambia (BoZ) and the World Bank (WB). BoZ provided monthly copper output and export data for Zambia, while historical copper price figures were retrieved from the WB.

2.1.1.2 In person

Below follows a list of meetings where secondary data was obtained, in no particular order;

- Extractive Industries Transparency Initiative Zambia (ZEITI), Lusaka
- Mines Safety Department (MSD), Kitwe
- Ministry of Mines (MoM), Lusaka
- Central Statistical Office (CSO), Lusaka

Employment time series data for the mines were obtained from the MSD, by visiting their local offices in Kitwe. MoM provided monthly output data on a mine specific level, while BoZ provided aggregated monthly output data.

ZEITI provided us with yearly reconciliation reports from 2010 until 2015, which included comparisons of information provided by government entities and extractive industries, and illustrated relevant details in government policy changes.

Labour Force Survey Reports (LFS) were obtained from the CSO in Lusaka. The LFS have historically been conducted at irregular time intervals and every available report relevant for our time period of interest was obtained. This included reports from 2005, 2008, 2012 and 2014.

Additionally, meetings for additional contextual information were held with the following institutions;

- Mining Union of Zambia (MUZ), Kitwe
- International Monetary Fund (IMF), Lusaka
- Zambian Chamber of Mines (CoM), Lusaka

These meetings provided insights which will be used as a source for context and when discussing our findings.

2.1.2 Primary Data Collection

2.1.2.1 Survey Design

The survey was performed in Kitwe, the largest city in the Copperbelt province. It consisted of a questionnaire and follow-up interviews with some of the respondents.

The respondents were given closed-ended questions on how dependent they are on clients operating in mining, whether they operate internationally, how many employees they have, how employment has changed over the years etc., as well as a data request for time series employment figures. The full questionnaire can be found in appendix A.

The purpose of the questionnaire was to obtain cross-sectional data using closed-ended questions on how employment numbers, size of profits and length of contracts had changed from 2011 until the day of participation. Our initial plan was to ask for the specific time

period between 2011 until 2016, but due to the potential difficulties in exactly recalling how situations have changed over such a specific time period, we chose to keep the questions as easily answerable as possible.

A request for secondary time-series data on number of workers for each SME per month was also included in the end of the questionnaire, in order to allow identical comparison between the sample of SMEs and the data from MSD. However, due to the extra effort required by participants to do so, affirmative response rates were expected to be low. Because of this, the easily answered closed-ended questions were designed to provide the essential information required for analysis, although in less detail.

A final question was included in which the respondents were asked whether they were willing to participate in a follow-up interview, and if yes, to attach their contact details. This was done in order to get a wider understanding of their answers and anecdotal evidence.

In distributing the questionnaire the aim was to maximise the number of observations without compromising the quality of the responses, and in turn the subsequent analysis. Even if email would be the easiest way to obtain responses, we were advised by researchers at the Southern African Institute for Policy and Research (SAIPAR) to not solely rely on web-based methods, since the respondents may have lacking access to digital resources. Because of this, the questionnaire was distributed both physically and electronically.

2.1.2.2 Distribution in person

A number of questionnaires were filled out physically by attendees at a workshop organised by the Association of Small Scale Contractors (ASSC) in Kitwe. At the workshop we briefly introduced ourselves and explained that the topic of our study is the falling copper price and how businesses in the Copperbelt have been affected. This was purposefully disclosed to maximise the number of responses, since it is reasonable to assume that respondents are more likely to answer truthfully if they know the purpose of the study, especially since some of the questions were of a sensitive nature. Whether this approach would result in strategic behaviour among the respondents was also taken into consideration. An example of this could be that the respondents believed the result of our study might help change future governmental policy, which in turn could cause them to answer that they have been more

affected than they actually have. However, since we were also clear on informing that the study was for a university thesis, the problem should be negligible.

During our field study, we also managed to find additional connections with managerial positions at SMEs in Kitwe without going through member organisations. We were able to ask them to participate and fill out the questionnaire directly.

2.1.2.3 Distribution by email

The Association of Mining Suppliers and Contractors (ASMC) provided the opportunity to send our questionnaire in email form to their members. We sent an email containing the link to our online questionnaire in a formal request to the secretary. If approved, it would be distributed to the members by email. In our request, we also expressed our interest to get in touch with the member businesses in other ways, such as by phone or meetings, since the secretariat had earlier expressed challenges with a web-based questionnaire and explained that response rates might be low. However, the members were not contacted in any other way.

2.1.2.4 Questionnaire over the phone

Due to the limited time for physical meetings, difficulties regarding internet access and concerns of low e-mail response rates, questionnaires were also filled out on behalf of respondents over the phone. This enabled conversations with a larger number of businesses and to obtain their answers in a more efficient way that would otherwise have been possible. Due to the differences in physically handing out a questionnaire and holding a conversation, we obtained some additional information from some of the respondents doing the questionnaire over the phone, beyond just marking the alternatives of the questionnaire. This information was recorded and transcribed for additional anecdotal evidence.

In order to get phone numbers to potential businesses, we looked on previous research in the area of SMEs in Zambia. In this way, we found that Mr. Kaleng'a, a researcher at the University of Zambia (UNZA), had done previous work on the copper value chain in Zambia. After contacting him and presenting our study he provided us with a list of 46 businesses, their location and their phone numbers, which had been compiled for the Successful African Firms and Institutional Change (SAFIC) project. Out of the 46 businesses, we managed to get in contact with 34 and successfully complete the questionnaire with 26.

2.1.2.5 In-depth interviews

The six in-depth interviews were performed based on whether the respondent had expressed interest in this when filling out the questionnaire. Enough respondents answered affirmatively to provide a solid base for interviewee selection, representing several different scales of businesses in terms of size, number of employees etc. All interviews were held in Kitwe, in cafes and other casual establishments. The interviews were structured with a formula of open-ended questions, see appendix B, which allowed the interviewee to speak as freely as possible while still maintaining a relevant structure of the discussion.

3. Descriptive analysis

3.1 Secondary data

3.1.1 Employment

The data sheets we received from MSD in Kitwe included monthly numbers for permanent employees and contractors for 18 of the largest mines in the Copperbelt. According to MSD[2], the permanent workers represented workers employed directly by the mines in the daily operations. The contractor-category can be more accurately defined as contract-style employees, who are not on an individual mining company payroll, but work within the same premises. They do not work permanently for the mines but rather perform a specific task during a predetermined period of time.

The data has missing values for some of the companies during certain months. According to the data compiler at the MSD, this was due to the fact that the companies had not reported any labour figures for that particular month. We were advised to average the previous and following months for a reasonable and realistic approximation of the missing months. Even if this is cause for inaccuracy, it is necessary that we derive aggregated monthly labour data for our subsequent presentation of diagrams.

[2] Meeting with Mines Safety Department, 13 April 2017, Kitwe

The equation is illustrated below, where *L* represents the number of either permanent workers or contractors at time *t* for firm *i*.

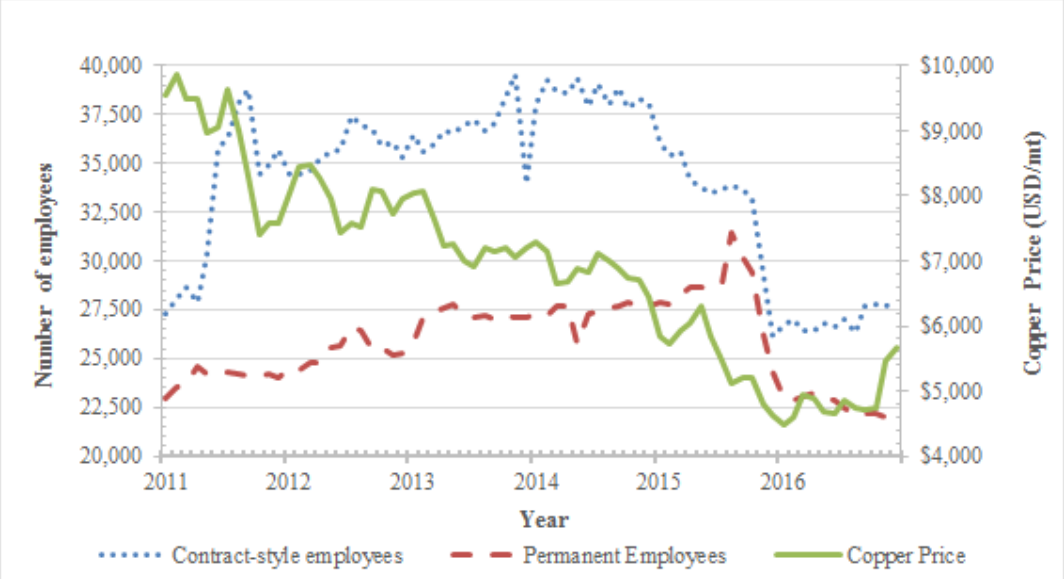
$$L_{i,t} = \frac{\left(L_{i,t-1} \times L_{i,t+1}\right)}{2}$$

Secondly, we aggregate the number of both permanent workers and contractors for each month from January 2011 until December 2016, as illustrated by the equation below, where *AL* represents the aggregated number of workers, either permanent or contractors, at time *t*.

$$AL_t = L_{i,t} + L_{i+1,t} + L_{i+2,t} + \ldots + L_{i+17,t}$$

The numbers are presented in the diagram below along with the copper price.

Diagram 1. Copper price and aggregated employment in large mines



Source: WB and MSD

The diagram illustrates that there is a clear upward trend in aggregated number of contractors from 2011, rising from 27,000 to around 35,000 at the end of the year. This level is maintained with a slight increase up to 38,000 until 2015. From the beginning of 2015 the trend shifts negatively and the number is continuously falling. At the end of the year there is a

sharp drop down to 26,000, which is slightly lower than in the beginning of the measured period. During the rest of 2016, the number is increasing slightly. The sharp drop in 2015 occurs simultaneously as the copper price decreased from $6,000 per mt down to $4,500 per mt.

When it comes to the aggregated number of permanent employees, the initial number of workers is around 23,000. The number is also increasing from 2011 and onwards, though at a slower rate than the number of contractors. It reaches a maximum in the second half of 2015, with a last rapid increase up to 31,000. After that the number falls sharply down to 23,000 in the beginning of 2016, which represents a drop in employment of almost 26%. Unlike the number of contractors, the number of permanent employees continues to decrease for the rest of 2016. However, the sharp drop in permanent employees for the second half of 2016 also corresponds to the drop in the copper prices from $6,000 to $4,500 per mt.

In our meeting with CoM, we were informed that the cost of producing one mt of copper in Zambia is around $4,000 to $5,000. This could explain the sharp drop that occurs in the number of workers in 2015, as the price then drops below $5,000 per mt.

Furthermore, when it comes to retrenchments, we were informed by MUZ[3] that most of the permanent workers in the larger mines are part of a union. Contractors on the other hand enjoyed less predictability of their future employment situation and reduced influence in negotiations. MUZ, like CoM, also explained that $4,000-5,000 was the price range when mines start to retrench workers, since copper mining is no longer cost effective. The process starts when mines inform the government about their intentions to lay off workers 60 days in advance, which is followed by negotiations on severance pay or to find other ways of cutting costs, such as ceasing wage increases or even cutting wages.

When comparing the permanent workers and the contractors, it is clear that the absolute aggregated number of contractors is always higher than the aggregated number of permanent workers. Even if this might be different between different individual mines, the overall picture seems to be that the majority of the workers in the large mines work as contractors rather than being permanently employed. When including the copper price in the comparison,

[3] Meeting with Mining Union of Zambia, 27 April 2017, Kitwe

there is an increasing trend for both permanent workers and contractors, but the contractors increase at a faster rate in the beginning of the time period. At the same time, they also seem to be the first to lose their jobs in the beginning of 2015, when the copper price starts moving below $6,000 per mt.

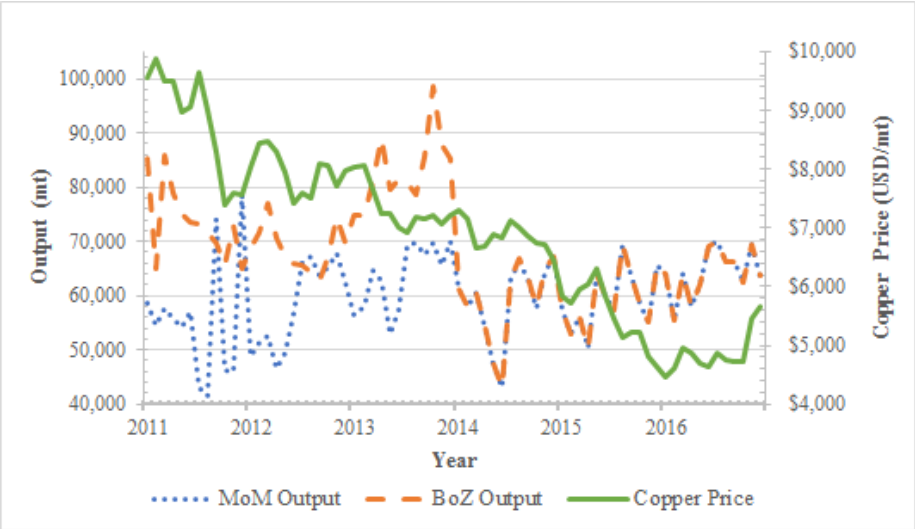
In terms of casualisation, it is difficult to say something clear about workers moving from permanent employment on to temporary contracts. Given the sharp decrease in the second half of 2015, it is clear that a lot of permanent employees will enter unemployment. Whether they will be rehired as contractors or permanent employees again during a more favourable economic situation is not something this particular data set can reveal.

3.1.2 Production and export

If copper price has a significant effect on output, then it is likely that the effects on employment follow, given reduced activity in the mines. If we see contradicting trends in output and employment, then other explanations should be taken into consideration. This could be productivity changes in the form of technological advancement or retrenchment of redundant labour.

We received data on monthly copper output from both BoZ and MoM. However, they were showing different numbers from the beginning of 2011 until late 2014, when they started showing identical numbers for the rest of the period. According to ZEITI, there has not been a standardized way of measuring national copper output, but different institutions have been measuring it independently and in their own way, which would explain the difference. Since we have been unable to deduce which of the organizations that has the most accurate measurement, both were included in diagram 2, which also features the copper price.

Diagram 2. Monthly Copper Output and Price

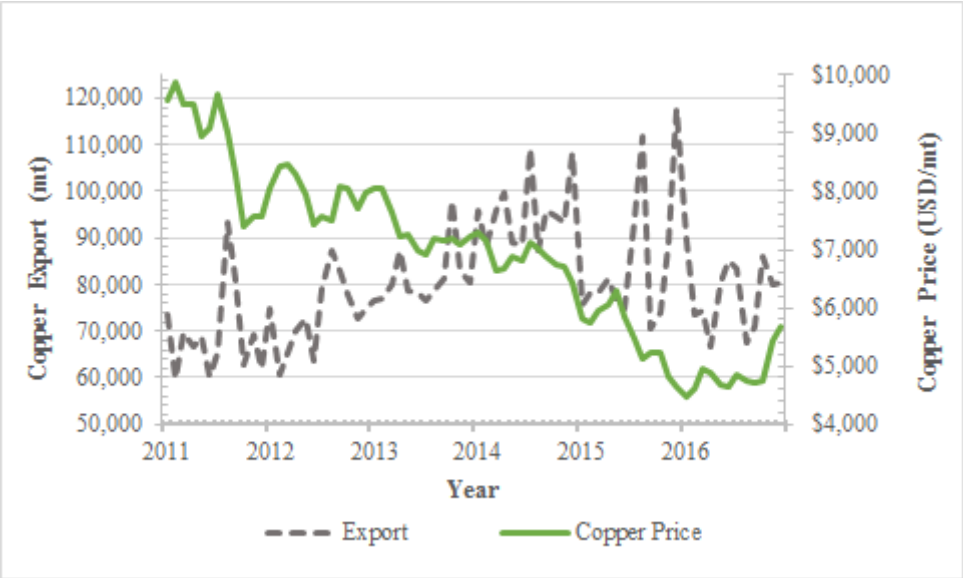


Source: MoM, BoZ and WB

From the diagram it is clear that the output of copper has been volatile in the data both from MoM and BoZ, up until 2014. At that time there is a sharp decrease in the BoZ numbers, from 100,000 mt to around 40,000 mt per month. The data from MoM shows a somewhat smaller decrease in absolute numbers, from 70,000 mt down to 40,000 mt. After that both data sets show that the output moves within a span of 40,000 mt to 70,000 mt per month. Thereby the data from BoZ shows an initially higher level of copper output and a larger fall in 2014, whereas the data from MoM is at a lower level initially, and shows a rather uniform level of output during the same time period.

When it comes to the exports, consideration has to be taken to that the copper being exported is both in the form of raw and purified copper. In our meeting with IMF, we were told that some of the purified copper is made by raw copper imported from the Democratic Republic of Congo (DRC). This could be one of the explanations to why the export figures sometimes are noticeably different from the output figures.

Diagram 3.Monthly Copper Export and Price



Source: BoZ and WB

Initially in 2011, the exports were around 70,000 mt per month, with some minor monthly volatility. From 2012 until 2015, the exports are steadily increasing to a level of 100,000 mt per month. In 2015 however, the exports becomes increasingly volatile throughout the year. This continues for the remaining year and up until 2016, at which the exports have decreased to around 80,000 mt. The intuition behind increasing exports when the price is falling could be that in order to withhold the same level of revenue from copper exports, Zambia must export increasing quantities to its trading partners.

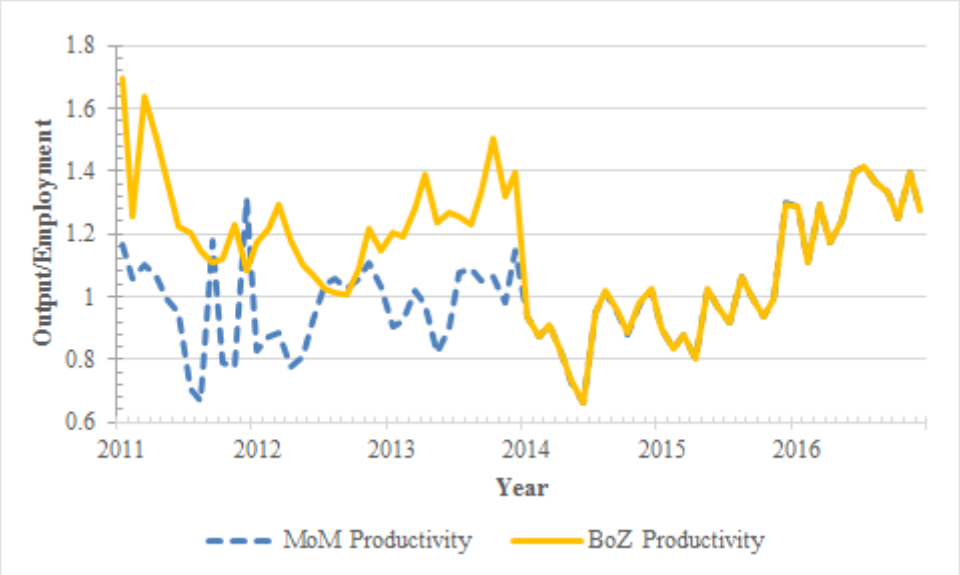
3.1.3 Productivity in Mining businesses

In our meeting with CoM, we were informed about a problem with overemployment in the Zambian mines, which dates back to the time they were state-owned. Having a large number of employees initially made the new private owners forced to lay back on staff, simply due to the low productivity of the labour force. Since previous literature (Sikamo, Mwanza, & Mweemba, 2016) also has stated that the mines suffered low productivity under government, we construct a simple productivity measure which is illustrated below:

$$P_t = \frac{Q_t}{AL_t}$$

P represents productivity at time *t*, which consists of the copper output *Q* at time *t* divided by the total number of employees *AL* at time *t*, meaning both permanent workers and contractors. This illustrates how many mt of copper that is produced monthly per worker in the mines. One measure was constructed from the data obtained by BoZ and one from the data from MoM. The results are illustrated in the diagram below.

Diagram 4. Productivity



Source: MSD, BoZ and MoM

Looking at the data from BoZ it is clearly illustrated that productivity was higher initially, with 1.6 mt/worker, and then have a downward trend until 2014, with a temporary upswing at the end of 2013. This time period would thereby illustrate decreasing productivity. However, from mid-2014 and onwards, there is a stable rise in output per worker from the bottom at around 0.7 and up to 1.3 mt. Thereby productivity has increased steadily since 2014, according to our way of measuring. However, the measurement indicates that there has not been a substantial increase in productivity over the time period, which might indicate that the retrenchments that has occurred over the time cannot be solely motivated by initial overemployment and low productivity in the mines.

A clear disadvantage of our productivity measure is that it does not include the aspect of working hours of the employees. Labour productivity is defined as "real gross domestic product (GDP) per hour worked" (OECD, n.d.). Since our measure does not include the potential changes in working hours, an increase in the number of working hours of each

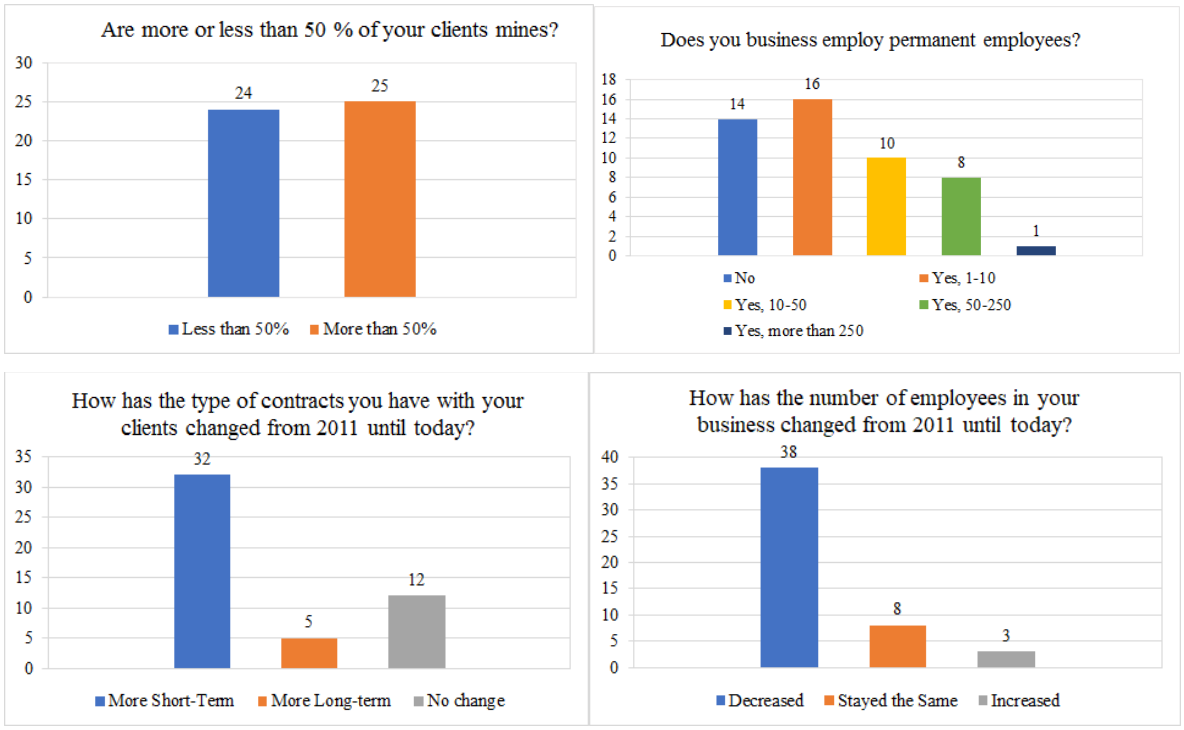
employee could potentially be misinterpreted as an increase in labour productivity, when it is actually just an effect of longer working hours. Thus collecting information on number of working hours of employees could be a good approach to further investigations on productivity in the mines.

3.2 Survey results

3.2.1 Characteristics of respondents

The total number of SMEs answering our questionnaire was 53. 23 answered in paper form, 26 answered over the phone, one answered the online questionnaire distributed through email and three respondents were the businesses we were able to meet without going through a member organization. The email response rate was lower than expected. Four responses were dropped due to incomplete questionnaires or because of our failure to interpret an answer. Below follow bar charts displaying the most relevant answers from the questionnaire;

Diagram 5. Survey Response Summary



We see an almost equal share between SMEs with more than 50% mining clients and SMEs with less than 50% mining clients. A clear majority employ less than 50 permanent employees. Most of the respondents have experienced a worsening situation for their business, as only three respondents state that their profits have increased or that they have been able to increase their number of employees.

One of the companies stated that they had more than 250 employees, which technically is not an SME according to the EU commission. However, as it accounts for one observation and acts in the local setting as a similar type of company as the other investigated firms, we still include it as an observation.

3.3 In-depth interviews

The in-depth interviews were performed with 6 respondents representing SMEs to allow them to provide further information in the changes for contractors to the mining industry.

- Respondent 1 stated that corruption in the country was the major reason for declining revenues for the contractors, since the opportunities to find work was complicated due to bribing in the process of tendering for contracts. Respondent 1 also expressed that corruption had devastating effects in terms of wealth distribution generated by the copper exports, due to political short-term perspective and uncertainty among investors. When it comes to small companies, they have been hit severely from low copper prices, since large mines withhold payments.

- Respondent 2 is primarily in the events management business, but have moved into the construction and supply business, while also providing computer service and

repair. The respondent wanted to emphasize the problem of corruption in the process of acquiring contracts, which harms competition and makes it very hard for small contractors to get contracts when they cannot bear the bribing costs in the same way as the larger contractors. The respondent states that the effects of the recovering copper price has not yet been felt by contractors, saying that "the light and the end of the tunnel is very small and vague". Further, he explains that "when the price goes down, all contractors lose their jobs, but when it goes up, not everyone gets it back". This, coupled with increasing taxes and corruption makes it very hard for a contractor in the Copperbelt.

- Respondent 3 was in the construction business, running a semi-prominent steel company. He explained that business with the mines had been good a couple of years ago, but lately they had been reducing their affiliation with the mines more and more, up until today when they did not do business with the mines at all. They found it easier to get contracts from the government, since the mines were much more selective and cost-oriented in their process of selecting contractors for their jobs. He also mentioned the hardships due to the increasing competition from the Chinese, since they perform the jobs "very cheaply, but at inferior quality". Respondent 3 also brought up an interesting aspect of the depreciating Zambian currency, the kwacha (ZMK). Since his business did jobs spanning over multiple years, they had problems with this. "When we signed this contract, the kwacha stood at 5.6 to a dollar. Now it is at 10, so everything that has to be imported has become increasingly expensive, since some of it is in dollars." This means that the contractors are still paid the amount of ZMK they signed for at the beginning of the contract, but their costs are increasing.

- Respondent 4 was the director of a small company which was involved in many different types of businesses, ranging from collaborations with international clothing brands to running a butchery and supplying to the mines. She expressed that diversification has become increasingly important as those who did not venture into new business would be more affected when copper prices decreased. She further stated that administration costs following new government regulations that had begun to target small companies, for example in terms of documentation and pension schemes. She also expressed the difficulty with importing goods to sell in Zambia

when the currency had lost so much of its value, which further had forced her to cut costs where possible.

- Respondent 5 was in the manufacturing business, machining anything as long as the clients provide the drawing. He spoke at length about how it's harmful that the mines are not willing to commit long term to a supplier, since it hinders their ability to invest and prepare for larger projects and larger volumes. Further, he explained that "the biggest problem with the mines is bribery and corruption", since it always results in the wrong contractor getting the job. He also said that even if 60% of his business is with the mines, 100% of all business on the Copperbelt is indirectly with the mines, since "everything starts with them". The business had tried its hardest to not retrench any workers, but had been forced to lay off about a dozen employees last December. They do not employ temporary workers, since they need to train all their labourers for at least 6 months before they can do the job properly. This means that they lose a significant investment if they have to let someone go. The exchange rate was not a problem, since the business use both a dollar and a ZMK account with buffers to hedge against fluctuations. They also keep large stocks of input goods, which makes them flexible and able to satisfy the mines requirements faster than many others.

- Respondent 6 was director at a factory which produced high-quality plastic products. He stated that the company used to do more business with the mines, but that it had been decreasing over the years. The competition in the bidding process had increased and the larger mines had become a lot pickier when it came to which contractors they hired. Sometimes the mines would also hold back on payments for longer periods of time, which made daily operations increasingly difficult. Further difficulties exist with finding qualified labour and coping with government policy, since it does not instil confidence. This in turn has to do with the exchange rate fluctuations, since it is affected a lot by government policy. In order to deal with fluctuations, the company has both a USD account and a ZMK account, and manages to predict rises and falls reasonably well. He further described the difficulties with the bureaucratic process when hiring and retrenching workers, which could lead to conflicts and payments required to different entities. Lastly he described an increase in the foreign competition among the suppliers, as firms from South Africa and China are becoming more present in the Zambian market.

In summary, many of the interviewees emphasized the problem with corruption and bribes in the process of tendering for contracts, leading to increased competition and costs. They also expressed that business with the mines had decreased, and that competition was increasing in the bidding process causing the mines to become pickier. Furthermore there seems to be a risk of not getting paid on time when doing business with the mines during times of low copper prices, at which time the number of contracts also decreases. There is also a perception that when the price increases and business improves for the larger mines, the suppliers does not enjoy the same upswing. There also seems to be discontent concerning the government being short-sighted and business unfriendly when imposing taxes and new regulations. When it comes to the exchange rate, some of the interviewees held both a ZMK and a USD account to protect themselves against currency fluctuations, while others found it difficult to write contracts or import goods from other countries when the exchange rate fluctuated.

3.4 Limitations

3.4.1 Secondary data

The employment data was self-reported figures reported to the MSD by the mines themselves, categorised by 'Permanent'- or 'Contract' style employment for each individual mining business. These were the only attainable labour figures for the time period of interest. However, the fact that these figures are self-reported and not externally verified raises concerns about the validity of the figures. The concern is further justified by the fact that it is common for labourers to be employed informally in Zambia, as previously mentioned. This might lead us to incorrectly calculating the true causal effect the copper price has on labour. Regarding the relationship between copper price and informal labour, it is reasonable to assume that it should be in the same direction as the relationship between price and formal labour. It also follows intuitively that the effect might be stronger among informal workers, given the difference in written and structured terms of employment between the two groups. Thereby we might estimate a slightly lower effect than the true causal effect.

The employment data contained a number of missing values, spread out over all years, seemingly at random occurrence. According to the data compiler at the MSD who gave us the figures, this was simply due to the fact that the mines had not reported any figures for that

particular month and not that the number of employees dropped to zero. As previously mentioned, for our descriptive analysis we filled in missing values by averaging over previous and following months.

3.4.2 Survey

When choosing the sample for our survey, we could not ensure randomisation nor find out to what extent the sample could be susceptible to selection bias. Our aim was to select businesses which we had no reason to believe were differently affected than the population of SMEs as a whole. In order to achieve this, we requested the respondents to provide information on the main areas of operations and geographical location of their business. By getting mixed results, we are able to say that the sample is spread in several different sectors and cities.

When it comes to the businesses at the workshop event specifically, one could argue that they might be more inclined to participate in member organised activities if they have suffered recent hardships. However, given that the workshop subject was the importance of pension plans, which is arguably not connected to the copper price in any way, we have no reason to believe those businesses should be selected in a way that would cause bias in our model. All the companies at the seminar were small-scale, some with only a few employees. Thereby it might be that we are missing out on medium-sized enterprises in this subset of companies.

Regarding the respondents who participated over the phone, they may be more likely to respond if they have certain characteristics, for example if they have experienced a deteriorating business situation and feel a stronger need to voice their concerns. However, it might also be the case that those who have experienced such a situation are less inclined to talk about it. What is known for certain is that these companies were all in different areas, both geographically and business-wise.

4. Econometric analysis

4.1 Employment data

4.1.1 OLS model

The descriptive analysis shows the overall trend in the variables we are interested in, but in order to find the causal effect of declining copper prices on number of employees in the large mines, we use econometric methods.

First, the data is structured in a way so that the number of workers in each category amongst all the 18 firm was aggregated for each month *t*, as illustrated below:

$$\sum_{i=1}^{18} Contractors_{i,t} = Contractors_t$$

$$\sum_{i=1}^{18} Permanent_{i,t} = Permanent_t$$

$$\sum_{i=1}^{18} Total_{i,t} = Total_t$$

The aggregated numbers are then used in the OLS model shown below:

$$Contractors_t = \beta_0 + \beta_1 C_t + u_t, \qquad t = 1, 2, \dots, 72$$

$$Permanent_t = \beta_0 + \beta_1 C_t + u_t, \qquad t = 1, 2, \dots, 72$$

$$Total_t = \beta_0 + \beta_1 C_t + u_t, \qquad t = 1, 2, \dots, 72$$

The three dependent variables represents the number of different types of workers at month *t* and *C* represents the price of copper at month *t*. The values of both the independent and dependent variables are logged, since interest primarily lies in percentage changes rather than absolute changes when it comes to both price of copper and number of employees.

Regarding correlation between the copper price and the error term, we assume the copper price to be exogenous, since it is completely determined on the global market, as mentioned in section 1.2.

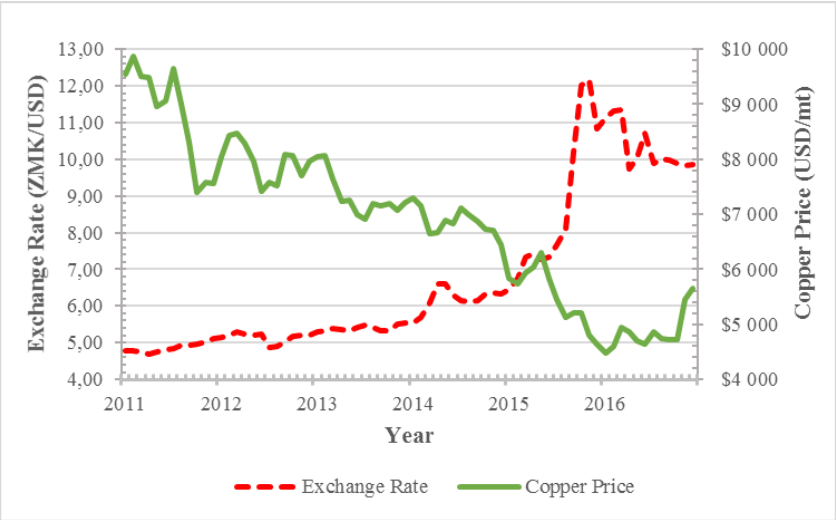
Using three different outcome variables enable estimation of the effect on permanent workers and contractors both separately and jointly. This is done in order to find if there is a difference in the effect on workers that enjoy permanent contracts and those with less extensive contracts, as well as to say something in general about the total mining labour force.

When it comes to control variables, one aspect that could be interesting is exchange rate of the ZMK. Being a small and export dependent economy, the country is affected significantly by changes in the exchange rate. Since 2010 the ZMK has depreciated steadily, with a sharp drop in 2015, when the USD became twice as expensive in terms of ZMK over just a few months. This affects all exports and imports, and thereby the mining industry and Zambia as a whole.

The exchange rate was also discussed in the previously mentioned report by ZIPAR, *"In the Eye of a Storm: The impact of the economic slowdown on the labour market in Zambia".* Since the report showed that ZMK depreciation was the most frequently identified cause of the economic slowdown, we included a similar question in our survey in order to identify the attitude of our respondents. Several told us that depreciation had the largest effect on their business from the time period between 2011 until the day of the questionnaire.

The exchange rate was convenient as it was possible to average the values over an entire month expressed in ZMK/USD. To illustrate the relationship between the copper price and the exchange rate, they are both plotted in the following diagram.

Diagram 5. Copper Price and Exchange rate



In the diagram the exchange rate is adjusted for the currency rebasing that was done on a national level in the beginning of 2013. All the values of the exchange rate from before the year end of 2012 has been divided by 1,000, as was advised during our meeting at the IMF. The numbers obtained show that the ZMK has been depreciating from 2011 until 2016, with a rapid depreciation in 2015.

However, the exchange rate has a very high negative correlation with the price of copper of -0.94, meaning that a decrease in 1% of the copper price would have a corresponding increase in 0.94 in the ZMK/USD. This was further described in the same meeting with the IMF, that there is a clear link between the exchange rate and the copper price, as a high price increases business and in turn demand for ZMK to pay local employees, suppliers and taxes. Thereby in times with a high price, the limited amount of ZMK and the high demand causes the exchange rate to appreciate. Meanwhile, when times are the opposite and there are less local costs, the ZMK loses value. This has spillover effects, since Zambia is very import-dependent, especially from South Africa and its neighbouring countries. It increases prices for both consumer goods and input goods that are required to conduct business in Zambia, such as machinery.

Thereby, since the exchange rate is so highly correlated with the copper price it might lead to multicollinearity, which causes difficulties in estimating the partial effect of each variable (Wooldridge, 2015). However, since it is highly correlated but not perfectly correlated and the data on the ZMK/USD exchange rate is also time-variant and easily obtainable, it might

still be interesting to see if the exchange rate can explain some of the changes in number of employees. Thereby, we run two regressions, the first one with only the copper price and a second one when the ZMK/USD exchange rate is included as a control variable. The results are illustrated below:

Table 1. Results from OLS regressions, using logged variables.

VARIABLES	(1) Permanent	(2) Contractors	(3) Total	(4) Permanent	(5) Contractors	(6) Total
Price of Copper	0.0867**	0.501***	0.319***	-0.147	-0.176	-0.160
	(0.0391)	(0.0630)	(0.0492)	(0.117)	(0.160)	(0.134)
ZMK/USD				-0.185*	-0.535***	-0.378***
				(0.102)	(0.118)	(0.107)
Constant	9.452***	6.086***	8.251***	11.86***	13.05***	13.17***
	(0.349)	(0.552)	(0.434)	(1.215)	(1.620)	(1.366)
Observations	72	72	72	72	72	72
R-squared	0.096	0.604	0.505	0.184	0.745	0.651

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We see a significant effect of copper prices on employment across all the subgroups when we do not include the exchange rate. We see the smallest effect among permanent workers, where a 1% decrease in the copper price corresponds to a decrease of 0.087% in employment, significant at a 5% level. The largest effect is seen among contractors, where a 1% decrease in the price of copper corresponds to a 0.5% decrease in the number of labourers in the mines, significant at a 1% level. Total employment decreased by 0.32% when the copper price falls by 1%, also significant at a 1% level.

When including the ZMK/USD exchange rate, significance of the copper price variable is lost across all regressions. We see similar coefficients on exchange rate, although negative. This could be explained with regard to our previous discussion about multicollinearity and partial effects between the exchange rate and the copper price, since they were negatively and highly correlated.

4.1.2 Fixed effect model

In our previous OLS-model, time-constant differences between companies are not taken into account and might bias the results. For example, each firm may have individual traits and characteristics, such as differences in quality and style of management, which should arguably be taken into account. When it comes to management of a mining company, the CEO and the overall board of governors are likely the same over a time period of 5 years. Even if new strategies would be implemented or senior positions would change, it is unlikely that there would be a fundamental shift in the quality of management over such a short time period.

Thereby we might assume that managerial style could be an example of a time-invariant variable across firms. In order to remove the time constant heterogeneity, a fixed effects model was used, which controls for such differences and thereby represents a more accurate estimator of the true causal effect (Wooldridge, 2015). The fixed effect regression takes firm-specific factors into account and sorts them out, so that the copper price effect is observed and not employment differences stemming from time invariant variables.

In this case, we create a new variable SC, which represents the share of contractors by the total number of workers in each mine and month. Using this variable in an interaction term with the copper price illustrates if a higher share of permanent workers are less or more affected than companies with a lower share of permanent workers due to changes in the said price.

$$SC_{i,t} = \frac{Contractors_{i,t}}{Total_{i,t}}$$

The derivation of the fixed-effects model is illustrated below:

$$T_{i,t} = \beta_0 + \beta_1 C_t + \beta_2 SC_{i,t} + \beta_3 (SC_{i,t} * C_t) + a_i + u_{i,t}$$

$$T_{i,t} - \overline{T}_i = \beta_1 (C_t - \overline{C}_i) + \beta_2 (SC_{i,t} - \overline{SC}_i) + \beta_3 ((SC_{i,t} * C_t) - \overline{(SC_{i,t} * C_t)}) + a_i - \overline{a} + u_{i,t} - \ddot{u}_i$$

$$\ddot{T}_{i,t} = \beta_0 + \beta_1 \ddot{C}_t + \beta_2 \ddot{SC}_{i,t} + \beta_3 (\ddot{SC}_{i,t} * C_t) + U_{i,t}$$

$T_{i,t}$ stands for the logged total number of workers at firm *t* in month *i*. In this regression, we use the new variable SC to investigate the effect from having a larger share of contractors instead of performing three different regressions.

The model includes time-invariant variables denoted by a_i. By subtracting the mean value of all observations on all of the cross-sectional units, the time-demeaned employment data is obtained for only the total number of employees, illustrated by $\ddot{T}_{i,t}$. Since a_i is assumed to be constant over time, $\bar{a} = a_i$, the time invariant heterogeneity will be removed from the equation.

The interaction term illustrate the additional effect of the copper price on firms depending on their share of contractors. The 5-year average values of each firm's share of contractors are displayed in the table below.

Table 2. The average share of contractors over time among all firms

Firm	Average over time
1	0.54
2	0.53
3	0.67
4	0.49
5	0.64
6	0.49
7	0.57
8	0.64
9	0.78
10	0.59
11	0.47
12	0.62
13	0.37
14	0.89
15	0.52
16	0.40
17	0.24
18	0.25
Average	0.54

From the table we find the lowest average share of contractors across time is 24%, and the largest share is 89%. Most of the firms have average shares over time between 40 and 70%,

and the average across all firms lies at 54%. This is relevant in the interpretation of the results from the fixed effects regression below:

Table 3. Results from the fixed effect regressions

VARIABLES	Total Employment	Total Employment
Price of Copper	-0.110 (1.185)	-0.137 (1.341)
SC	-3.285 (17.47)	-3.305 (17.53)
Price of Copper*SC	0.643 (2.005)	0.645 (2.010)
Exchange Rate		-0.0210 (0.306)
Constant	7.118 (10.33)	7.402 (12.08)
Observations	1,296	1,296
R-squared	0.199	0.199
Number of firms	18	18

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

From looking at the copper price coefficient and the interaction term, we see a positive relationship between the copper price and employment, and it seems to be stronger in firms with a larger share of contractors. The coefficient on copper price is negative, but the coefficient on the interaction term compensates for this, especially when we take into account that the firm with the lowest share of contractors averaged 0.24 over the time period, at which the effect of a decrease in price would be positive. A higher share of contractors would lead to an even larger effect.

Including the exchange rate in this analysis changed very little, and the variable is statistically insignificant. The negative coefficient on share of contractors is not relevant and is also statistically insignificant. Even if the interaction term illustrates that the effect from a price fall is stronger when a firm has a larger share of contractors, we do not see any statistically significant variables in these regressions, and we cannot draw any reliable conclusions from them.

4.2 Survey Data

With the survey data, we move on to the analysis of local labour effects on suppliers and contractors. The original intention was to compare the contractors and the larger mines with a comparable set of data on monthly number of employees. However, this was not successful since this type of data was not available. For that reason we use the responses to the closed-ended questions to find how contractors dealing with mining clients have been affected by falling copper prices in comparison with contractors dealing with other types of clients.

Intuitively, the company that states that most of their clients come from mining would have been affected more than those who states they deal mostly with other types of clients, since they are at greater risk due to lack of diversification. It is also interesting to consider whether enterprises who employ a larger number of permanent employees are more or less likely to have reduced their number of employees. Thereby, the aim is to find if businesses that differ, in terms of who their clients are and how many permanent employees they have, have been affected differently by the copper price fall. The result might provide insights into the extent of the benefits of diversification, and also into the subject of casualisation.

In order to do this, a probit regression model is used. The model allows us to find the likeliness of firms to have reduced employment, profits or if they have experienced a change in their contracts, partly dependent on whether the respondent reports a larger share of mining or international clients.

Three regressions were performed. The first one looked at decreasing profits, the second one looked at decreasing employees and the third one looked at shorter contracts with clients. The explanatory variables are the same in all the regressions. The models are illustrated below:

$$P(Profits = 1|X) = \phi\begin{pmatrix}\beta_0 + \beta_1 MiningRev + \beta_2 PermEmployees + \beta_3 Specialized + \\ \beta_4 MultLocations + \beta_5 LargeCity + \beta_6 IntCompany\end{pmatrix}$$

(Profits = 1 if the firm experienced decreased profits from 2011 until 2016)

$$P(Employees = 1|X) = \phi\begin{pmatrix}\beta_0 + \beta_1 MiningRev + \beta_2 PermEmployees + \beta_3 Specialized + \\ \beta_4 MultLocations + \beta_5 LargeCity + \beta_6 IntCompany\end{pmatrix}$$

(Employees = 1 if the firm has reduced their number of employees over the time period of 2011 to 2016)

$$P(Contracts = 1|X) = \phi\begin{pmatrix}\beta_0 + \beta_1 MiningRev + \beta_2 PermEmployees + \beta_3 Specialized + \\ \beta_4 MultLocations + \beta_5 LargeCity + \beta_6 IntCompany\end{pmatrix}$$

(Contracts = 1 if the firm has experienced a change towards more short-term contracts over the time period of 2011 to 2016.)

For all 3 models, the following applies:

- *MiningRev* is a dummy taking the value of 1 if the firm reports that more than 50% of their total revenue comes directly from mining companies.
- *PermEmployees* is a dummy taking the value of 1 if the firm employs more than 50 permanent employees.
- *Specialized* is a dummy taking the value of 1 if the firm specified one single operational area for their business.
- *MultLocations* is a dummy taking the value of 1 if the firm specified more than one geographical business location.
- *LargeCity* is a dummy taking the value of 1 if the firm is located in either Kitwe or Ndola.
- *IntCompany* is a dummy taking the value of 1 if the firm stated they are part of a company group operating internationally.

The most interesting variables to us is *MiningRev* and *PermEmployees*. By seeing if the companies with a larger share of mining company clients are more likely to have lost employees and profits than the others, it shows evidence that diversification is a good way for SMEs to avoid the downside of dealing with mining customers that are heavily dependent on copper prices. When looking at *PermEmployees* we can also say something about the likeliness to reduce number of workers if the company has a large number of permanent employees, which can be connected to the potential differences with permanent and contractor styled employees during a fall in copper prices.

Table 3. Probit Regression on Survey Data

VARIABLES	(1) Profits	(2) Employees	(3) Contracts
Mining Rev Share	0.213**	0.028	0.072
	(0.099)	(0.124)	(0.141)
Perm Employees	-0.162	-0.166	0.079
	(0.223)	(0.167)	(0.170)
Specialized	0.105	-0.161	0.095
	(0.110)	(0.118)	(0.142)
Mult.Locations	0.068	0.068	0.008
	(0.113)	(0.139)	(0.167)
Large City	0.092	-0.089	-0.238
	(0.178)	(0.139)	(0.148)
Int. Company	omitted	0.295	-0.106
		(0.486)	(0.208)
Observations	39	49	49

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The only significant coefficient in the probit regressions is *Mining Rev Share* in the Profits regression. This takes the value of 0.213, meaning that businesses with more than 50% of clients in the mining sector are 21.3% more likely to have experienced reduced profits during 2011-2016, than firms with less than 50% of clients in mining.

Other interesting, though statistically insignificant results, include the approximate -0.16 coefficients on *Perm Employees* in both the Profits and Employees regressions. If statistically significant, this would have indicated that firms employing a larger number of permanent employees are less likely to have reduced their number of employees or experienced reduced profits.

When it comes to the other explanatory variables, the coefficients are rather small and insignificant. Thereby the findings that may be presented from these estimates are limited. Some of the variables had low p-values, and it could be possible that they would be significant if more observations would have been collected. However, this is not something we can draw any reliable conclusions from in our study, and should rather present an opportunity for continued investigation.

5. Conclusion and discussion

The aim of this thesis is to investigate the impact of falling copper prices on local employment in the Copperbelt province of Zambia. This was done by looking at two different areas, the first being changes in the number of different types of workers in the large Zambian mines and the second being how different local suppliers and contractors had been affected depending on different characteristics.

From secondary data, we can see that the aggregated number of workers in the larger mines was increasing from 2011 until around 2015, but then decreased sharply. Since this was when the copper price dropped below $5,000/mt, and sources informed us that it cost around $4,000-$5,000 to produce a mt of copper, it is likely that at this particular price level, employment is affected drastically at once rather than over a longer period of time.

From the productivity measure constructed based on the output and number of employees, we could see that the output per worker increased from 2014 and onwards, which might indicate increased productivity. However, it could be argued that the level of productivity has not changed over the period to an extent which would motivate retrenchments as an effect of initial overemployment. Since our productivity measure does not include working hours, more research could be done on this area to draw more accurate conclusions.

In our econometric analysis of the MSD employment data, we find some indications that a falling copper price decreases employment, and that the effect is stronger on contractors than for the permanently employed. However, when investigating a relationship between copper price and share of contractors in a fixed effect model, the significance of the findings is lost, thereby we are unable to draw any conclusions. Including exchange rate as a control variable in the models does not give any additional or significant results for the effect of the copper price either.

Control variables are lacking in both regressions, and further research on the subject might strive for a more detailed analysis with a larger number of quantifiable and relevant variables. Other ways to improve the model could be to consider that the effect of copper prices is not immediate, but that the mines retrenchment-decisions took time, as discussed by MUZ. One way to account for this time delay would be to incorporate some sort of lagged variable in the regressions, which we did not include.

The findings are applicable when discussing the theories of Lungu and Fraser in terms of a prolonged historical process of casualization, since the aggregated number of contractors was larger than the aggregated number of permanent workers in all of the large mines during 2011 until 2016. The estimators obtained in the regressions also show some indications that the falling copper price has a larger effect in terms of contractors losing their jobs than on permanent workers. This could illustrate that workers on temporary contracts not only enjoy less job security and benefits, but also that they are in practice retrenched and possibly rehired at a faster rate than permanent employees.

The survey results showed that the vast majority of the responding SMEs had experienced decreasing profits, decreasing employees and shorter contracts with clients, no matter if they had the majority of minority of their business with mines. By using a probit regression method, we found that the likeliness to have reduced profits was higher among respondents who stated the majority of their business were with mines, which goes back to our research question and shows that businesses with a more diversified customer base are slightly less likely to have reduced profits.

We see an indication, albeit statistically insignificant, towards that businesses which employ a larger number of permanent employees are less likely to have been forced to reduce their

number of employees, and also to have experienced reducing profits. This could be the case simply because they are larger, and as such less vulnerable to shocks. It could also illustrate that the firms with permanent employees are less likely to reduce number of workers, which can be associated with the long term effects of historic casualisation as discussed about the larger mines, and that the contract-style employees enjoy less job stability in times of price volatility. However, since the response rate was limited to 53, there is clear potential for continued research in this area. Some suggestions would be to perform questionnaires over the phone and consider the limitations in using online questionnaires.

When it comes to comparing the large mines and the local SMEs, we can state that the aggregated number of permanent and contract-style employees in the large mines both categories have reduced the number of workers. We cannot compare the magnitude of the decline, since that type of data was not collected, and since no significant results on employment among SMEs was obtained, further justified comparisons are limited.

Summarily, in this thesis we provide a rather new perspective in the distinction between permanent and contract-style employees in our analysis of employment in the larger mines. We also hope our discussion of the local SMEs and the new dataset we present might be of interest for local stakeholders and also provide a point of perspective for future research which may contribute to sustainable development for the Zambian Copperbelt.

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7. Appendix

Appendix A. Questionnaire

We are two students from the University of Gothenburg in Sweden and the answers in this survey will be used in our bachelor's thesis.

All respondents will be anonymous in our thesis and answers will be kept confidential.

When our work is finished in August of 2017, our findings will be shared with the respondents who express interest.

This questionnaire is part of a study on how the copper price is affecting local business in the Copperbelt region.

In February of 2011, the international price of copper reached a top of 9,868 USD per metric tonne and in December of 2016, it had fallen to 5,660 USD per metric tonne, a decrease of 43%.

Please answer the questions below with a short answer or by marking the alternative of your choice.

1. Is your business part of a company group that operates in other countries than Zambia?
    a. Yes No

2. If no, in which Zambian city/cities is your business operating?
    a. _____

3. In short, what does your business do?
    a. _____

4. Does your business have permanent employees?

a. No No, but temporary when necessary Yes, between 1 and 10 Yes, between 10 and 50 Yes, between 50 and 250 Yes, more than 250

5. How much of your revenue comes directly from mining company clients?
   a. More than 50% Less than 50%

6. How much of your revenue comes directly from clients operating internationally?
   a. More than 50% Less than 50%

7. From 2011 until today, has the profits of your business increased, decreased or stayed the same?
   a. Increased Decreased Stayed the same

8. From 2011 until today, has the number of employees in your business increased, decreased or stayed the same?
   a. Increased Decreased Stayed the same

9. From 2011 until today, have you noticed a change in the type of contracts you have with your clients?
   a. More long-term contracts More short-term contracts No change Other

10. If other, please specify below:
    a. _____

11. Which of these factors do you think has had the largest impact on your business from 2011 until today?
    a. Copper prices Kwacha exchange rate Government Policy Other

12. If other, please specify below:
    a. _____

13. Would you be willing to share information on how the number of employees in your business has changed over time since 2011?
    a. Yes No

14. Would you be willing to participate in a follow-up interview at your convenience?
    a. Yes No

15. If 'Yes', please specify contact details below so we can get in touch with you:
    a. _____

Thank you for your participation!

Appendix B. In-depth Interview structure

1. Can you tell us about your business? What do you do, who are your clients? (Changes over time?)

2. Can you tell us about the process when you get your contracts? Is there a lot of competition for contracts? (corruption etc?) How has this changed over time? (especially between 2011 and 2016) (short/long contracts?) What is it like to work with the mines? Difference from other clients?

3. What is it like to work with the mines? Difference from other clients?

4. Can you tell us about how you have been affected by the copper price during 2011-2016? Profits? Employment (also temporary/permanent)?

5. Can you tell us about how you have been affected by the kwacha exchange rate during 2011-2016? Profits? Employment (also temporary/permanent)?

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6. Have you taken any special actions to cope with the price of copper or the kwacha exchange rate?

7. Can you tell us about how have been affected by changes in government policy during 2011-2016? Profits? Employment? (also temporary/permanent)?

8. Is it easy to find labour (skilled or unskilled)?

9. Is it difficult to retrench or lay of workers when you have to? Regulation/unions?

10. Can you tell us about why you have the structure of permanent/temporary employment that you have?

11. What do you think about the role of suppliers in the copper industry?