Zambia, China and the "Dutch Disease"

-Can copper revenues bring long-term development?

Elias Efvergren and Gözde Turgut

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Abstract

The growth rates of Sub-Saharan Africa have been more positive than for a long time, mainly due to the recent boom in commodity prices. During the same years China has increased its involvement in many of the resource-rich countries of the continent. The focus on natural resources has, however, raised concerns about the long-term development. The so called "Dutch Disease-model" has in this study served as a framework for the problem of natural resources and industrialization. The model predicts that increased commodity exports lead to a real appreciation of the currency which in turn harms the competitiveness of the country's other exports. We have in this study applied the model to the case of Zambia, with its vast copper reserves and its relationship with China, using both a theoretical and econometric approach. The results show that the increased copper exports has in fact led to a real appreciation. It is however difficult to ascertain whether this has worsened the possibilities for other export sectors.
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1. Introduction

The economic success of China has not only altered the economic and political order of the world, but has also provided an opportunity for Sub-Saharan Africa (SSA). During the last decade we have witnessed dramatic increases in Chinese activity and involvement in the region. China’s policy in Africa has been a package of aid, foreign direct investments (FDI) and trade. During the same period SSA has experienced increases in its share in world trade after years of economic marginalization and poor rates of growth. The consolidation of the relationship between China and SSA started with the formation of the Forum on China-Africa relation (FOCA) in the year 2000. China has been engaging increasingly in SSA ever since.

The poor economic performance of many African countries has to a certain extent been explained by a paradox called the "Resource Curse" or the "Dutch Disease" (DD). The model basically refers to the negative correlation between resource-abundance and economic growth. The logic behind this counterintuitive relation is as follows; resource-rich countries tend to focus its assets in the commodity sector and consequently fail to industrialize. The recent commodity price boom has placed the question of the Dutch Disease on the agenda in several Sub-Saharan countries, not least in Zambia\(^1\). The recent boom in copper prices and the increased copper production have meant both opportunities and challenges for the country. On one hand, capital inflows to the country have led to higher growth rates of GDP. On the other hand, too much focus on the copper industry might harm the long-term industrialization.

The aim of this thesis is to examine the effects of China’s growing role in the Zambian economy using the DD-model as a theoretical framework. There exists a large literature on the subjects “China in Africa” and the Dutch Disease separately, but until date no research that combines the two perspectives. This paper will therefore attempt to conduct and apply the DD-model to a country-to-

\(^1\) See appendix 1 for general facts on Zambia.
country relation. This implies that we will incorporate the “China effect” into the traditional DD-model when assessing the Zambian case.

Examples of articles that partially examine the topic are; Calí and te Velde (2007) who investigated the implications of the recent boom in copper prices on the Zambian economy. Their main finding is that copper revenues have led to positive growth in the short term but potential developmental problems in the long-term. In line with this, Carmody (2008) argues that Zambia has to canalize its copper revenues wisely in order to make the current growth rates sustainable.

In order to increase the understanding of the recent “China-Zambia” relation, this paper seeks to answer the following question:

- How did China, through its increased engagement mainly in the copper industry, affect the industrialization process of Zambia during the last decade?

The analysis made in this paper is, however, limited to certain aspects. The following issues are not included in the analysis of the question stated above; (1) Corruption (2) Environmental issues (3) The aspect of Chinese competition leading to displacement of Zambian exports from the third market (Kaplinsky, 2008). These three aspects are additional impact channels of China regarding the future of Zambia’s industrialization.

This paper is organized into five sections; next section, Background, provides an overview of the current Chinese involvement in Africa and the Zambian case for a broader understanding of the situation. Section three, Theoretical framework and analysis, presents the theoretical model and an analysis of the Zambian economy based on the model. In section four, Empirical findings and analysis, theory is used as a framework which is then applied to an econometric model. Finally in section five we summarize and conclude the analysis and the results.
2. Background

China in Africa

The emergence of China as an economic world power has changed several aspects of the global economic landscape and has also changed the way China acts on the world market. To maintain its impressive growth, China has to import large amounts of natural resources which has had implications for Africa and its relations with China. The recent increase in demand from China in for example oil and metals has led to higher commodity prices affecting Sub-Saharan commodity exporters positively. Furthermore, the growth rates of oil and metal producing countries have increased and the terms of trade for the same countries have also improved.

The history of commodity prices has been characterized by repeated boom and bust cycles. However, the emergence of China is expected to lead to structural changes on world commodity prices in the long run (Zafar, 2007). It has been estimated that China has contributed extensively to the recent commodity boom that has benefited many Sub-Saharan countries. Both regarding oil and metals the effect of China's increased demand is positive. As an example of this, China stood in the period 2000-2005 for 47.6% of the 102.9% increase in copper price. The rise in copper prices has affected Zambia in particular due to its vast copper reserves.

China has affected the economic climate of the African continent in more ways than just increasing the commodity prices. Since China's liberalization in the end of the 1970's the amount of trade, investments and aid has increased. Since the beginning of the 21th century it has expanded substantially (Zafar, 2007).

The aid donated from China to the African countries cannot be discussed in detail since official figures are not available. Although, preferential loans, a China-Africa development fund and HIV prevention are known to be focus areas of Chinese aid (Zafar, 2007, p. 23). As opposed to traditional western aid, the aid

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2 Zafar, 2007. Table 1 page 9.
given by China has no political conditionalities; no demands for increased transparency nor democratic reforms are made. The conditionalities have instead been economical, China seeks first to secure the commodity export before signing the contracts for economic assistance (Kommerskollegium, 2009, p. 15-18).

In contrast, investments from China to Sub-Saharan Africa are more easily depicted than aid. In the Zambian case, similar to many of the other countries’, a large share of the investments are focused on the mining sector with the extraction and refinement of copper and other metals as the final goal. This has for example led China to invest in a copper smelter of 200 million $ connected to the now Chinese-owned Chambishi copper mine. Other investment projects are also being carried out across Zambia. Altogether Zambia is the third largest recipient of Chinese FDI in Africa and number 19 in the world (Carmody, 2008, p. 1199).

Even though China's policies and way of dealing with Africa differ in many aspects from that of the western countries, certain similarities can be observed. When it comes to trade, the relation between China and Africa still resembles traditional structures. The resource-abundant countries in Sub-Saharan Africa exports natural resources and China on the other hand exports manufactures and high-technology goods. This pattern fits well into the Ricardian comparative advantage model (Zafar, 2007, p. 15). Trade, aid and investment are all intertwined into what seems to be a common objective, i.e. to secure the supply of the necessary natural resources for Chinese industries.
The figure illustrates the main impact channels through which China affects the Zambian economy. The impact the three components of the “China package” has on the Zambian economy is, however, connected and intertwined in a way that makes Chinese engagement in Zambia different from traditional partners. Accordingly, Chinese aid is given in forms of loans to infrastructure projects and technical assistance for training whereas investments are focused on the industries (McCormick, 2008). Altogether, they pave the way for a Ricardian way of trading between China and Zambia, where the former exports labour-intensive manufactures and the latter mainly exports raw materials.

In order to examine the effect of this complex engagement, next section will deal with the history of the Zambia-China relation and the current situation in relation to the copper boom.
China in Zambia

After its independence in 1964 Zambia had the highest income per capita in Southern Africa. This all changed during the 1970's and onwards because of falling copper prices, oil-shocks and bad governance. The growth rates have been low and even negative up until recent years. Ever since independence the Zambian economy has been tightly connected to the world copper price fluctuations (Carmody, 2008, p. 1197).

Graph 1: The relation between GDP and copper price

![Graph](image)

*Source: World Bank Statistics and IMF (GDP in millions)*

The history of China's economic relationship with Zambia began in the 1970's when China built a railway between Tanzania and Zambia. This was done, already then, to facilitate the transportation of Zambia's copper. During the 1980's, China once again invested in Zambia, this time in a textile factory which at first experienced success but recently had to shut down because of increased Asian competition (in a way China outperformed its own investment) (Carmody & Hampwaye, 2009, p. 4).

In this study we will however focus on the relationship that has been built up since the beginning of the 21th century. Although much of China's interest in the Zambian economy is centered around metal extraction, other sectors are also of importance. Construction with focus on infrastructure is one sector that has attracted many Chinese companies (Carmody, 2008, p. 1998-1999).
3. Theoretical framework and analysis

The Dutch Disease-model

The theory of the “Dutch Disease” was originally designed to explain the relation between natural resources and poor economic performance in the Netherlands with the discovery of gas in the 1970’s. The revenues from gas exports led to a real appreciation which then deteriorated competitiveness for other exports.

What has been found in several studies of economic growth and the discovery of natural resources is seemingly counterintuitive, the correlation is negative (Sachs and Warner, 2001). The increase of extraction or production of the natural resource may originate from either a new discovery, technological progress or an exogenous price increase of the resource. The mechanisms behind the adverse effect can be explained by the resource movement in favor of the booming natural resource sector. As a result, other sectors in the economy such as manufactures are affected negatively by the increased concentration in the booming sector. Economic growth and the condition of the manufacturing sector are often tightly connected and the Dutch Disease can thus be said to be harmful to growth and the industrialization process, a sort of “de-industrialization”. An empirical study that supports the theory has been conducted by Sachs and Warner (2001). They conclude that the share of manufacture exports to GDP is in fact lower in resource-rich countries compared to those that are resource-poor (the correlation is presented in the Graph 2 below).
The Core model

One of the most commonly used and influential models under the framework of “Dutch Disease” is “the Core model” or “the Corden-Neary model” (Falck, 1992, p. 5). According to this model, the economy consists of three sectors; two tradable sectors and one non-tradable sector. Tradable \( X_n \) is in this case a booming natural resource sector and tradable \( X_m \) is then a lagging manufacturing sector. Non-tradables, \( X_n \), consists of services\(^3\). The main assumptions underlying the theory are:

- Small open economy
- Two tradable goods traded at exogenously given world prices

\(^3\) Services comprises value added from wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, personal services such as education, health care and real estate services. Source: UN Data
- A third non-tradable good at a flexible price decided by supply-demand equilibrium.
- $X_n$ (natural resources), $X_m$ (manufactures) and $X_s$ (services) ($X=output$)
- Full employment
- Labour and capital moves freely between the sectors with equal rate of return in equilibrium

These assumptions are then used to explain what the impact is on the economy when one tradable sector is booming. The two effects that dictate the outcome are called the “Resource Movement effect” and the “Spending effect”.

The real exchange rate (RER) in this model and this study is explained as:

$$\text{RER} = \frac{P_n}{P_t}$$

where $P_n$ is the price level of non-tradables and $P_t$ is the price level of tradables.

When $P_n$ increases so does the RER which implies an appreciation. The economy is in equilibrium when:

$$X_n(P_n) = C_n(P_n, Y)$$

i.e. when supply equals demand in the non-tradable sector ($Y=income$, $C=consumption$).

**The resource movement effect**

The resource movement effect implies that the booming sector attracts resources from the lagging tradable sector and the non-tradable sector. The mechanism behind this is that the marginal product of the booming sector rises in relation to the other sectors. As a result, labour and capital move to this sector because of higher wages and higher returns on investments. The labour movement affects the output of services negatively which in turn leads to excessive demand for services. This then drives up the price level of services (non-tradables). The increase in prices of non-tradables then implies an appreciation of the real exchange rate (according to RER=$P_n/P_t$). The same effect appears in the other
tradable sector (manufactures) where relative profitability now is lower than in the booming sector. Consequently, resources move to the sector with highest profitability. This development or restructuring of the economy is called "direct de-industrialization" (Corden & Neary, 1982, p. 830).

**The spending effect**

The spending effect on the other hand occurs from increased demand for non-tradables as a result of higher incomes of labor in the booming sector. The increased demand for services due to higher incomes increases the prices in the service sector. The price level of the manufacturing sector, however, is not explained by the spending effect since it is determined on the world market. The spending effect, which abstracts from how resources move, predicts a higher output of services in order to meet the new higher demand. This higher price level in services (non-tradables) will according to the spending effect also lead to a real appreciation. The spending effect which results in higher demand of services and a real appreciation is assumed to lead to "indirect de-industrialization" (Corden & Neary, 1982, p. 831).
Figure 2: Effect of the boom on the commodity market

Source: Corden&Neary 1982, with adjustments made by the authors

Figure 2 illustrates the commodity market with traded goods (manufactures and natural resources combined) on the y-axis and the non-traded good (services) on the x-axis. The TS-curve represents the pre-boom Production Possibilities (PP) showing the total amount of goods attainable, On is the income-consumption curve. Further, point a indicates the initial equilibrium (before the boom). In the case of the resource movement effect, to abstract from the spending effect, income-elasticity of demand is assumed to be zero. This is represented by the vertical income-consumption ZZ-line. Following the boom the TS-curve shifts outwards as the attainable amount of traded goods increase. When the real exchange rate is held constant, the equilibrium moves from point a to point b (labour moves from services and the output in the sector falls). Services demanded after the shift in the TS-curve, is however at point j. This results in an excess demand represented by the distance between b and j. In order to bring the market back to its equilibrium,
a real appreciation occurs. As stated previously, a real appreciation can take place if the price of non-tradables increases according to the principle: \( \text{RER} = \frac{P_n}{P_t} \) (price of tradables is exogenously determined, therefore fixed in the model). Finally, the price of non-tradables (services) rises to meet the excess demand, the equilibrium moves to a new final point somewhere between b and j. The resource movement effect finally implies a lower output level of services than in the pre-boom equilibrium.

When we consider the spending effect, the assumption of zero income-elasticity is dropped. Demand for services in this case increases with higher income. The income-consumption curve is instead illustrated by the On curve (as opposed to the vertical ZZ-line). This time the boom follows a movement along the On curve to point c. Again, this results in an excess demand which must be met by a real appreciation for the same reason explained in the case of the resource movement effect. The ultimate point lies somewhere between j and c, output of non-tradables increases (as opposed to the resource movement effect) (Corden & Neary, 1982).

The ultimate effect on the output of services is ambiguous. The resource movement effect predicts a decrease in services in contrary to the spending effect. The final outcome is consequently not determined within the model but depends rather on which of the two effects dominates. What can be said, though, is that both cause the real exchange rate to appreciate. A summary of the outcomes is presented in Table 1.

**Table 1: Post-boom outcomes**

<table>
<thead>
<tr>
<th>Effects</th>
<th>Goods</th>
<th>Output</th>
<th>Prices</th>
<th>Reer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource movement effect</td>
<td>Tradables</td>
<td>+</td>
<td>Given</td>
<td>Appreciation</td>
</tr>
<tr>
<td></td>
<td>Non-tradables</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Spending effect</td>
<td>Tradables</td>
<td>+</td>
<td>Given</td>
<td>Appreciation</td>
</tr>
<tr>
<td></td>
<td>Non-tradables</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>
Other aspects of the Dutch Disease

There are other aspects that need to be accounted for when applying the DD-model. Technological progress can both lead to increased productivity but also decreased demand for labour. The increased efficiency of capital can in this case reduce the resource movement effect since labour is not demanded (Corden & Neary, 1982, p. 839-409).

Moreover, the "China effect" mentioned in the introduction will also be included as a reason for potential Dutch Disease in the case of Zambia. What is meant by the "China effect" is (1) China's contribution to the increased world market price of copper. Also, (2) increased Chinese investments in Zambia during the last decade which has improved the capacity of the copper industry.

Dutch Disease applied: China and Zambia

There are many aspects of the DD-model that can be applied to the case of Zambia. The DD-model has historically been applied both to Zambia as well as a variety of other countries. As mentioned previously, there are several sources of the Dutch Disease such as increased inflow of capital (e.g. aid), discovery of natural resource, commodity price boom etc (Falck, 1992, p. 4). In this section we will add another potential cause of the Dutch Disease which we refer to as the "China effect". Furthermore, we will examine the potential Dutch Disease symptoms in Zambia and also look at the implications of the China-Zambia relationship in the Dutch Disease context, the risk that China exacerbates the symptoms of the disease.

When applying the resource movement effect to the Zambian case, several features need to be taken into account. As stated above, the resource movement effect predicts that resources will be attracted due to higher wages and increased returns on investments. The resources are then expected to move to the booming sector. Resources have in fact been attracted to the copper sector in Zambia. Chinese investments and the rise in copper prices have created jobs in the copper sector. However, as stated as a possibility in the theoretical section, the
technological progress that has taken place in the copper industry may lead to lower labour demand. When "more efficient techniques are used" (Carmody, 2009, p. 1203) labour is not demanded to the same extent. This could, in the Zambian case, slow down the job creation of the copper sector and thus also reduce the resource movement effect.

In Zambia, it is difficult to claim with certainty that these resources have moved from another (lagging) sector. In fact, it is more likely that they have not. One of the main assumptions of the DD-model is not achieved in Zambia, namely that of full employment. In practice this means that resources (labour) do not have to move from one sector to another but can rather be drawn to the booming sector from an unemployment pool. Regarding capital, a movement to the booming sector can be observed. However, it is difficult to argue that the booming sector draws capital from other sectors. Investments, including the ones from China, have during the last decade been concentrated in the copper industry. During the same period the manufacturing sector has also experienced increases in investments (total as well as Chinese) (Zambia Development Agency, 2010). It should be taken into account, however, that the manufacturing sector also contains copper processing and copper refinement (Carmody & Hampwaye, 2009).

The application of the spending effect on the Zambian case is more straightforward to evaluate. The spending effect suggests that overall higher income levels lead to increased demand for services (non-tradables), thus appreciation of the real exchange rate.

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4 The official rate of unemployment was in the year 2000 equal to 50% (CIA World Factbook).
5 Statistics of FDI from the Zambian development agency, "research, planning and policy division". See appendix 2.
As demonstrated in Chart 3, there has been a real appreciation of the Kwacha\(^6\) over the period investigated. According to the model this is harmful for the entire tradable sector due to loss in international competitiveness. Whether this appreciation originates from the resource movement effect or spending effect is nevertheless difficult to determine. However, a main assumption of the DD-model predicts that the appreciation originates from the boom in the natural resource sector. This will be investigated further in the empirical part of the study. Moreover, the increase in world copper price has been calculated to be a product of China's increased demand. Without the increase in copper price combined with the general increase in world demand for copper, we consider it to be unlikely that Zambia would be producing copper at current levels. Arguably China has in this way contributed to raising the real effective exchange rate in Zambia.

In the case of Zambia, the development of the copper industry and the real appreciation do not seem to have led to de-industrialization. On the contrary, the manufacturing sector has, over the period studied, experienced growth. Even though manufactures has declined in relative terms to the traditional sector (wherein copper is found) it has developed in absolute terms (as shown in Chart 4).

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\(^6\) National currency of Zambia.
Based on the statistical findings, one could conclude that instead of specializing only in the booming sector, Zambia has succeeded in developing its non-traditional sector. This statement is although not final. There are several industries that are connected to copper production which are included in the non-traditional manufacturing sector. The actual situation could still be that the Zambian economy is indirectly concentrated on the copper production even though growth has taken place in the manufacturing sector.
4. Empirical findings and analysis

This aim of this section is to examine how variables used in Dutch Disease studies appear in the Zambian case. In order to examine the theoretical part and the assumptions made in the model we have run regressions on the following variables: the real effective exchange rate (Reer)\(^7\), the copper price, a dummy variable for the years 2000-2008, value added\(^8\) services, value added manufacturing and inflation.

China’s influence in the Zambian economy can then be measured predominantly via the increased demand of copper, represented in the regressions by the copper price. The copper price boom has to a large extent been attributed to Chinese increased demand (Zafar, 2007). China’s influence increases in the 21\(^{th}\) century and we capture this by including a dummy variable that takes the value one in the years 2000-2008 and zero before this period.

We have based our empirical method and the choice of the dependent variables on the work of Lartey, Mandelman and Acosta who researched the Dutch Disease and remittances (Lartey, Mandelman and Acosta, 2008).

Data limitations

In the empirical part we have limited the time period to 1985-2008. The argument behind this limitation is that we needed enough observations to be able to look at a single country. However, with 24 observations one should be careful not to make to strong conclusions. Even though we can show correlations, it is impossible to claim causality based on our regression results.

The main interest was, however, the period 2000-2008 when the relationship between China and Zambia was consolidated further which is the reason why a

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\(^7\) REER (Real Effective Exchange Rate) Index : Ratio of an index of a currency's period- average exchange rate to a weighted geometric average of exchange rates for the currencies of selected countries, weighted by each country’s trade in both manufactured goods and primary products with its partner countries, and adjusted for relative changes in consumer prices. Base year:2000. Source World Bank.

\(^8\) Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs (UN database).
dummy was created for the period (Mwanawina, 2008). The reason for limiting this study to the year 2008 is that we chose to avoid possible effects of the economic downturn of the financial crisis. The financial crisis disturbed the international trade flows and possibly also the relation between the two countries under investigation.

Two other variables that could have been included in the study are China's FDI and also its foreign aid. These were however unavailable due to the lack of data. China's aid data is difficult to quantify and thus unfeasible to incorporate (Kaplinsky, McCormick& Morris, 2007). China's FDI is only available for the period 2000-2008 and would lead to insufficient numbers of observations.

**Data description**

In order to make the regression more comprehensible Table 2 is presented with the summary of the variables.

**Table 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper price</td>
<td>Copper prices measured in $/barrel</td>
<td>IMF Commodity Prices</td>
</tr>
<tr>
<td>Reer</td>
<td>Trade weighted real exchange rate</td>
<td>African development indicators (World Bank)</td>
</tr>
<tr>
<td>China dummy</td>
<td>The years 2000-2008, represents China's increased engagement in Zambia</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>Inflation (GDP deflator)</td>
<td>African development indicators (World Bank)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Manufacturing value added, measured in current $</td>
<td>UN database</td>
</tr>
<tr>
<td>Services</td>
<td>Services value added, measured in current $</td>
<td>UN database</td>
</tr>
</tbody>
</table>
The regression model

Based on the previous theoretical section we have chosen to study how the increase in copper price has affected three endogenous variables: Reer, manufacturing and services. The model used in the regressions was the standard Ordinary Least Squares (OLS) method.

The first regression was divided into three steps. We start by showing how the Reer correlates with inflation, meant to represent the macroeconomic conditions in Zambia during this period. In the second step we ran the regression with the China dummy, this was done in order to test the effect of inflation during the period of the “China-years” (2000-2008). Finally, in the third regression the copper price was added.

To test the assumption described in the DD-model concerning the resource movement and spending effect we also ran regressions with manufacturing and services as dependent variables. Independent variables were, as in the previous regression, inflation, copper price and the China dummy.

Regression 1:
Reer= β₀ + β₁ (Inflation) + β₂ (China dummy) + β₃ (Copper price) + ε

Regression 2:
Services= β₀ + β₁ (Inflation) + β₂ (China dummy) + β₃ (Copper price) + ε

Regression 3:
Manufacturing= β₀ + β₁ (Inflation) + β₂ (China dummy) + β₃ (Reer) + ε
Table 3: Regression results

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Reer</th>
<th>Services</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.350***</td>
<td>-0.134</td>
<td>-0.112</td>
</tr>
<tr>
<td></td>
<td>(0.123)</td>
<td>(0.125)</td>
<td>(0.0878)</td>
</tr>
<tr>
<td>China dummy</td>
<td>33.47***</td>
<td>18.30**</td>
<td>730.6***</td>
</tr>
<tr>
<td></td>
<td>(10.85)</td>
<td>(8.222)</td>
<td>(153.8)</td>
</tr>
<tr>
<td>Copper price</td>
<td>0.00993***</td>
<td>0.451***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00207)</td>
<td>(0.0388)</td>
<td></td>
</tr>
<tr>
<td>Reer</td>
<td></td>
<td></td>
<td>10.73***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.847)</td>
</tr>
<tr>
<td>Constant</td>
<td>119.7***</td>
<td>96.68***</td>
<td>73.82***</td>
</tr>
<tr>
<td></td>
<td>(7.878)</td>
<td>(10.03)</td>
<td>(8.482)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.270</td>
<td>0.498</td>
<td>0.766</td>
</tr>
<tr>
<td>Observations</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

Notes: *** significant at 1% level, ** significant at 5% level, * significant at 10% level

Results and analysis

As R-squared values indicate, the dependent variables can be explained to a large extent. The first regression was run with Reer as dependent variable in three steps. The coefficient on inflation is, in the first step, significantly different than zero. Low inflation accompanies a real appreciation of the Zambian currency, as suggested by macroeconomic theory. But when we include the other regressors, the coefficient on inflation loses its significance. Both variables representing the Chinese involvement are strongly correlated to the real exchange rate in Zambia.

However, during the "China-years" the appreciated Reer is instead due to the rise in copper prices. As stated in previous sections the increase in copper price is to a large extent explained by the surge in Chinese demand.
In the second regression *services* (which here represents the non-tradable sector) is used as the dependent variable. As the DD-model predicts the increase in the copper price will lead to increased demand for services which is followed by increased output (spending effect). So in this simplistic fashion what can be said is that the theory is supported by the statistical findings. The China dummy is significant also in this regression, services has thus further increased during this period.

In the third regression *manufacturing* (which represents the other "lagging" tradable sector, as opposed to the "booming" copper sector) is used as the dependent variable to give additional aspects of the assessment of the DD-model. According to the DD-model a real appreciation of the currency (a Reer-increase) would harm the competitiveness of the manufacturing sector (since it is a tradable sector and becomes relatively more expensive with an appreciation). This is however not supported by the regression which shows a positive relation between the Reer and manufacturing. According to the regression results an appreciation of the Reer instead shows an increase in manufacturing even during the "China-years". The result is however consistent with the previous statements made in section three, manufacturing has increased in absolute terms during the years used in the regression.
5. Summary and Conclusion

The main purpose of this study was to examine the impacts of Chinese involvement in the Zambian economy and its development. This was done with the guidance of the key question posed in the introduction: "How did China, through its increased engagement mainly in the copper industry, affect the industrialization process of Zambia during the last decade?". A theoretical framework of the Dutch Disease was used in order to understand the principal macroeconomic aspects of this bilateral relationship. Also, data from the different sectors composing the Zambian economy along with other variables were empirically tested.

The theoretical application and the empirical results showed a mixed picture. Therefore, the initial question has to be answered in two parts. First of all, the theory suggested that a real appreciation of the currency and the movement of resources from the non-booming sectors would lead to de-industrialization. Even though the real appreciation has occurred during the examination period there is no empirical support that this would have led to de-industrialization. Secondly, the empirical results were also ambiguous. Despite the fact that the non-booming (manufacturing) sector has experienced growth it is worth noticing that copper refinement and processing are included in the manufacturing sector.

To conclude, although it has historically been difficult to develop with a natural resource as economic engine, there are of course positive aspects of the recent development. The increase in the world market price of copper and the increased amounts of investments to Zambia have to a large extent been a product of China and "the China effect". These are opportunities for Zambia's economic growth. Whether or not Zambia contracts the Dutch Disease depends on how well it can take advantage of these opportunities. Furthermore, the future of Zambia's industrialization will be determined by how it manages to diversify the economy using the revenues obtained from copper production.
Other perspectives of Chinese influence in Zambia and Sub-Saharan Africa is still left for future studies. Another subject that would be interesting for further research on the topic of China-Zambia relations is for instance the development of income distribution following the boom. Also, what could be included in further studies is the impact China has on corruption which is another important factor of development.
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McCormick, Dorothy, (2008), "China & India as Africa's New Donors: The Impact of Aid on Development", Institute for Development Studies, University of Nairobi, 73-90


**Data collection:**


# Appendix 1: Zambia Facts

<table>
<thead>
<tr>
<th>Independence</th>
<th>1964 from Britain</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>(purchasing power parity) $18.5 billion (2009)</td>
</tr>
<tr>
<td>GDP/capita</td>
<td>$1500 (2009), country comparison to the world: 200</td>
</tr>
</tbody>
</table>
| GDP composition  | Agriculture: 19.2 %  
|                  | Industry: 31.3 %  
|                  | Services: 49.5 % (2009) |
| Industries       | copper mining and processing, construction, foodstuffs, beverages, chemicals, textiles, fertilizer, horticulture |
| Imports          | machinery, transportation equipment, petroleum products, electricity, fertilizer; foodstuffs, clothing |
| Import partners  | South Africa 52.5%, UAE 8.2%, China 6.9% (2008) |
| Export partners  | China 13.8%, South Africa 8.2%, Democratic Republic of the Congo 7.8%, Saudi Arabia 7.6%, South Korea 7.6%, Egypt 7.4%, Italy 6.7%, India 4.6% (2008) |
| Capital          | Lusaka |
| Government type  | Republic |
| Population       | 11,862,740 (2009) |
| HIV/AIDS         | 1.1 million (2007), country comparison to the world: 11 |
| Religions        | Christian 50-75%, Muslim and Hindu 24-49 % |
# Appendix 2: FDI to Zambia (total and Chinese)

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>TOTAL FDI PLEDGES</th>
<th>CHINESE FDI PLEDGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>320,198,456</td>
<td>7,786,257</td>
</tr>
<tr>
<td>Construction</td>
<td>206,361,704</td>
<td>38,889,243</td>
</tr>
<tr>
<td>Education</td>
<td>11,562,500</td>
<td>1,150,000</td>
</tr>
<tr>
<td>Energy</td>
<td>1,305,343,661</td>
<td>0</td>
</tr>
<tr>
<td>Engineering</td>
<td>9,526,398</td>
<td>0</td>
</tr>
<tr>
<td>Financial Institutions</td>
<td>74,361,200</td>
<td>0</td>
</tr>
<tr>
<td>Health</td>
<td>58,253,800</td>
<td>3,439,600</td>
</tr>
<tr>
<td>ICT</td>
<td>257,225,283</td>
<td>0</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2,068,129,865</td>
<td>571,194,637</td>
</tr>
<tr>
<td>Mining</td>
<td>8,197,830,724</td>
<td>5,509,776,766</td>
</tr>
<tr>
<td>Real Estate</td>
<td>301,923,456</td>
<td>8,000,000</td>
</tr>
<tr>
<td>Service</td>
<td>284,809,451</td>
<td>22,707,000</td>
</tr>
<tr>
<td>Tourism</td>
<td>502,090,421</td>
<td>26,447,300</td>
</tr>
<tr>
<td>Transport</td>
<td>392,037,875</td>
<td>3,800,000</td>
</tr>
<tr>
<td><strong>Total FDI</strong></td>
<td><strong>13,989,654.794</strong></td>
<td><strong>6,193,190.803</strong></td>
</tr>
</tbody>
</table>

In US$