A case of the Dutch disease: made in China?

An analysis into the effects of China's commodity demand on resource exporting countries

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Abstract

My thesis uses a panel data fixed effects approach to analyse the effect of exporting commodities to China by two groups, namely total exporting countries and Sub-Saharan African countries, between 1996 to 2014. Four hypotheses are tested for evidence of: 1. The resource movement effect, 2. The spending effect, 3. a slowdown in economic growth, and 4. a correlation between less democratic countries exporting commodities to China, and worsening Dutch disease symptoms. Hypothesis 1 was rejected for Sub-Saharan African countries, i.e. there is no resource movement effect. I was unable to reject Hypothesis 2 for Sub-Saharan African countries and there is evidence of the spending effect. Hypothesis 3 was rejected as the results did not significantly differ from zero for either group, which was also the result for Hypothesis 4.

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1. Introduction

China's economic rise is unique in that her lack of natural resources has meant she has had to actively engage in world markets in order to sustain both her population and economy. China's growth has been attributed to export led trade, increasing from $18 billion in 1980 to $970 billion in 2006, an annual growth rate of nearly 17 percent (Greenspan, 2007). As the world's major exporter of manufactured goods, China's appetite for commodities has shaped trade imbalances as she has also become the world's single largest market for iron, ore, copper, cement, aluminum and nickel (Su, F. Wei, G. & Tao, R. 2016). Further, U.S. Energy Information Administration (2015) reports that China officially surpassed the United States at the end of 2013 as the world's largest net importer of petroleum and her oil consumption accounted for about 43% of the world's oil consumption growth in 2014.

Due to the magnitude of both the commodities imported and manufactured goods exported by China, there are concerns that resource endowed countries are not only becoming dependent on Chinese consumption, but also becoming less competitive in other sectors of their economy. This correlation has been captured in the term 'Dutch disease', coined in the late 1970's to describe the declining Dutch economy following the discovery of gas reserves (The Economist, 2014). The large increase in exports of gas reserves saw the Guilder (the then Dutch currency) increase in value, while corporate investments fell, unemployment increased, and other sectors of the economy become less competitive in international markets. This pattern accompanying natural resource discovery has arguably been replicated around the world. Due to the possible detrimental effects of such a phenomenon, there has been a large interest by scholars to research this pattern. However, there are surprisingly small amounts of studies devoted to exploring the possible links between China's commodity demand and the Dutch disease. Thus, this provides an interesting platform on which to apply the well-established theory of the Dutch disease to a modern setting. There are two prominent studies focusing on the link between China and the Dutch disease in developing countries or specific regions i.e. Sub-Saharan Africa or Latin- America (Su et al. 2016; Meyersson, Miquel, Qian 2008, Gonzalez-Vicente 2011), and my thesis will follow suit. I will start by studying the effects of exporting commodities to China with a larger range of countries, and then focus on a smaller sample of Sub-Saharan African countries to see how a low-income region fares compared to the rest of the world. Gelb (1998) highlights that exports by developing countries are skewed towards commodities, and as the World Bank (2015) list of low-income countries is largely made up of Sub-Saharan African countries, I choose to focus on this region. Hence, I aim to see how trading with China, a commodity importer, could affect Sub-Saharan African

economies. Further, many previous studies on the Dutch disease empirically test for the effects on economic development and institutions, whereas I will empirically test four hypotheses that have their roots in the theoretical Dutch disease literature, and link them with exporting commodities to China. My four hypotheses will test the resource movement effect, the spending effect, the impact of commodity exports to China on economic growth and lastly, how these exports to China coincide with the political system of a country to influence the symptoms of Dutch disease. I use a panel data fixed effects model, containing data beginning from the early 1990's where China's trade started to increase substantially, to test the four hypotheses. The empirical results reveal that there is no evidence of the resource movement effect found for either country group, nor statistically significant negative effects on the economic growth of commodity exporting countries. However, there is evidence of the spending effect which was found to be statistically significant when tested for in Sub-Saharan African countries. Lastly, except when the resource movement effect is tested for Sub-Saharan African countries, there is no statistically significant effect between less democratic countries exporting commodities to China, and worsening symptoms of the Dutch disease for either country group tested in the previous three hypotheses.

The rest of my thesis proceeds as follows: Section 2 will discuss previous studies that focus on the Dutch disease, including both theoretical and empirical papers, and will state the hypotheses that are tested throughout the rest of this thesis. Section 3 will describe the empirical strategy employed, followed by a descriptive overview of the data in section 4. Section 5 will relay the empirical results, and section 6 will directly address the hypotheses and will draw together the central points of the tests. Lastly, section 7 will conclude this thesis and provide the general implications for public debate and further research.

2. Theoretical Framework

Since the term Dutch Disease first appeared, a large body of academic work analysing this counterintuitive phenomenon has appeared. The term describes the apparent causal relationship between an economic boom in one sector, namely of an extractive nature, and the decline in other sectors of the economy, such as manufacturing. This is facilitated via the appreciation in the given country's currency, which leads to the non-extractive sectors becoming less competitive as their exports become more expensive on global markets. Section 2.1 will define the core Dutch disease model that captures these mechanisms at play. Section 2.2 will elaborate on the divergent theoretical works, followed by section 2.3 stating the hypotheses my thesis will test. Section 2.4 will focus on previous empirical studies of the

Dutch disease and lastly, section 2.5 will present two studies that focus on the possible correlation between China and the Dutch disease.

2.1 The Core Model

Corden and Neary's (1982) study is considered a theoretical cornerstone for Dutch disease research. Corden's (1984) paper narrows in on what he labels as the *Core model*, which captures the mechanisms attributed to the essential problems of the Dutch disease. In his model, there are three sectors: The Booming sector (B), the Lagging sector (L), and the Non-Tradeable sector (N). Both B and L produce tradeable goods at given world prices. Additionally, all prices for factors used to produce output are flexible and all factors are internationally mobile.

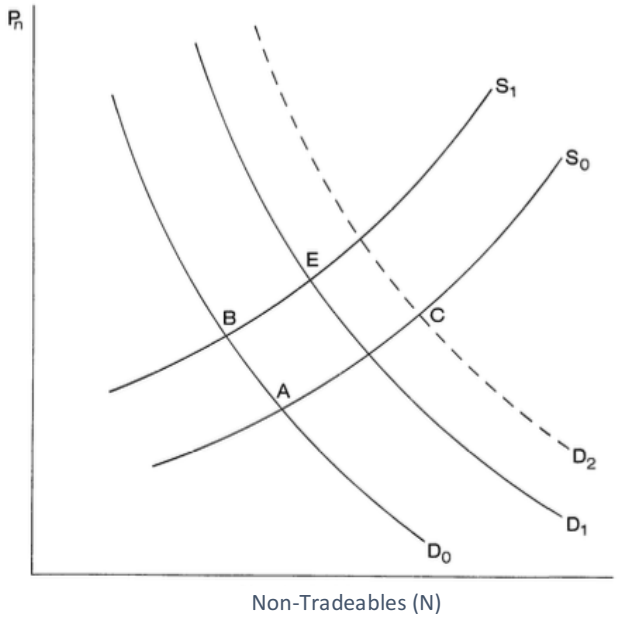
A sudden increase (or boom) in B has the initial effect of raising aggregate income of the factors initially employed there. This boom can happen in one of three ways:

1. A once-for-all exogenous technical improvement in B, i.e. a favourable shift in the production function,
2. A windfall discovery of new resources e.g. an increase in supply of a specific factor, or
3. B produces only for export and there is an exogenous price increase of its product on the world market relative to the price of imports.

The follow-on effects of these booms is captured by two effects: the resource movement effect and the spending effect.

The *Spending effect* is the series of events that follow in B, where part of the extra income gained due to a boom is spent. As the income elasticity of demand for N is positive, the price of N relative to the prices of B and L increases. This is a real appreciation, and is reflected in Figure 1, where P_n indicates the price of N relative to the price of L. The spending effect shifts the demand curve from D_0 to D_1, raising P_n and drawing resource out of sectors B and L into N, as well as shifting demand away from N towards B and L. The demand curve is demand for N at various prices of N when expenditure is always equal to income.

Figure 1: Core model



Source: Corden (1984)

The *Resource movement effect* is apparent when the marginal product of labour rises in B due to a boom, leading to an increase in demand for labour in B and inducing a movement of labour out of L and N. Corden (1984) states this effect has two parts:

The first is called *direct de-industrialisation*, and is realised when the movement of labour out of L into B, lowers output in L. The second part involves the movement of labour out of N and into B, at a constant real exchange rate. In figure 1, the resource movement effect can be seen to have shifted the supply curve, derived from the transformation curve between N and the two tradeables, from S_0 to S_1. This results in excess demand for N, on top of the amount already created by the spending effect.

Thus, figure 1 begins at the equilibrium point of A, where S_0 and D_0 intersect. However, as the supply and demand curves shift with the resource movement and spending effects (collectively labelled the Dutch disease) the new point of intersection is E, resulting in an increase of P_n.

2.2 Alternative Theories

Many scholars have since built on, or varied, Corden and Neary's (1982) theory to further explain why such a phenomenon is possible. Gelb (1988) for instance, incorporates the notion of the Dutch disease as one of four possible theories to explain the paradoxes found in

resource abundant economies. His three additional theoretical approaches defining the mechanisms behind what he labels 'windfall gains' are the linkage, neoclassical growth, and export instability theories (Gelb, 1988, pp. 14-29). These three theories are explained in the following three subsections.

2.2.1 The linkage theory

The linkage theory captures the interaction between the principal booming sector of an economy and the non-booming sectors. These interactions are divided into three: production, consumption and fiscal linkages, with fiscal linkage considered the most important determinant for the distribution of the accrued 'windfall' benefits. The fiscal linkage emphasises the allocative distortions due to inefficient use of resource rents. This is highlighted by the rent-seeking behaviour exhibited by a relatively small group of decision makers in the respective resource rich countries, who remain with a majority of the surplus windfall gains (Gelb, 1988). Auty (2001) extends on this premise by emphasizing that resource abundance creates fertile ground for a predatory political state, inevitability leading to governments distorting the economy in pursuit of rents. This leads to a staple trap, predicting declining economic growth from which recovery is slow due to run down, or obsolete, productive capital, both human and physical. Hence, a natural resource boom creates an economy lacking in incentive to implement competitive industrialization models (Auty, 2001). Following from this, Gylfason (2001) explains that a false sense of security by governments, driven by immediate gains from natural resources, creates risks and patterns exemplified when contrasted to resource-poor nations.

2.2.2 Neoclassical growth theory

The neoclassical growth theory describes the efficiency of allocation of factors of production. This theory stresses that rent-intensive activities enable the relaxation of three constraints: domestic savings, foreign exchange, and fiscal revenues. The theory stipulates that resource rents are consequently taxed away and/or invested rather than consumed, and that a windfall can result in a positive impact on economic growth (Gelb, 1988). Mehlum, Moene & Torvik (2006) emphasise that ultimately the quality of institutions determines whether a country will experience the positive effects of resource abundance or not. They conclude that low growth is associated with institutions who exhibit rent seeking behaviour at the expense of production activities. This is made possible due to political structural cracks such as weak rule of law,

malfunctioning bureaucracy, and corruption (Mehlum et al, 2006). Hence, the skewed rent seeking behaviour exhibited by governments and the ruling elite, creates economic distortions hindering growth and rendering capital unproductive. From a theoretical standpoint, the presence of resource abundance creates a sequences of follow on effects. The reallocation of gains is inefficiently done, with both governance and institutional quality corroding and thus, constraining economic growth and creating a rentier state. Lane and Tornell (1999) argue that in such an environment where both strong institutions are lacking, and multiple powerful groups dominate, there is slower economic growth. This can be attributed to the accessibility of production such groups possess, who create higher productivity levels and output leading to decreases in both the rate of return on investment and growth. As productivity increases, each group will attempt to acquire greater shares of production by demanding more transfers, and thus leading to an increase in the tax rate and reduction in the net return of capital (Torvik, 2002). Ultimately, this redistribution effect may outweigh the direct effect of increased productivity.

2.2.3 Export instability theories

Export instability theories attempt to explain whether the adverse effects from the irregular income of natural resources could offset the benefits associated with the temporary high income gained from them. An important distinction is made here in regards to developing and developed countries. Exports by developing countries tend to be skewed towards agricultural and mineral commodities, which are exposed to wider fluctuations in both export prices and revenues. Hence, fluctuations in the terms of trade tends to be larger for developing countries (Gelb 1988). The possible symptoms from the Dutch disease have been especially scrutinized in regards to governments and public officials. Resource booms lead to powerful groups within an economy to have increased incentives to lobby local governments and realise rent-seeking activities (Lane and Tornell, 1999; Torvik, 2002). In this respect, the classical Dutch disease literature has been extended to encompass not only the mechanisms leading to a slowdown in economic growth, but also the policy responses to a resource boom. Arguably, economies abundant in natural resources have weakened abilities to respond effectively to the negative effects of a resource windfall due to increased economic and social divisions and ineffective institutions (Isham et al., 2005). This has led to scholars emphasising poor long-run economic performances can be attributed to the waste and corruption stemming from resource dependence, rather than from the mechanisms Dutch disease theory alone provides (Sala-i-Martin and Subramanian, 2003). Arguably, the effects of Dutch disease in themselves

are not the sole cause of deteriorating growth, but rather it acts as a trigger to spur corruption, hindering important fractions of a growing economy, such as entrepreneurs. Corruption sterilizes incentives for entrepreneurs to invest back into the economy, harming an economy's progression (Su et al. 2016).

With the various theories attempting to capture the paradox of natural resource abundance, it is important to note that the theories are not mutually exclusive and can be combined to create a unified framework (Gelb, 1988). The theories proposed underline different aspects of the set of constraints, choices, and polices available to countries undertaking the task of productively absorbing windfall gains. Therefore, the theoretical arguments put forward present an underlying unity capturing the effects of resource dependence, with the Dutch disease theory stipulating the principal economic mechanisms.

2.3 Hypotheses

Given the core model and theoretical propositions, my thesis aims to establish whether increased exports in commodities to China can lead to the Dutch disease occurring globally or in a specific region, namely Sub-Saharan Africa. The Dutch disease can occur through two principal channels: the resource movement effect and the spending effect (Corden and Neary, 1982). The former can be identified through the decrease in size of the manufacturing sector and the latter through an appreciation in the relative price level. The overall impact of exporting commodities to China is tested by the impact this has on the exporting country's GDP per capita.

To test for the resource movement effect, the following hypothesis is examined for both country groups:

H_{01}: *Increased commodity exports to China leads to a decline in the manufacturing sector i.e. the resource movement effect*

The second economic mechanism through which the Dutch disease can occur, is the spending effect. Similar to the resource movement effect, the hypothesis formulated to verify this phenomenon is as follows:

H_{02}: *Increased commodity exports to China leads to an appreciation in relative price levels i.e. the spending effect*

I will also examine whether exporting commodities to China affects the exporting country's economic growth, and hence capturing the overall economic impact of the Dutch disease. This is done through testing the third hypothesis:

H_{03}: *Countries exporting commodities to China experience slower economic growth*

Lastly, I will also examine if the political institutions within a country exporting commodities specifically to China, influences the Dutch disease effects proposed in hypotheses 1 to 3:

H_{04}: *Countries with less democratic political institutions who export commodities to China, experience worsening symptoms of the Dutch disease*

The next section will focus on the empirical Dutch disease studies, followed by section 2.5 which highlights two studies examining the possible correlation between China and the Dutch disease. This will give some first insights on whether we can expect any of these hypotheses to be empirically validated.

2.4 Empirical Findings

Unlike the theoretical underpinnings, the empirical studies based on the Dutch disease lack a general consensus. This section will be divided into two parts, with the first highlighting studies that find symptoms of the Dutch disease, and the second part highlighting those that do not.

2.4.1 The Dutch disease does exist

Using cross-country effects of resource endowments on various macroeconomic variables, Sachs and Warner (1995) confirm an inverse relationship between natural resource endowment and economic growth over a span of twenty years. This result is attributed to the Dutch disease. Even when including additional variables previously omitted, such as geographical or climate variables, Sachs and Warner (2001) once again confirm that natural resource abundance leads to low levels of economic growth.

Furthermore, Gylfason (2001) finds that there is a tendency for countries who are heavily dependent on natural resources to neglect other sectors of their economy, in particular human capital. The result of this is that an excess supply of people gravitate towards low-skill natural

resource centred industries and stay there, consequently failing to develop their own, or their children's, education. However, the government, and other authorities, are also liable as there is a tendency for officials to become both overconfident and overlook sound economic policies to promote education Gylfason (2001).

Birdsall, Pinckney & Sabot (2000) confirm the notion that resource rich countries invest less in their human capital, and state that this holds true even when different indicators and times are used, and regardless if per capita income is controlled for. They conclude that the effects of the Dutch disease can lower the rate of return to agricultural and human capital investments available to the poor. Furthermore, Birdsall et al. (2000) provide examples of countries, such as Indonesia, who have avoided the resource traps, commonly seen as inevitable, by pursing successful development strategies.

Further, Easterly and Levine (2002) apply a cross country approach to their study and find evidence that the quality of institutions has a crucial role on the impact natural resources can have on economic development. They argue that the negative effects experienced by resource rich countries works through the weakening of institutions. Thus, unlike Sachs and Warner (2001) who ascribe the Dutch disease as the main mechanism linking natural resource abundance to slow economic growth, Easterly and Levine (2002) expand the Dutch disease mechanism to include the role of institutions and how it impacts on the economic development of resource endowed countries.

2.4.2 The Dutch disease does not exist

Davis (1995) paper analyses the long-run economic and development performances of 22 mineral dependent countries and 57 non-mineral dependent economies, and find that the mineral dependent had higher average levels of development. The results suggest that mineral rich economics have not regressed in growth due to the Dutch disease the previous literature has claimed to accompany mineral booms. The study does not neglect the fact that spurious correlation could be the cause of such findings, such as common factors found in mineral rich economies stimulating their development that has nothing to do with minerals (Davis, 1995). For example, a mineral rich country could have a relatively stable political environment compared to other developing countries and hence, attracts foreign capital. Finally, Tunisia has been noted as the only economy that has transitioned from being a mineral producer with no adverse effects. Hence, other economies would need to attain similar results before the hypothesis of the Dutch disease can be finally dismissed (Davis, 1995).

Alexeev and Conrad (2009) corroborate these results, producing little or no evidence that countries endowed with natural resources, such as oil or minerals, have slow long term economic growth. In fact, by focusing on the level of per capita GDP, rather than on the rates of growth, their data suggest that the possession of natural resources enhances long term growth. Furthermore, the study shows that previous literature employing initial GDP as a control variable has led to bias results toward a negative effect of natural resources on institutions (Alexeev & Conrad, 2009). Ultimately, Alexeev & Conrad (2009) reveal that although the gains from oil has not improved institutions, it has not caused them to deteriorate either. Thus, the theory that resource richness leads to adverse effects on institutions, and harms growth, is deemed invalid. Additionally, whilst there have been examples of countries who have suffered worsening economy's and institutions, there have also been examples of countries who have benefited from a commodity boom, such as Botswana, Norway, and the 19th century USA (Su et al. 2016). Due to this, Su et al. (2016) suggest that the impact of resource abundance is unlikely to be uniform but rather conditional on other factors. Following this premise, researchers have begun to explore other possible factors and control for them. Recent studies have begun to recognize that the effects of resources depend on a combination of two variables: resources in comparison to GDP, and inequality in the non-resource private sector (Dunning, 2008). Furthermore, Luon & Weinthal (2010) propose that rather than employing governance as an intervening variable (found in previous Dutch disease literature), institutions can play an independent role. In this regard, Mehlum et al. (2006) conclude that there has been a mix of countries rich in natural resources who could be classified as either growth winners or losers. What ultimately distinguishes the two is the quality of their institutions. 'Grabber friendly' institutions in resource abundant economies will lead to low economic growth, yet 'producer friendly' institutions will enable their host countries to acquire the full benefits of the natural resources (Mehlum et al., 2006). Not only does this study contrast the claims of Sachs and Warner that institutions are not significant in relation to the resource curse, but it also contrasts the most common Dutch disease explanations i.e. natural resources crowds out growth-enabling traded goods production (Mehlum et al., 2006).

The lack of a unifying empirical approach can in some way explain the conflicting results often found in Dutch disease literature. However, the indeterminate results and approach's also leave scoop for new research to begin. How this study empirically approaches the Dutch

disease will be further elaborated on in section 3. The next section will focus on two studies linking China and the Dutch disease.

2.5 China and the Dutch Disease

Meyersson et al. (2008) and Su et al. (2016) are two studies that focus on China's economic rise as being a possible catalyst for the Dutch disease in commodity exporting countries. Their studies diverge in that they employ different empirical methods and focus on different country groups (the former on African countries and the latter on developing countries).

Meyersson et al. (2008) employs instrumental variables in order to explore the causal impact of China on Sub-Saharan Africa's political and economic development. They compare exports to China with exports to the World, USA and India, finding that exporting natural resources to China has a positive effect on economic growth and investment.

Motivated by the criticism surrounding China's presence in poor, yet resource-rich countries, Su et al. (2016) empirically test these effects of trade with China in a cross-country study. They adopt the system GMM method to help estimate a dynamic panel model with fixed effects. Their study does not support the notion of the resource curse in hindering economic development, nor of the existence of the Dutch disease. Additionally, *governance* was used as an intervening variable to examine institutional quality with no evidence of increased corruption or wasteful spending found due to trade with China. Similar to Meyersson et al. (2008), Su et al. (2016) conclude that the effects of exporting natural resources are conditional upon the *initial* quality of institutions.

For varying reasons however, neither of these studies focuses on 1. All natural resource exporting countries i.e. both studies focus on a particular region or status, either African or developing countries and 2. Do not directly measure the mechanisms of Dutch disease set in previous theoretical literature. Rather, both studies empirically test for the effects on economic development and institutions.

My study differs in that I empirically test for four effects (resource movement, spending effect, economic growth and political institutions) that have been well defined in the theoretical Dutch disease literature, and link them with China's commodity demands.

The following section outlines the empirical strategy and data I will use to test the effects.

3 Empirical Strategy

3.1. Specification

A panel data approach is adopted to deal with the limitations of using a cross-section framework (Manzano & Rigobon, 2001; Hsiao, 2007). Panel data provides more informative data by allowing the introduction of additional explanatory variables (Baltagi, 2008). Further, using panel data has the advantage of producing more accurate inferences of model parameters, with more degrees of freedom present than in using cross-sectional or time series data, and thus improves the efficiency of economic estimates (Hsiao, 2007). Van der Ploeg (2011) suggests that Dutch disease studies should move away from cross-section oriented models to panel-data regressions. Hence, the adoption of a panel-data approach in my thesis is in line with Van der Ploeg's (2011) recommendation, and follows previous studies employing panel data to test the Dutch disease (Manzano & Rigobon, 2011; Su et al. 2016). However, it should be noted that panel-data analysis cannot be considered a panacea for all econometric problems, and there are limitations including measurement errors and selectivity problems e.g. missing observations or cross-section dependence (Baltagi, 2008). Due to this study containing many cross-sectional units and relatively few time-series observations (De Hoyos & Sarafidis, 2006), cross-sectional dependence was tested and had been recognised. How I account for the limitations present is explained in the section 3.2.
The following models explain the goal of my thesis.

Equation 1 allows for the testing of hypothesis 1. Here, the logarithm of the net output of the manufacturing sector (*net output Manuf*) in country *i* at year *t* (measured as a percentage of GDP) is explained by the main independent variables of interest: the logarithm of the lagged value of total commodities exports to China (*CEC*) (β) expressed in US dollars, and lagged natural resource rents, *NR* (δ_1), a proxy for natural resource endowments expressed as a percentage of GDP.

$$ln(net\ output\ Manuf)_{i,t} = \alpha + \beta ln(CEC)_{i,t-1} + \delta_1 ln(NR)_{i,t-1} + \delta_2 Polity * ln(CEC)_{i,t-1} + \delta_3 Polity * NR_{i,t-1} + \theta_1 X_{i,t-1} + \nu_i + \gamma_i + \varepsilon_{i,t} \quad (1)$$

I include the interaction terms *Polity*ln(CEC)* (δ_2) and *Polity*NR* (δ_3) in the equation. The variable *Polity* ranges from -10 (strongly autocratic) to +10 (strongly democratic). This is followed by θ_1X, a matrix containing a number of control variables to minimise the

possibility that the effect of commodities exported to China on the manufacturing sector is driven by other factors. A detailed description of θ_1 can be found in section 4.3. Lastly, ν_i indicates country fixed effects, γ_i indicates year fixed effects, and $\varepsilon_{i,t}$ is an idiosyncratic error term.

In equation 1, a negative β and δ_1 suggests a contraction in the manufacturing sector due to exporting commodities to China and resource abundance respectively i.e. the resource movement effect. A negative sign for δ_2 and δ_3 indicates that for a given level of Polity, a higher level of commodities exported to China (or natural resource endowments) the more negative is the impact on the dependent variable.

Equation 2 captures the spending effect (hypothesis 2) by examining the changes in the independent variable, *CEC,* on the logarithm of the relative price level, *ln*(*PPP*), measured in current international U.S dollars.

$$ln(PPP)_{i,t} = \alpha + \beta ln(CEC)_{i,t-1} + \delta_1 ln(NR)_{i,t-1} + \delta_2 Polity * \ln(CEC)_{i,t-1} + \delta_3 Polity * NR_{i,t-1} + \varphi_1 Z_{i,t-1} + \nu_i + \gamma_i + \varepsilon_{i,t} \quad (2)$$

The independent variables, *CEC* (β) and *NR* (δ_1), are the same as described in equation 1, as are the interaction terms, *Polity*ln(CEC)* (δ_2) and *Polity*NR* (δ_3). However in equation 2, a positive β and δ_1 will be taken as evidence of the spending effect as higher price levels could be driven by increased commodities export to China or natural resource endowments respectively. Positive δ_2 and δ_3 indicate that for a given level of Polity, increased commodities exported to China, and increased in in natural resource endowments, leads to a greater appreciation on the *PPP*. $\varphi_1 Z$ is a matrix containing the control variables specific for testing PPP. A detailed description of the variables contained in this vector are found in section 4.3.

Lastly, equation 3 tests the effects of changes in the independent variable, CEC, on the logarithm of GDP per capita expressed in current US dollars.

$$ln(GDPpc)_{i,t} = \alpha + \beta ln(CEC)_{i,t-1} + \delta_1 ln(NR)_{i,t-1} + \delta_2 Polity * ln(CEC)_{i,t-1} + \delta_3 Polity * NR_{i,t-1} + \theta_2 X_{i,t-1} + \nu_i + \gamma_i + \varepsilon_{i,t} \quad (3)$$

The sign and effect of the independent variables, *CEC* (β), *NR* (δ_1), and interaction terms *Polity*ln(CEC)* (δ_2) and *Polity*NR* (δ_3), are the same as described in equation 1. A negative β indicates that exporting commodities to China decreases economic growth. This would be a similar interpretation if δ were negative, indicating that natural resource endowments negatively impact GDP per capita. The same control variables are maintained in matrix $\theta_2 X$ as those found in $\theta_1 X$ in Hypothesis 1.

3.2 Estimation Technique

The foremost problem in interpreting the results is that countries with certain ineffective economic and political characteristics may see governments shift investment towards the booming sectors. This could create a negative correlation between exporting natural resource to China (or the world at large) and macroeconomic outcomes, which will inevitably reflect both the effect of those characteristics, as well as any causal effect of natural resource exports. In order to mitigate the possibility of these effects much as possible I apply fixed effects to a panel of countries, in a similar fashion as Su et al. (2016). Hsiao (2007) highlights that in combining fixed effects with panel data, individual and/or time specific effects are allowed to be correlated with the explanatory variables. However, he states two specific disadvantages: a) the number of unknown parameters increases with the number of sample observations and b) fixed effects doesn't allow for the estimation of coefficients that are time-invariant. Hsiao (2007) recognizes that the weaknesses attributed to a fixed effects model are the strengths of a random effects model, and vice versa. Therefore, in order to determine which was most suitable for this study I conducted a Hausman test and was able to confirm that a fixed effects model was best suited. Additionally, past studies have pointed out that endogeneity could be a problem, amongst the other limitations of panel data, and therefore all independent and control variables have been lagged by 1 year to address endogeneity concerns.

4. Data

For the first part of the econometric analysis in my thesis, the three empirical models (equation 1-3) are applied to a total of 121 countries, over the period 1996 to 2014. My final sample contains a total of 1,953 observations. The second part of the analysis will focus on 32 Sub-Saharan African countries with a 528 observations.[1] The dependent variables used in the

[1] See Table 1 and 2 in Appendix for full list of total and Sub-Saharan countries respectively

models are described in section 4.1, followed by the main independent variables of interest in section 4.2. Lastly, section 4.3 elaborates on the control variables found in matrices X and Z.[2]

4.1 Dependent Variables

The data for all three dependent variables has been obtained from the World Bank database (2015). Manufacturing as percentage of GDP (hypothesis 1) refers to the industries belonging to ISIC division 15-37 and is calculated as the net output of a sector after subtracting intermediate inputs from total outputs. The indicator measuring the relative price level in hypothesis 2, PPP, is measured in current international U.S dollars. An international dollar has the same purchasing power over GDP as the U.S dollar has in the United States. The relative price level has been chosen in accordance with Corden and Neary's (1982) theoretical propositions and Sachs and Warner's (2001) study where they control for the relationship between price level and GDP to see if resource rich countries have additionally higher relative prices. Finally, GDP per capita is the gross domestic product divided by midyear population. This has been measured in current U.S dollars and used in hypothesis 3 to test whether exporting natural resources to China affects economic growth as Dutch disease theory postulates.

4.2 Independent Variables

The main independent variable of interest is *Commodities export to China* (CEC) and has been taken from Comtrade database (Comtrade, UN, 2015). The CEC trade values are based on the HS-code 25-27 and 72-80, and are a range of natural commodities reported in US dollars.

Natural resource rents (NR) was obtained from the World Bank data base (2015) and calculated as the sum of oil, natural gas, coal, mineral and forest rents. Finding a measure of a country's resource endowments was challenging as studies differ on sources and definitions to measure natural resources. Hence, although the disadvantage of NR is that it is measured as a percentage of GDP, and therefore determined by the relative size of a country's GDP, its advantages include allowing for comparison of resource rents across countries and that it is available from a reliable source. Due to the possible weakening of institutions in resource-rich countries as found by Easterly and Levine (2002), I include the variable *Polity,* as a proxy for institutions and I create two interaction terms, *Polity*ln(CEC)* and *Polity*NR*, to see how, for

[2] See Table 3 and 4 in Appendix for summary statistics of total and Sub-Saharan countries respectively

a given democracy level, a higher level of commodities exports to China, or natural resource endowments, impacts the dependent variables. *Polity* has been taken from INSCR Data Page (2014) and is a combined polity score calculated by subtracting the autocratic score from the democratic score, ranging from -10, for strongly autocratic countries, to +10, for strongly democratic countries.

4.3 Control Variables

It may be the case that the effects on the dependent variables are correlated with other unobserved macroeconomic influences. To control for this, a number of variables represented in the matrices X and Z, have been selected following previous studies.

The variable *Polity*, described in section 4.2, is kept as a control variable in both matrices X and Z, as are *Total exports to China* and *Total imports from China.*

I include total exports due to the observation that countries who export natural resources to China are also more likely to export to China in general. Additionally, I include Total imports to capture the total trade relations between China and it's trading partner. Both variables are reported in U.S dollars and have been obtained from BACI, an international trade database with a high level of product disaggregation (Su et al. 2016).

The rest of the control variables differ and therefore this section is divided into two parts. The first part describes the variables for hypotheses 1 and 3, and the second part elaborates on the variables used for hypothesis 2. All following data has been taken from the World Bank database (2015).

4.3.1 Resources movement effect and economic growth

Gross capital formation (*Gross capital formation*) is measured as a percentage of GDP and comprises of expenses on additions to the fixed assets of the economy, plus net changes in the income inventories. It is used in the regression as an indicator for economic outcomes and taken as a proxy for investment in the economy (Su et al., 2016).

Following Sachs and Warner (1995), I include the variable Trade (*Trade openness)* as a proxy for trade openness. It is the sum of exports and imports of goods and services measured as a share of gross domestic product, and expressed as percentage of GDP. It has been argued that at higher levels of resource abundance, economies are more likely to be open. Additionally, other studies have used this variable to control for that fact that if a country trades with China, it is also more likely to trade with the world in general.

According to Romer (1990), human capital determines the rate of economic growth and hence, I control for it here with the variable Population growth (*Population growth*). It is expressed as an annual percentage. Further, I include Military expenditure (*Military expenditure*) as used by Su et al. (2016) in their study. This variable is a measured as a percentage of GDP, and is an indicator of the proportion of national resources devoted for military activities and the burden this has on the other sectors of the economy. Hence, this variable controls for government priorities.

4.3.2 Spending effect

In order to test for the spending effect, different control variables are required then those of hypothesis 1 and 3. GDP growth (*GDP growth*) is used following the study by Su et al. (2016), and is measured as the annual percentage growth rate of GDP at market prices based on constant local currency. I include the variable Net barter terms of trade index (2000=100) (*Barter terms)* to control for the possibility of trade shocks, i.e. the increase in export prices relative to import prices, which can affect a country's real exchange rate and can therefore influence the dependent variable, PPP. It has been calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000. Additionally, Money and Quasi money (*M2*), expressed as percentage of GDP, controls any surplus in money growth which can increase the price of the non-tradeables, which in turn is linked with an increase in the real effective exchange rate (Lartey, et al., 2008). General Government final consumption expenditure (*Government consumption*) and Household final consumption expenditure (*Household consumption)* are both measured as a percentage of GDP, with the former comprising of all government current expenditures of purchases of goods and services and the latter covering the market value of all goods and services purchased by households. Both groups are controlled for as they are most likely to spend on the non-tradable good in the economy, thus placing upward pressure on relative price levels of a country and the exchange rate (Lartey et al., 2008).

5. Empirical estimation results

This section reports the results of both the total sample of countries and Sub-Saharan African countries, when tested against the aforementioned hypotheses. Sections 5.1 to 5.3 will relay the results for total exporting countries, whilst Sections 5.4 to 5.6 will relay the results when only Sub-Saharan African countries are tested.

5.1 Hypothesis 1: Total Countries

Increased commodity exports to China leads to a decline in the manufacturing sector i.e. the resource movement effect

Table 1:

Dependent variable	Log of net output of Manufacturing sector (% of GDP)			
	CEC only	NR only	Polity*ln(CEC)	Polity*NR
ln(Commodities Export to China) $_{i,t-1}$	0.00158		0.00242	0.00245
	(0.00384)		(0.00395)	(0.00399)
Natural resource rents$_{i,t-1}$		-0.00382**	-0.00489*	-0.00492*
		(0.00191)	(0.00271)	(0.00272)
*Polity*ln(CEC)* $_{i,t-1}$			-7.18e-05	
			(0.000128)	
*Polity*Natural resource rents* $_{i,t-1}$				-2.31e-05
				(4.01e-05)
Polity $_{i,t-1}$	-6.15e-05	-0.000458**	0.00114	0.000173
	(0.000350)	(0.000225)	(0.00224)	(0.000488)
ln(Total exports to China) $_{i,t-1}$	0.00358	-0.0339	0.00523	0.00599
	(0.0203)	(0.0283)	(0.0203)	(0.0203)
ln(Total imports from China) $_{i,t-1}$	-0.00483	-0.00239	-0.00231	-0.00235
	(0.00939)	(0.00784)	(0.00971)	(0.00975)
Gross capital formation$_{i,t-1}$	0.00411**	0.00347*	0.00379*	0.00389*
	(0.00205)	(0.00189)	(0.00201)	(0.00202)
ln(Trade Openness) $_{i,t-1}$	-0.00247	-0.00958	0.000324	0.000551
	(0.0182)	(0.0201)	(0.0185)	(0.0186)
Population growth $_{i,t-1}$	-0.00983	-0.0123	-0.0108	-0.0106
	(0.00725)	(0.00842)	(0.00720)	(0.00708)
Military expenditure $_{i,t-1}$	-0.00199***	-0.00158*	-0.00183***	-0.00181***
	(0.000457)	(0.000810)	(0.000479)	(0.000480)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Countries	109	121	109	109
Observations	1,454	1,953	1,454	1,454
R-squared	0.235	0.135	0.252	0.252

Robust standard errors in parentheses

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

Table 1 shows the results when testing the impact of exporting commodities to China on the manufacturing sector of total countries. Following the theory behind the resource movement effect, I expect a negative sign when looking at my main independent variable of interest, *ln(Commodities export to China)* (CEC). This is also the expected sign for the independent variable *Natural resource rents* (NR).

CEC is positive yet insignificant in column 1, indicating that the hypothesis cannot be empirically validated. This result remains when the interaction terms *Polity*ln(CEC)* and *Polity*NR* are included in columns 3 and 4, respectively.

NR, the proxy for natural resource endowments, is negative and significant in columns 2 to 4. This is a robust result in line with the intuition behind the resource movement effect. In columns 3 and 4, a 1% increase in natural resource endowments leads to an average decrease of 0.005 in the manufacturing sector at the 10% significance level.

The variable *Polity* is negative in columns 1 and 2, and positive in columns 3 and 4. It is significant in column 2 only when only NR is included in the regression.

The interaction term, *Polity*ln(CEC)* is negative and indicates that for a given level of Polity, a higher level of commodity exports to China leads to a more negative impact on the manufacturing sector. However, the term is statistically insignificant and further interpretation cannot be empirically validated.

The interaction term *Polity*NR* included in column 4 is used to compare the effect political institutions have in resource-rich countries, regardless if they export to China or not. The term is negative and insignificant, and once again further interpretation cannot be empirically validated.

In regards to the control variables, *Gross capital formation,* the proxy for investment in the economy, is positive and significant across all four columns. In columns 3 and 4, a 1% increase in investment leads to an average increase of 0.004 in the manufacturing sector, at the 10% significance level. This is an expected result as increasing investment in the economy could include increasing investments directly aimed at the manufacturing sector.

The control variable *Military expenditure* is negative throughout the four columns and is significant at the 1% level. A 1% increase in military expenditure decreases the manufacturing sector by an average of 0.002. This is arguably unsurprising as a government who devotes more of its resources towards its military, can draw these resources away from other sectors of the economy, such as the manufacturing sector. Thus, the control variables reveal that there are other macroeconomic factors that need to be taken into account in order

to capture the full effect of exporting commodities to China on the manufacturing sectors, and thus to realize the existence of the resource movement effect.

5.2 Hypothesis 2: Total Countries

Increased commodity exports to China leads to an appreciation in the relative price level of resource exporting countries i.e. the spending effect

Table 2:

Dependent variable	Log of PPP (current international $)			
	CEC only	NR only	Polity*ln(CEC)	Polity*NR
ln(Commodities Export to China)$_{i,t-1}$	0.00192		0.00230	0.00227
	(0.00227)		(0.00219)	(0.00219)
Natural resource rents$_{i,t-1}$		-0.00289*	-0.00448***	-0.00455***
		(0.00156)	(0.00160)	(0.00158)
*Polity*ln(CEC)* $_{i,t-1}$			-1.20e-05	
			(0.000118)	
*Polity*Natural resource rents* $_{i,t-1}$				-6.49e-05**
				(2.56e-05)
Polity $_{i,t-1}$	0.0776***	0.0652***	0.0756***	0.0761***
	(0.0151)	(0.0137)	(0.0149)	(0.0148)
ln(Total Export to China) $_{i,t-1}$	0.00755	0.00638*	0.00833	0.00833
	(0.00598)	(0.00339)	(0.00581)	(0.00581)
ln(Total Import from China) $_{i,t-1}$	0.00339***	0.00439***	0.00373***	0.00381***
	(0.00115)	(0.00101)	(0.000955)	(0.000964)
GDP growth$_{i,t-1}$	0.0255	0.0329	0.0356	0.0391
	(0.0477)	(0.0419)	(0.0462)	(0.0468)
ln(Barter terms)$_{i,t-1}$	0.00885	0.00591	0.00565	0.00520
	(0.0206)	(0.0212)	(0.0216)	(0.0215)
M2$_{i,t-1}$	-0.00683***	-0.00592***	-0.00778***	-0.00785***
	(0.00179)	(0.00136)	(0.00185)	(0.00182)
Government consumption$_{i,t-1}$	-6.27e-05	-0.000227	-4.79e-05	-8.92e-05
	(0.000685)	(0.000665)	(0.000699)	(0.000698)
Household consumption$_{i,t-1}$	0.0776***	0.0652***	0.0756***	0.0761***
	(0.0151)	(0.0137)	(0.0149)	(0.0148)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Countries	101	111	101	101
Observations	1,296	1,681	1,296	1,296
R-squared	0.925	0.926	0.928	0.929

Robust standard errors in parentheses

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

Table 2 reveals the effect on the relative price level in total countries due to exporting commodities to China. According to the economic theory of the spending effect, I would expect a positive sign for the main independent variable of interest, *ln(Commodities export to China)* (CEC), and for *Natural resource rents* (NR), indicating an appreciation in the relative price levels of a commodity exporting country.

CEC is positive in columns 1, 3, and 4, however it is insignificant, and remains so, in all columns. This positive sign confirms the economic intuition that increased exports of commodities to China can cause an appreciation in relative price levels, however this is not reflected in the econometric results and the effect does not significantly differ from zero.

The variable NR is both negative and significant in the columns 2 - 4. This result is contrary to the Dutch disease theory stipulating that increased endowments of natural resources can cause the spending effect. This is a robust result and in columns 3 and 4, where the interaction terms are included, an increase of 1% in natural resource endowments leads to a depreciation of 0.005 in relative price levels at the 1% significant level.

The *Polity* variable is positive and significant at the 1% level in all 4 columns. In columns 3 and 4, a 1% increase in democracy levels leads to a 0.076 appreciation in relative price levels.

The interaction term, *Polity*ln(CEC),* is negative and statistically insignificant, thus further interpretation cannot be empirically validated.

*Polity*NR* is also negative, though it is statistically significant at the 5% level, indicating that for a given level of commodity exports to China, a higher *Polity* value leads to a greater depreciation in relative price levels.

As for the control variables, *Total imports from China* and *Household consumption* are both positive and significant at the 1% level. Additionally, *M2* is also significant at the 1% level, though negative, and indicates that a 1% increase in money growth leads to a depreciation in relative price levels.

5.3 Hypothesis 3: Total Countries

Countries exporting commodities to China experience slower economic growth

Table 3:

Dependent variable	Log of GDP per capita (current US $)			
	CEC only	NR only	Polity*ln(CEC)	Polity*NR
ln(Commodities Export to China)$_{i,t-1}$	0.00298		0.00302	0.00301
	(0.00537)		(0.00531)	(0.00529)
Natural resource rents$_{i,t-1}$		0.000102	-0.000250	-0.000274
		(0.00304)	(0.00306)	(0.00307)
*Polity*ln(CEC)* $_{i,t-1}$			-4.44e-05	
			(0.000237)	
*Polity*Natural resource rents* $_{i,t-1}$				2.68e-05
				(3.08e-05)
Polity $_{i,t-1}$	0.000226	0.000898	0.000974	-8.29e-05
	(0.000576)	(0.000832)	(0.00413)	(0.000729)
Total Export to China $_{i,t-1}$	0.172***	0.162***	0.172***	0.171***
	(0.0305)	(0.0315)	(0.0305)	(0.0307)
Total Import from China$_{i,t-1}$	0.00498	0.00268	0.00515	0.00507
	(0.00941)	(0.00530)	(0.00946)	(0.00947)
Gross capital formation $_{i,t-1}$	0.00398	0.00269	0.00393	0.00391
	(0.00401)	(0.00309)	(0.00405)	(0.00400)
ln(Trade openness) $_{i,t-1}$	0.0193	0.0215	0.0195	0.0190
	(0.0206)	(0.0197)	(0.0207)	(0.0209)
Population growth $_{i,t-1}$	-0.0183	-0.0118	-0.0186	-0.0181
	(0.0116)	(0.00886)	(0.0118)	(0.0116)
Military expenditure $_{i,t-1}$	0.00164**	0.00162**	0.00164**	0.00164**
	(0.000740)	(0.000661)	(0.000739)	(0.000738)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Countries	109	121	109	109
Observations	1,451	1,949	1,451	1,451
R-squared	0.841	0.836	0.841	0.841

Robust standard errors in parentheses

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

Table 3 reveals the empirical results of exporting commodities to China on economic growth. According to the established Dutch disease literature, a country that is endowed with natural resources, and is dependent on their exportation, can exhibit signs of de-industrialisation, or declining economic growth. Due to this, I expect the variables capturing exports of natural resources to China, CEC, and the endowment of natural resources, NR, would have negative signs to indicate the possible detrimental effects on GDP per capita.

In column 1, 3, and 4, CEC is positive and therefore contradicts the economic intuition of the Dutch disease theory. The positive sign indicates that increased exports of commodities specifically to China increases growth in the exporting country's economy. However, CEC does not significantly differ from zero. This is also the case for NR, used as proxy for natural resource endowments. It is positive in column 2, and negative in columns 3 and 4. The negative sign is in line with the Dutch disease postulations stating natural resource endowments can lead to a decrease in economic growth, though it is insignificant across all three columns.

The *Polity* variable is positive in columns 1 – 3, and negative in column 4, and is statistically insignificant in all columns.

The interaction term in column 3, *Polity*ln(CEC),* is negative and reveals that for a given level of *Polity*, a higher level of exporting commodities to China leads to a more negative impact on the exporting country's GDP per capita. However, it is also statistically insignificant and therefore further conclusions cannot be confidently drawn from this variable.

The interaction term in column 4, *Polity*NR,* has a positive sign and for a given level of commodity exports to China, higher levels of democracy lead to a more positive impact on GDP per capita. However, this interaction term is also statistically insignificant.

The control variable *Total exports to China* and *Military expenditure* are both positive and significant at the 1% and 5% level respectively. Hence, the results indicate that exporting to China on average is positive for economic growth, as is military expenditure by governments.

5.4 Hypothesis 1: Sub-Saharan African Countries

Increased commodity exports to China leads a decline in the manufacturing sector i.e. the resource movement effect

Table 4:

Dependent variable	Log of net output of Manufacturing sector (% of GDP)			
	CEC only	NR only	Polity*ln(CEC)	Polity*NR
ln(Commodities Export to China) $_{i,t-1}$	0.00136		0.0387*	0.00629
	(0.00653)		(0.0194)	(0.00765)
Natural resource rents$_{i,t-1}$		-0.0122**	-0.00934**	-0.0175**
		(0.00527)	(0.00340)	(0.00788)
*Polity*ln(CEC)* $_{i,t-1}$			-0.0123*	
			(0.00679)	
*Polity*Natural resource rents* $_{i,t-1}$				-0.000133
				(0.000131)
Polity $_{i,t-1}$	-0.000217	-0.000616	-0.00980	0.00181
	(0.00109)	(0.000581)	(0.0174)	(0.00263)
ln(Total exports to China) $_{i,t-1}$	-0.0545*	-0.0450	-0.0259	-0.0603**
	(0.0294)	(0.0557)	(0.0457)	(0.0289)
ln(Total imports from China) $_{i,t-1}$	0.0314*	-0.00295	0.0555**	0.0451**
	(0.0176)	(0.0119)	(0.0198)	(0.0200)
Gross capital formation$_{i,t-1}$	0.00185	-0.00123	-0.000619	-0.000704
	(0.00325)	(0.00281)	(0.00287)	(0.00274)
ln(Trade Openness) $_{i,t-1}$	0.0596	0.194**	0.0161	0.0894
	(0.0753)	(0.0769)	(0.0772)	(0.0708)
Population growth $_{i,t-1}$	-0.00676	-0.0289	-0.0226	-0.0157
	(0.0193)	(0.0221)	(0.0201)	(0.0188)
Military expenditure $_{i,t-1}$	-0.00437**	-0.00116	-0.00419***	-0.00405**
	(0.00163)	(0.00138)	(0.00136)	(0.00149)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Countries	27	32	19	27
Observations	326	528	206	326
R-squared	0.225	0.179	0.531	0.359

Robust standard errors in parentheses

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

Table 4 captures the impact on the manufacturing sector in Sub-Saharan African countries who export commodities to China.

CEC is positive across all columns 1, 3, and 4. A positive sign is contrary to the intuition behind the Dutch disease theory and indicates that exporting commodities to China does not lead to a movement of resources away from the manufacturing sector. In column 3, when the interaction term *Polity*ln(CEC)* is included, it is statistically significant and reveals that a 1% increase in exporting commodities to China leads to an increase of 0.039 in the manufacturing sector of Sub-Saharan African countries, at the 10% level.

NR has a negative sign in columns 2 - 4, in line with the resource movement effect, stipulating that countries endowed with natural resources can expect a contraction in their manufacturing sector. This is a robust finding and significant at the 5% level. In column 3, a 1% increase in NR leads to a decrease of 0.009 in the manufacturing sector. When *Polity*NR* is included in column 4, a 1% increase in NR leads to a 0.018 decrease in the manufacturing sector.

Polity is found to be negative in columns 1 to 3 indicating that for a 1% increase in democracy levels, a decrease in the manufacturing sector is expected. In column 4 however, *Polity* is positive, yet in all four columns the variable remains insignificant.

The result for the interaction term *Polity*ln(CEC)* reveals that it is negative and significant at the 10% level. Thus, for a given level of Polity, a higher level of commodities exports to China leads to a more negative impact on the Sub-Saharan African manufacturing sector.

*Polity*NR* is also negative, however it is insignificant and further interpretation cannot be empirically validated.

The variable controlling for total exports from China is both negative and significant in columns 1 and 4, and remains negative through all four columns. The variable controlling for total imports from China is positive in columns 1, 3 and 4, and significant at the 5% level in column 3 and 4.

Lastly, an increase in 1% military expenditure leads to an average decrease of 0.004 in the manufacturing sector, at the 1% significance level in columns 3 and 4. The intuition behind the result is the same as in hypothesis 1 for total countries (section 5.1)

5.5 Hypothesis 2: Sub-Saharan African Countries

Increased commodity exports to China leads to an appreciation in the relative price level of resource exporting countries i.e. the spending effect

Table 5:

Dependent variable	Log of PPP (current international $)			
	CEC only	NR only	Polity*ln(CEC)	Polity*NR
ln(Commodities Export to China)$_{i,t-1}$	0.00778**		0.0147	0.00881**
	(0.00357)		(0.0127)	(0.00343)
Natural resource rents$_{i,t-1}$		-0.00483*	0.00235	-0.00647**
		(0.00241)	(0.00192)	(0.00278)
*Polity*ln(CEC)* $_{i,t-1}$			-0.00419	
			(0.00606)	
*Polity*Natural resource rents* $_{i,t-1}$				-6.99e-05
				(6.61e-05)
Polity $_{i,t-1}$	-0.000349	4.36e-05	0.00338	0.000690
	(0.00175)	(0.00154)	(0.00861)	(0.00285)
ln(Total Export to China) $_{i,t-1}$	0.0625	0.0387	0.0677*	0.0649
	(0.0439)	(0.0276)	(0.0341)	(0.0409)
ln(Total Import from China) $_{i,t-1}$	0.00926	0.0119**	0.0137	0.0111
	(0.00848)	(0.00453)	(0.0102)	(0.00809)
GDP growth$_{i,t-1}$	0.00535**	0.00480**	0.00526*	0.00476*
	(0.00248)	(0.00188)	(0.00289)	(0.00244)
ln(Barter terms)$_{i,t-1}$	0.0773	0.0688	-0.0110	0.0787
	(0.0899)	(0.0655)	(0.103)	(0.0782)
M2$_{i,t-1}$	-0.00763	-0.0173***	-0.0128*	-0.0147**
	(0.00698)	(0.00506)	(0.00693)	(0.00602)
Government consumption$_{i,t-1}$	-0.00265	-0.00647***	-0.000223	-0.00366*
	(0.00225)	(0.00171)	(0.00214)	(0.00192)
Household consumption$_{i,t-1}$	-0.000127	-0.000569	-0.000281	0.000323
	(0.000857)	(0.000983)	(0.00250)	(0.000758)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Countries	27	32	18	27
Observations	299	485	188	299
R-squared	0.916	0.919	0.934	0.923

Robust standard errors in parentheses

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

Table 5 captures the effect on the relative price levels in Sub-Saharan African countries when commodities are exported to China. In order for the spending effect to be made apparent, the independent variables would need to be positive.

In column 1 and 4, CEC is both positive and significant at the 5% level. In column 4, where the interaction term *Polity*NR* is included, a 1% increase in exporting commodities to China leads to an appreciation of 0.009 in the relative price levels of Sub-Saharan African countries. This result reflects the expected effect stipulated by the Dutch disease literature.

The variable NR, is significant at the 5% level in column 4, yet negative. Thus the econometric findings do not reflect the corresponding theory of the spending effect and indicates that a 1% increase in owning natural resource endowments leads to a depreciation of 0.006 in relative price levels, ceteris paribus.

The variable *Polity* is negative in column 1, indicating that for a given level of polity, the higher the level of commodity exports leads to a greater depreciation in relative price levels. In columns 2– 4, the variable is positive. However, in all columns *Polity* remains insignificant.

Further, the interaction variable *Polity*ln(CEC)* in column 3, has a negative sign yet it is not statistically significant and therefore cannot be empirically validated. This result is the same for the interaction term, *Polity*NR*. It is both negative and insignificant.

For the control variables, *Total exports to China* is positive and significant at the 10% level in column 3, and *Total imports from China* is also positive, yet significant at the 5% level in column 2 only. *GDP growth* is positive and significant in all four columns. In columns 3 and 4, a 1% increase in GDP growth leads to an average appreciation of 0.005 in relative price levels at the 10% significance level. Contrary to this, *M2* and *Government consumption* are negative and significant at the 5% and 1% level respectively in column 4. A 1% increase in *M2* and *Government consumption* leads to the depreciation in relative price levels of 0.015 and 0.004 respectively.

5.6 Hypothesis 3: Sub-Saharan African Countries

Countries exporting commodities to China have declining levels of economic growth

Table 6:

Dependent variable	Log of GDP per capita (current US $)			
	CEC only	NR only	Polity*ln(CEC)	Polity*NR
ln(Commodities Export to China)$_{i,t-1}$	-0.00709		-0.00791	-0.00260
	(0.00863)		(0.00978)	(0.00872)
Natural resource rents$_{i,t-1}$		-0.00909	0.00225	-0.00960
		(0.00659)	(0.00302)	(0.00696)
*Polity*ln(CEC)* $_{i,t-1}$			-0.000579	
			(0.00477)	
*Polity*Natural resource rents* $_{i,t-1}$				0.000152
				(0.000114)
Polity $_{i,t-1}$	-0.000818	0.000329	-0.0198	-0.00387
	(0.00199)	(0.00177)	(0.0155)	(0.00314)
Total Export to China $_{i,t-1}$	0.0714	0.0330	0.0795	0.0594
	(0.0534)	(0.0325)	(0.0693)	(0.0524)
Total Import from China$_{i,t-1}$	0.0176	0.00454	0.0167	0.0248
	(0.0147)	(0.00672)	(0.0140)	(0.0148)
Gross capital formation $_{i,t-1}$	0.00636**	0.00568**	0.00373	0.00464*
	(0.00279)	(0.00229)	(0.00356)	(0.00246)
ln(Trade openness) $_{i,t-1}$	0.0809	-0.0374	0.167	0.101
	(0.0984)	(0.0565)	(0.105)	(0.0879)
Population growth $_{i,t-1}$	-0.0359	-0.0188	-0.0506	-0.0444
	(0.0249)	(0.0172)	(0.0402)	(0.0278)
Military expenditure $_{i,t-1}$	0.00418***	0.00189*	0.00447***	0.00447***
	(0.00124)	(0.00105)	(0.00153)	(0.00129)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Number of country1	27	32	19	27
Observations	326	528	206	326
R-squared	0.833	0.802	0.878	0.846

Robust standard errors in parentheses

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

Table 6 captures the effect of exporting commodities to China on the GDP per capita of Sub-

Saharan African countries.

The results for the main independent variable of interest, CEC, reveal that exporting commodities to China is both negative and insignificant in all columns.

NR is also insignificant in all columns, and negative in columns 2 and 4.

The negative sign for both variables is in line with what is expected from the Dutch disease theory, stipulating resource endowments can lead to a decline in economic growth. However, as neither CEC, nor NR, is statistically significant, further interpretation cannot be empirically validated.

For the variable *Polity*, it is negative in columns 1, 3 and 4, indicating that for a given level of Polity, the higher the commodity exports to China, the more negative is the impact on GDP per capita in Sub-Saharan African countries.

This is also the case for both interaction terms, *Polity*ln(CEC)* and *Polity*NR,* in columns 3 and 4 respectively. *Polity*ln(CEC)* is negative, thus for a given level of Polity, a higher level of commodity exports to China, leads to a more negative impact on GDP per capita in Sub-Saharan African countries. However, *Polity*NR* is positive and for a given level of Polity, a higher level of commodities export to China leads to a more positive impact on GDP per capita. However, both interaction terms are insignificant and the effect of the terms do not significantly differ from zero.

In regards to the control variables, *Gross capital formation* is positive and significant throughout all four columns. This indicates that increased investment in the economy is associated with an increase in economic growth in Sub-Saharan African countries. This is also the case for *military expenditure,* which is positive and significant at the 1% level in all four columns.

6. Discussion

6.1 Results summary

Due to the extensiveness of the Dutch disease literature, the intuition behind the results was strong. However, the findings proved to be somewhat mixed and ultimately the econometric results did not reflect the Dutch disease theory. Four hypotheses were tested for both total countries and Sub-Saharan African countries, following previous studies who have linked the Dutch disease effects with China.

Hypothesis 1 tested for the resource movement effect, and therefore a negative sign was expected for the main independent variables. However, the main variable of interest, *Commodities export to China* (CEC), is positive when tested in both total countries and Sub-

Saharan African countries. CEC is insignificant when included for total countries, however it is significant when regressed in Sub-Saharan African. From this result, I reject the Null hypothesis (H_{01}), and increased commodity exports by Sub-Saharan African countries to China does not lead to a decline in the manufacturing sector i.e. there is no resource movement effect. The positive sign is contrary to the expected effect and indicates that increased exports of commodities to China does not lead to a shift of resources away from manufacturing, or the 'lagging', sector in Sub-Saharan African countries.

The variable *Natural resource rents* (NR) is negative and significant for both total countries and Sub-Saharan African countries, confirming the theory of the resource movement effect. This result indicates that countries who are endowed with natural commodities tend to shift their capital away from the lagging sector towards the booming sector. Although there is evidence of natural resources paying a role in shifting resources away from the manufacturing sector, there is no indication that exporting these natural commodities specifically to China causes the resource movement effect, thus there are other factors that need to be taken into account in order to realize the potential economic harm this may have to a resource rich country.

Hypothesis 2 was used to test if there is an impact on the relative price levels of countries exporting commodities to China.

In line with the Dutch disease theory, CEC is positive when tested in both total countries, and Sub-Saharan African countries. CEC is statistically insignificant for total countries and cannot be empirically validated. When CEC is tested with Sub-Saharan African countries only, CEC is both positive and significant. With this result, I fail to reject the Null hypothesis (H_{02}), and increased commodity exports to China leads to the spending effect in Sub-Saharan African countries, i.e. an appreciation in relative price levels. In confirming the existence of the spending effect, the non-tradeables sector of a given Sub-Saharan African economy sees its prices rise relative to the prices of the tradeables sectors.

For both total countries and Sub-Saharan African countries, NR was found to be negative and significant. A negative sign indicates that increased natural resource endowments leads to a depreciation in the relative price levels, contrary to the expected spending effect results. Hence, the endowment of natural resources does not seem to influence the relative price levels of an economy in the manner anticipated by Dutch disease theory. Thus, a country who is resource rich does not necessarily experience the spending effect, yet if a Sub-Saharan African country exports these commodities, there is an impact on their respective relative price levels leading to an appreciation.

Hypothesis 3 was used to test if there is an impact on economic growth for countries who export commodities to China, thus testing the overarching theory of the Dutch disease.

When CEC was regressed in the models for both total countries and Sub-Saharan African countries, it was found to be insignificant. As the coefficient for either country group does not significantly differ from zero, I reject the Null hypothesis (H_{03}) that countries exporting commodities to China have declining levels of economic growth.

The variable NR is negative for total countries and Sub-Saharan African countries. Further, it is statistically insignificant in both country groups and cannot be empirically validated. Thus, although the economic theory linking natural resource abundance to economic decline was theoretically strong, and the sign of the NR variable reveals this to be true, the econometrics conclusions do not support this.

Lastly, all three equations, and their corresponding regressions, include the interaction terms *Polity*ln(CEC)* and *Polity*NR*. The interaction terms focus on the democracy level of a country exporting commodities to China and resource endowment respectively, and the impact on the three dependent variables capturing the Dutch disease effects i.e. the manufacturing sector, the relative price level, and economic growth of a country.

When *Polity*ln(CEC)* is tested for total countries, it is negative for all three hypotheses and there is no statistically significant evidence between the political institutions of a country and exporting commodities to China correlating with worsening Dutch disease symptoms. This is also the result when *Polity*ln(CEC)* is tested in hypothesis 2 and 3 in Sub-Saharan African countries. Thus, as the interaction term does not significantly differ from zero I reject the Null hypothesis (H_{04}) for both groups.

Only when *Polity*ln(CEC)* is tested in hypothesis 1 for Sub-Saharan African countries, is the interaction term significant. It has a negative sign indicating that for a given Polity level, a higher level of commodities exports to China leads to a more negative effect on Sub-Saharan African manufacturing sectors. Hence, for this hypothesis I am unable to reject the Null hypothesis (H_{04}) that Sub-Saharan countries who have less democratic political institutions and who export commodities to China, experience worsening symptoms of the resource movement effect.

These results are similar to those found when the interaction term *Polity*NR* was included in the regression. For both total countries and Sub-Saharan African countries, the sign of the term remained negative and insignificant. Only when *Polity*NR* was regressed in Hypothesis 2 for total countries was the term significant. This result indicates that a country endowed

with natural resource, a higher *Polity* value leads to a larger depreciation in relative price levels.

6.2 Limitations

The overall empirical results in my thesis do not support the conjecture that China's increased demand in natural resources has led to symptoms of the Dutch disease appearing. However, it should be reiterated that this does not imply such a phenomenon does not exist, only that the models do not present the expected results and that there are shortcomings present within the chosen data set and model. This includes the variables adopted as a proxy of natural resource abundance (natural resource rents) and commodities exports to China. Previous empirical studies have focused on specific commodities, such as oil and/or minerals. I have chosen to use a broader definition of resource endowments, and thus it could be the case that finding resource based effects depends on the type of natural resource defined and employed in the model. Finding data for natural resource endowments is a challenge and is not easily available from a reliable source. Thus, having such data available would be beneficial for future studies. An additional limitation is the fact that many low-income and developing countries used in the regressions have much of the missing data and this this could influence the results. Further, previous studies have separately instrumented for natural resource exports to China to determine the existence of the Dutch disease (Meyersson et al., 2008). I did not venture to apply these due the ambiguity and limited data available when choosing appropriate instrumental variables. Hence, finding the appropriate instrumental variable could add more depth to Dutch disease models and could provide more statistically significant results.

Additionally, there is a diverse range of econometric models used in previous Dutch disease studies that produce significant results. I use a panel data fixed effects model as a starting point. Future studies could be aimed at further developing the model to incorporate more sophisticated econometric approaches, and thus potentially revealing different relationships. A particular relationship of interest is the role political institutions have for commodity exporting countries. Although I include the interaction term *Polity*ln(CEC)* to determine if the quality of institutions did play a role, it did not produce statistically significant results and further research is evidently needed to focus solely on this important relationship.

7. Conclusion

The mid 1990's up until present day has seen China rapidly ascend to its current position as the world's second largest economy. This has consequently lead to a flurry of academic work

in analysing her growth and its impact from both political and economic perspectives. Chinas' engine of growth has been characterised by an export driven economic model with the underpinning of a large, highly educated, population. In order to sustain her population, the government has been actively seeking new trading partners to satisfy commodity demands.

Using a fixed effects panel data approach, I aimed to understand the relationship of Chinas' economic growth on her trading partners, and if this reflects traditional economic theory. My principal goal was to find whether China's pursuit of commodities presented symptoms of the Dutch disease in both a total of 121 countries and then, in a smaller group of 32 Sub-Saharan African countries. Without a strong common empirical model to analyse this phenomenon and with previous divergent empirical results, the panel data fixed effects model offered a foundation on which I could build on to test various factors I considered important to assess exporting commodities to China and the Dutch disease. My thesis only tested for the effects stated by Corden and Neary (1982) and defined in the core model (Corden, 1984). My statistical findings are mixed and do not present strong evidence of a direct link between exporting commodities to China and the negative effects of the Dutch disease. The results show that for Sub-Saharan African countries, exporting commodities to China leads to a positive shift towards the manufacturing sector, contrary to the expected result of resource movement effect. However, the results also show that exporting commodities to China by Sub-Saharan African countries can lead to an appreciation in relative price levels, thus confirming the presence of the spending effect for this country group. I also test for the role institutions play in commodity exporting countries. However, the findings were not robust and only in hypothesis 1 was there statistically significant evidence that for a given level of polity, higher commodity exports to China leads to a more negative impact on the manufacturing sector.

Lastly, although China remains the world's second largest economy, new global players are rising, such as India, who are rapidly growing as technology based economies. Future studies can use the Dutch disease theory to analyse how the composure of Chinese trade will change due to new emerging economies, and how this impacts resource exporting countries. This raises further questions in regards to the Dutch disease. As new economies emerge, with large populations, increasing pressure is placed on these governments to forge new trading partners, as China has done. Hence, based on the theory, Dutch disease could well emerge in resource exporting countries as demand for commodities continues to increase. Due to the detrimental effects Dutch disease can have, it is pivotal that there is constant analysis as to its existence, particularly as resource endowed countries tend to be developing countries. With time it will

be possible to extend the model to a larger timeframe and to include other fast growing economies to test for the presence of the Dutch disease, hence allowing policy makers to understand and work with this knowledge.

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World Bank, World Development Indicators (2015)

Appendix

Table 1: Total country list

Afghanistan	Costa Rica	Ireland	Nepal	St. Vinc. & the Grenadines
Albania	Cote d'Ivoire	Italy	Netherlands	Sudan
Algeria	Croatia	Jamaica	Nicaragua	Suriname
Antigua & Barbuda	Cuba	Japan	Niger	Swaziland
Armenia	Cyprus	Jordan	Nigeria	Sweden
Aruba	Czech Republic	Kazakhstan	Norway	Switzerland
Australia	Denmark	Kenya	Oman	Tajikistan
Austria	Djibouti	Kiribati	Pakistan	Tanzania
Azerbaijan	Dominica	Korea, Rep.	Papua New Guinea	Thailand
Bahamas, The	Dominican Rep.	Kosovo	Paraguay	Timor-Leste
Bangladesh	Ecuador	Kuwait	Peru	Togo
Belarus	Egypt	Kyrgyz	Philippines	Tonga
Belgium	El Salvador	Lao PDR	Poland	Trinidad & Tobago
Belize	Estonia	Latvia	Portugal	Tunisia
Benin	Ethiopia	Lebanon	Puerto Rico	Turkey
Bermuda	Fiji	Lesotho	Qatar	Turkmenistan
Bhutan	Finland	Lithuania	Romania	Tuvalu
Bolivia	France	Luxembourg	Russian	Uganda
Bosnia & Herzg.	Gabon	Macedonia	Rwanda	Ukraine
Botswana	Gambia, The	Madagascar	Sao Tome & Principe	United Arab Emirates
Brazil	Georgia	Malawi	Saudi Arabia	United Kingdom
Bruni Darussalam	Germany	Malaysia	Senegal	United States
Burkina Faso	Ghana	Maldives	Serbia	Uruguay

Burundi	Greece	Malta	Seychelles	Uzbekistan
Cabo Verde	Grenada	Mauritania	Sierra Leone	Vanuatu
Cambodia	Guatemala	Mauritius	Singapore	Venezuela, RB
Cameroon	Guinea	Mexico	Slovak Republic	Vietnam
Central Afr. Rep.	Guyana	Micronesia	Slovenia	Yemen, Rep
Chad	Honduras	Moldova	Solomon Islands	Zambia
Chile	Hungary	Mongolia	South Africa	Zimbabwe
Colombia	Iceland	Montenegro	Spain	
Comoros	India	Morocco	Sri Lanka	
Congo, Dem. Rep.	Indonesia	Mozambique	St. Kitts & Nevis	
Congo, Rep.	Iran	Namibia	St. Lucia	

Table 2: Sub-Saharan country list

Benin	Congo, Rep.	Madagascar	Sao Tome & Principe	Zambia
Botswana	Cote d'Ivoire	Malawi	Senegal	Zimbabwe
Burkina Faso	Ethiopia	Mauritania	Sierra Leone	
Burundi	Gabon	Mauritius	South Africa	
Cabo Verde	Gambia, The	Mozambique	Sudan	
Central African Republic	Ghana	Namibia	Swaziland	
Chad	Guinea	Niger	Tanzania	
Comoros	Kenya	Nigeria	Togo	
Congo, Dem. Rep.	Lesotho	Rwanda	Uganda	

Table 3: Total country summary statistics

	Obs.	Mean	St.dev	Min	Max
Dependent variables					
log of net output of Manufacturing (% of GDP)	3,167	2.427	0.679	-1.439	3.857
log of PPP (current international US$)	3,173	24.42	2.298	16.67	30.49
log of GDP per capita (current US $)	3,141	8.099	1.593	4.612	11.67
Independent variables[i]					
log of Commodities export to China (CEC)	1,858	16.68	4.000	0.693	25.06
Natural resource rents (% of GDP)	3,001	9.715	14.30	0	92.02
*Polity*log of CEC*	1,719	44.28	235.0	-1,965	250.6
*Polity*log of NR*	2,359	-2.021	234.1	-3,575	629.5
Control variables					
log of Polity	1,602	1.970	0.439	0	2.303
log of Total exports to China	2,810	19.23	2.844	7.862	26.63
log of Total import from China	2,677	17.82	4.141	0	25.99
Gross capital formation (% of GDP)	3,000	23.50	8.350	-2.424	74.82
log of Trade openness	2,654	0.221	1.083	-5.491	4.927
Population growth (annual %)	3,006	4.538	2.210	-0.938	19.26
Military expenditure (% of GDP)	2,998	66.83	25.59	1.061	100
GDP growth (annual %)	2,950	3.969	4.688	-36.05	88.96
Government consumption (% of GDP)	2,999	64.86	17.52	-10.84	133.1
Household consumption (% of GDP)	3,000	52.31	34.40	1.617	250.1
log of Barter terms	2,510	4.652	0.254	3.063	5.673
Money and quasi money, M2 (% of GDP)	2,426	3.720	0.680	0.481	9.817

Table 4: Sub-Saharan countries summary statistics

	Obs.	Mean	St.dev	Min	Max
Dependent variables					
log of net output of Manufacturing (% of GDP)	722	2.167	0.644	-1.439	3.821
log of PPP (current international US$)	722	23.41	1.459	19.29	27.68
log of GDP per capita (current US $)	717	6.556	1.042	4.612	9.353
Independent variables[ii]					
log of Commodities export to China (CEC)	343	14.79	3.982	3.178	24.27
Natural resource rents (% of GDP)	684	12.99	14.30	0.00185	77.05
*Polity*log of CEC*	211	27.79	11.71	0	53.37
*Polity*log of NR*	609	2.477	259.6	-3,575	454.5
Control variables					
log of Polity	643	0.0218	16.36	-88	10
log of Total exports to China	628	18.06	2.302	10.92	23.55
log of Total import from China	585	16.45	3.728	0	24.60
Gross capital formation (% of GDP)	684	20.60	9.846	-2.424	74.82
log of Trade openness	683	0.832	0.452	-1.832	2.078
Population growth (annual %)	684	4.375	2.345	1.012	15.62
Military expenditure (% of GDP)	684	47.01	28.58	2.684	99.27
GDP growth (annual %)	679	4.526	4.767	-36.05	33.74
Government consumption (% of GDP)	684	74.14	16.04	27.57	133.1
Household consumption (% of GDP)	684	29.92	18.74	1.617	151.5
log of Barter terms	656	4.679	0.299	3.063	5.461
Money and quasi money, M2 (% of GDP)	628	3.267	0.686	0.481	9.817

[i] All independent and control variables have been lagged by 1 year in order to control for endogeneity concerns

[ii] All independent and control variables have been lagged by 1 year in order to control for endogeneity concerns