Aid for Africa: A case of the Dutch Disease?

A comparative master thesis on the possible existence of the Dutch Disease in Sub-Saharan Africa and its policy implications.

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Abstract

This paper aims to identify one of the possible causes as to why aid is ineffective in Sub-Saharan Africa in the late 20th and the beginning of the 21st century. A number of prominent economists have linked this phenomenon to the Dutch Disease, otherwise also known as the resource curse. The disease occurs when a country experiences a wealth effect due to the discovery of natural resources, and subsequently perform poorer economically due to an appreciation of the exchange rate (spending effect) and a stagnating manufacturing sector (resource movement effect). This paper uses a fixed effect panel regression model to determine whether this wealth effect occurred following higher levels of aid being sent to Sub-Saharan Africa over the period of 1960 to 2013. From the general equilibrium model constructed at the start of this paper, the spending effect is expected to hold while the resource movement is expected not to occur. Empirically, the symptom of the spending effect is shown to indeed be present, but only if the inflow of aid has a large enough volume at a given point in time. This paper finds that the resource movement is not present, as the lagged effect of aid on the manufacturing sector is robustly positive. This paper concludes that the Dutch Disease did not occur, despite the symptoms being present as they are offset in the long run, a finding shared by Torvik (2001). These symptoms appear to become more pronounced as the volume of aid flowing into a given economy increases. This merits the policy implication that aid inflows should be moderated and spread over a longer period of time in order to avoid the Dutch Disease symptoms transgressing into an actual Disease.

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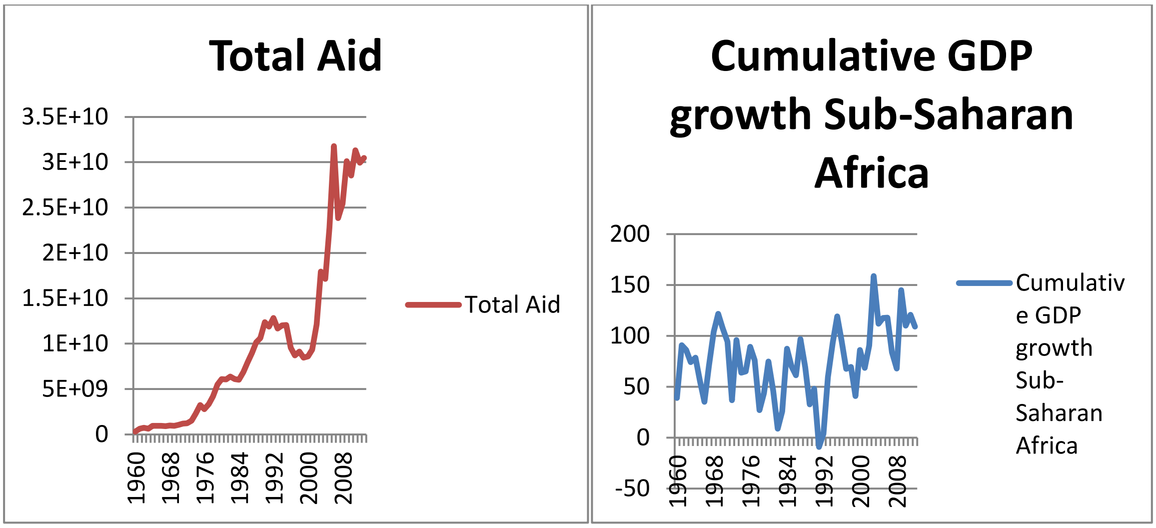
1. **Introduction:**

One of the core economic questions that divide many present day economists is the query as to whether aid is effective in eradicating poverty (The Economist, 2013). This question sprouted from the fact that despite developing economies receiving a record amount of development aid, namely 125.6 billion in just 2012 (World Bank, 2014), history has proven that this rarely translates into an economic success story (Burnside & Dollar, 1998). Some Economists argue that aid has even had a negative impact on African economies (Banerjee & Newman, 2003; Benjamin, Devarajan, & Weiner, 1989). This finding is echoed by the empirical relationship between total aid flowing into Sub-Saharan Africa and the cumulative GDP growth of this region. Higher levels of aid seem not to translate into higher levels of GDP growth.



Graph 1.1 (Source: World Bank (2015))

Easterly, Levine, & Roodman (2013), whom typify a larger group of economists, argue that the flow of aid has simply not been sufficient and has to increase. Again other economists state that Africa as a continent is not succeeding despite receiving the most net aid due to its frequent war-torn and politically unstable state (Bategeka & Matovu, 2011). Regardless of the view held by the reader, this begs the overall question as to whether the current development aid distribution system is sustainable in the long run or whether changes should be implemented.

The first step in changing the method in which aid is distributed is by identifying the key flaws in the current mechanism (Benjamin, Devarajan, & Weiner, 1989). Newer theories suggest that the lacking effectiveness of aid can be attributed to the Dutch Disease (Doucouliagos & Paldam, 2009). In classic literature, the Dutch Disease describes a phenomenon where an economy is worse off following the discovery of natural resources (Corden & Neary, 1982). This intuitively contradicting outcome is the result of two different economic channels. The first is the spending effect, which describes an exchange rate appreciation due to increased levels of wealth following the discovery of natural resources.

The second is the resource movement effect, which occurs due to a shift in factors of production from the manufacturing sector to the service sector (Corden & Neary, 1982). Both effects worsen the competitiveness of a country's exports, and hence lower economic growth (Corden & Neary, 1982).

This paper aims to extend this classical Dutch Disease model by investigating whether a similar effect holds true when countries receive aid. Previous literature has shown that both create a wealth shock, which merits the theory that the Dutch Disease can occur following an inflow of aid (Adam & Bevan, 2006). If the Dutch Disease indeed occurs, it could be a possible explanation as to why Sub-Saharan countries still perform relatively poorly to their South American and Asian counterparts (Anderson, 2014). In order to verify whether the Dutch Disease took place, this paper investigates Sub-Saharan Africa over the period of 1960 to 2013. This time-frame and geographical optic has been chosen as it has been testament to the largest increase in development aid in recent history (Bräutigam, 2004). Apart from establishing whether the Dutch Disease took place, this research also addresses the subsequent policy implications. This paper therefore aims to answer the following research question:

"Did the Dutch Disease occur in Sub-Saharan Africa over the period 1960-2013 following increased levels of development aid and what are the policy implications?"

This paper finds that there is indeed a robust negative relationship between aid received by a country and its Gross Domestic Product per capita. However, when investigating whether this effect can be attributed to the Dutch Disease it becomes apparent that the *Dutch Disease does not always occur when aid is received.* The spending effect seems to have a lagged effect on the Real Effective Exchange rate, but the effect does not persist through the different robustness tests. Instead this paper finds that a rise in income invariably causes an exchange rate appreciation, which is actually part of the spending effect mechanism (Corden & Neary, 1982). This suggests that a rise in income, *although it does not have to be attributed to an increase in aid*, can cause the spending effect to occur. This result has important implications as a sufficiently large wealth shock can cause the spending effect to occur.

At first glance the Resource Movement effect is also reflected by the data as there is a negative relationship between aid received and the size of the agricultural sector. However, the long term effect seems to be significantly positive. Previous research has attributed this to seasonality (Edwards C. , 1989). However (Fan, Hazell, & Thorat, 2000) and this paper instead credit this to the instantaneous cost and subsequent lagged benefits of investment in the agricultural sector. It is therefore unclear whether the resource movement effect occurred. This ambiguity has been frequently echoed by previous research (Breisinger, XinshenDiao, Schweickert, & Wiebelt, 2009).

The final section of this paper is devoted to possible policy implications as a result of this research. Taking the Millennium goal time frame of 2000 to 2015 as representative of a sudden large inflow of aid, this paper finds that the symptoms of the Dutch Disease become stronger. The exchange rate appreciates more and the instantaneous decrease in agricultural output becomes greater while the lagged payoff of the investments stays the same. The main policy implication this has is the fact that it is mutually beneficial to spread the inflow of aid into a given country over a longer period of time in order to allow local governments to counteract these Dutch Disease symptoms (Barder, 2006).

The crucial difference between this paper and previous research is the fact that until now only separate countries were observed when investigating the Dutch Disease as the cross-country differences were thought to be too great. This paper uses a fixed-effect panel regression model to alleviate these country specific effects (Liker, Augustyniak, & Duncan, 1985). This allows for making a general conclusion as to whether aid has caused the Dutch Disease to occur in Sub-Saharan Africa, a statement which has not been made previously.

The paper is structured as follows. The literature review stipulates the short and long run dynamics of the Dutch Disease according to classical and more recent literature. The subsequent section explores empirical research on the Dutch Disease in Africa and its results. Based on both the classical model and empirical specifications a theoretical general equilibrium model is produced which captures all of the different assumptions made. These outcomes are then tested empirically by a fixed-effects panel regression model and the results are discussed. In order to test for the reliability of these results they are subjected to a number of robustness tests. Concluding remarks are given in the final section of this paper.

2. Literature Review:

2.1.1 Classic Dutch Disease Literature and short run effects

As depicted by previous Dutch disease literature, the normal circumstance under which this economic phenomenon occurs is with the discovery of natural resources (Corden & Neary, 1982). It was first coined the Dutch disease by “The Economist” in 1970 after a slow-down of the Dutch economy following oil and gas discoveries in the North Sea (The Economist, 1970). This was the beginning of what economists tend to call “classical Dutch Disease literature”.

Classic Dutch Disease literature describes the contraction of an economy through two channels after an rise in wealth due to an increase in natural resources a country possesses. Corden & Neary (1982) describe a two factor by 3 sector economy. The factors of production are labor and capital, while the three sectors are divided into the tradable (manufacturing) sector, the non-tradable sector (also known as the service sector) and the booming sector. The latter sector is used to illustrate the industry which profits most as a result from the natural resource finding.

Davis (1995) went on to examine this booming industry sector by investigating the effect of increased productivity in the mining industry on an economy. He describes the booming sector as being the mining companies involved in extracting the crude resources and industries used as subsidiaries in the extraction process (Davis, 1995). Prati (2006) showed that these subsidiaries often entail infrastructure companies whom are charged with the constructing roads and production plants to facilitate the extraction process.

The manufacturing sector is assumed to be capital intensive, while the non-tradable or service sector is assumed to be relatively labor dependent (Corden & Neary, 1982). Labor is assumed to be perfectly mobile, and as such can move freely between these different industries (Corden & Neary, 1982).This is a key assumption which is necessary for the resource movement effect to occur.

Another key assumption for the classic Dutch Disease effect to take place is the fact that the country or economy in question has to be *a price taker for tradable goods*. The prices for the domestic tradable goods are set according to world prices. This however is, crucially, not the case for non-traded goods (Fielding & Gibson, 2012). As is explained later, this is key for the spending effect to take place.

The Dutch Disease leads to the stagnation of an economy following a resource gain. A counterintuitive finding as the general perception of finding scarce resources has previously been linked to strengthening economic performance (Adam, 2008). The Dutch disease defies this reasoning through two mechanisms known as *the resource movement effect* and the *spending effect* (Corden & Neary, 1982).

The spending effect takes place as follows. In classic literature, the increase in resources within an economy is modeled as a positive wealth shock, also known as a windfall gain (Corden & Neary, 1982). This describes the sudden increase in wealth within an economy due to a discovery of natural resources. As a result, *and with the assumption that consumers have a higher tendency to consume rather than invest*, consumption will increase. Specifically, demand for non-tradable services or luxury goods increases disproportionally with respect to the amount of tradable goods demanded. This is an assumption posed by Corden and Neary (1982) in their initial paper when they observed the change in spending patterns of Dutch Households following the North Sea oil and gas reserves. Following the discovery of gas and oil, Dutch households demanded more non-tradable (service) goods as opposed to tradable goods (Corden & Neary, 1982). As stated before, *tradable goods prices are set according to world prices while non-tradable prices adhere to domestic prices*. As a result, increased demand for non-tradable goods causes the price of this service to increase.

Within classic Dutch Disease literature the real effective exchange rate, denoted by British notation (Copeland, 2008)[1], may be represented by the following equation:

$$REER_{it} = \frac{P_{tradable_{it}}}{P_{non-tradable_{it}}} \qquad equation\ 1$$

As the price for non-tradable goods increases relative to the price of tradable goods, the real effective exchange decreases in absolute terms. This, in accordance with exchange rate literature, refers to a real effective exchange rate appreciation. An appreciation will result in a deterioration of the competitiveness of the export sector. As the domestic exchange rate appreciates, domestic goods become more expensive with respect to their foreign counterparts. This in turn means that it is more expensive for foreign countries to import these relatively expensive domestic goods, and hence exports will decrease following an exchange rate appreciation. Lower levels of exports may therefore result in a worsening of a country's economic position. Cordon and Neary (1982) coined this as the *spending effect.*

The second channel through which the Dutch Disease can occur is known as the *resource movement effect.* Due to the windfall gain within this three sector economy there will be an increase in consumption of non-tradable goods (Burnside & Dollar, 1998). This increase in demand for the non-tradable good will increase the price and consequently, the production in this sector will become more attractive relative to producing in the tradable sector. Under the assumption that in the short run the total amount of labor in an economy stays fixed and is perfectly mobile, there will be a shift in the labor force from the tradable sector to the non-tradable sector (Corden & Neary, 1982). The tradable-goods sector in classic literature is described as the manufacturing sector and the non-tradable-goods sector is known as the service sector (Corden & Neary, 1982). The shift towards the service sector means the real wage in this sector will increase and will draw more skilled labor into the non-tradable sector. This movement will cause wages to increase overall in an economy. As the price for traded goods are determined by the world price, the higher wage in terms of traded goods will increase the costs of producing these goods and consequently worsens the traded sector profitability (Rajan & Subramanian, Aid and growth: What does the corss-country evidence really show?, 2005). This decreases the competitiveness of an economy and will also lead to a decline in exports which can have similar consequences for an economy as the spending effect (Benjamin, Devarajan, & Weiner, 1989).

2.1.2 Long run dynamics and offsetting the Dutch Disease

The aforementioned classic argument has since been augmented in a multitude of ways. One key argument which has come forth is the alterations which take place once you examine the Dutch Disease in the long run.

[1] The IMF and World Bank also define the real effective exchange rate inversely. As stated above, the real effective exchange rate is expressed as the price of tradable goods relative to the price of non-tradable goods. A subsequent decrease in the REER denotes a real effective exchange rate appreciation and vice versa.

In the long run, the discovery of resources can simultaneously increase the productivity and supply of non-traded goods given that the monetary gains from this finding are re-invested in human capital (Bonacich, 1972). By investing in primary, secondary and tertiary schooling labor productivity can be heightened in such a way that it mitigates the excess demand for non-tradable goods. As aggregate supply and demand are equated, the price for non-tradable goods will not increase relative to tradable goods and hence there will be no real effective exchange rate appreciation, mitigating the spending effect.

Previous literature has found that in the long run the wealth gained is not only used for consumption but also for domestic investment, both private by also by local governments (Bourdet, 2007). An example of such an investment can be financing imparting skills or educational facilities. This, ceteris paribus, will increase the availability of skilled labor within an economy and offsets the initial resource and spending effects on the relative price of traded goods to non-traded goods as the excess demand for skilled labor is met and there are no wage discrepancies. Torvik (2001) therefore suggests that the impact of the Dutch Disease on a given economy may vary depending on what the additional wealth is invested in. If additional resources are spent on the manufacturing of traded goods or factors, such as imported capital goods or foreign consultants, and on factors not limited by supply (which according to Torvik (2001) could for example be skilled labor as described previously), the effect of the Dutch Disease can be nullified. *The notion that the effect the Dutch Disease can have on a given economy can be changed is one of the corner stones of this paper.*

First the effect of the volume of aid to a given economy is investigated. When the effect is established further research is performed as to how potential Dutch Disease effects can be mitigated and consequently policy recommendations are given. The generally observed pattern is that aid is directed from developed economies (net aid exporters) towards developing economies (net aid importers) (Nkusu, 2004; Acosta, Lartey, & Mandelman, 2002). As a result, the classic Dutch Disease model has been altered multiple times in order to replicate a developing economy as the initial model created by Cordon & Neary (1982) was used to describe a developed country. The following section highlights the key changes made to the core Dutch Disease model which are also implemented by this research.

2.2 The Dutch Disease, empirical literature and techniques on developing economies

Classic literature has since been changed in order to be applied to less developed economies in an attempt to explain the frequently observed economic slowdown in such countries following a natural resource discovery (Acosta, Lartey, & Mandelman, 2002).

The first change made was to extend the Dutch Disease investigation from a single country to a multi-country setting in order to make be able to make a general conclusion. Rajan and Subramanian (2011) investigated the effect of aid on growth and specifically of the manufacturing sector within a developing country. If the Dutch Disease occurs, an inflow of aid is expected to decrease the size and growth of the manufacturing sector. *A key contribution of this paper is that country specific effects, or variations between countries and across manufacturing sectors are corrected for* (Rajan & Subramanian, 2011). This is done by conducting a cross-country context, a technique which was also previously advocated by Rajan and Zingales (1998)[2]. The main finding by Rajan and Subramanian (2011) is that aid inflows into an economy have systematic adverse effects on the developing economy's competitiveness as indicated by the decreasing growth of the export industries, which is in accordance with the core Dutch Disease model. They find that the main channel through which the Dutch Disease takes place is a real exchange rate appreciation, also known as the spending effect (Corden & Neary, 1982). This result should however be interpreted with care according to Fielding & Gibson (2012), as the exchange rate is a variable which is influenced by a large host of fundamentals within the economy (Copeland, 2008). For example Adenauer (1998), finds that a large portion of the real exchange rate appreciation is not caused by the Dutch Disease, but instead by increased inflation due to the large increase in consumption of non-tradable goods. The main insight of Rajan and Subramanian (2011) used by this paper will therefore be the methodology, which not only corrects for country specific effects but also for omitted variable bias and reverse causation. This is further elaborated on in the data and methodology section.

The realization that the effect of the Dutch disease is country specific is further echoed by Kang, Pruti and Rebucci (2013). By using a heterogeneous panel VAR model the dynamic response of imports, exports and most importantly GDP per capita is investigated after modelling a global aid shock. The surprising result is that, depending on the country, the global aid shock can influence these three factors either positively or negatively (Kang, Prati, & Rebucci, 2013). Another concrete paper finding of this paper is the notion that when aid reduces both exports and imports, it also reduces growth, which is an assumption shared by this research (Kang, Prati, & Rebucci, 2013).

Vos (1998) finds that the effect aid has on overall GDP per capita growth can be influenced by the government, which has very interesting implications as it highlights the possibility of counteracting the Dutch Disease through monetary or fiscal intervention. Vos (1998) shows that governments with a managed or fixed exchange rate are less liable to experience the spending effect following an increase in economy-wide wealth. The proposition that governments can influence and even mitigate the Dutch Disease is also of importance to this paper. If governments can mitigate the slowdown of their manufacturing sectors following an influx of aid, why do we still see so many cases where the opposite holds true?

[2] By nullifying the country specific variation a common issue in Dutch Disease literature is avoided, namely that of omitted variable bias (Clarke, 2005). Omitted variable bias occurs when a model incorrectly neglects one or more key causal factors (Clarke, 2005). The bias comes forth from the fact that the model, when excluding the key causal factors, compensates by over or under valuating the effect of another independent variable.

The notion that the Dutch Disease phenomenon can be averted is also *theoretically* represented by Owen Barder (2006) in "A Policymakers' Guide to Dutch Disease". Barder shows that in the long run the effect of an appreciating currency (the spending effect) does not have to have a negative effect on the volume of exports from a country and that the overall impact on GDP per capita growth is limited (Barder, 2006). His second argument focuses on the supply side argument of aid induced Dutch Disease. This is an argument which has been explored by a number of different authors, such as Bourguignon (2007). The main line of this argument includes the notion that if aid is spent on the supply side of an economy, for example by investing in education, governmental and health institutions or infrastructure, any loss of competitiveness caused by the Dutch Disease can be offset. Investing in the supply side of an economy has the added benefit of increasing the share of skilled workers. If this is the case, there will be no wage differential between the manufacturing and service sector as there is no excess demand for skilled labor by the service sector (Prati, 2006). If there is no difference in wage across industry sectors, workers do not have an incentive to move as the wages are equated between both sectors. This means that the resource movement effect and hence the stagnation of the manufacturing sector will be less severe if not nullified.

In the core Dutch Disease model the welfare of an economy is defined as aggregate output. However, Barder (2006) along with Bräutigam (2004) question this statement. They say that the welfare of an economy also depends on their respective investment and consumption levels and possibilities. The additional consumption and investment as a result of the "windfall gain" or wealth shock frequently exceeds the adverse effect the influx of aid has on output (Bräutigam, 2004). Barder (2006) therefore stresses that the macroeconomic effect of aid in the short run may transgress to the long run if the flow of aid is sustained. This paper will encompass this finding by using different approximations in the empirical section for sustained aid as compared to sudden shocks in aid following an event.

When looking at country specific examples, one of the most prominent pieces of Dutch Disease aid literature includes Tanzania and Uganda, mainly due to their recent track records on growth, policy implementation and poverty reduction (Nyoni, 1998). Adam and Bevan (2006) build on the previous notion that investing aid in the supply side of an economy can alleviate the Dutch Disease effect. They go one step further and look specifically at which type of supply side investment yields the largest return to aid, which in this case turns out to be public infrastructure investment. The rationale behind this finding is the fact that investing more in infrastructure leads to a productivity bias in favor of the non-tradable (or service) section production sector. This however comes at the expense of the income distribution within an economy. As the non-tradable sector in developing economies is located in predominantly urban areas relative to rural areas, there is an asymmetric distribution of wealth (Adam & Bevan, 2006). (Un)skilled urban households benefit more as compared to rural households, both skilled and unskilled. Bategeka and Matovu (2011) have similar findings in the case of the oil discovery in the Ugandan river delta in the late 1990's. A predominant portion of the wealth is spent on non-tradable goods by urban households. This paper argues that a similar phenomenon should hold true in the case of increased levels of aid flowing into an economy. In order to investigate the effectiveness of aid, a distinction will therefore also be made between rural and urban households in the empirical specification of this paper. Additionally, Bategeka and Matovu (2011) find that Sub-Saharan African countries are characterized as having relatively large agricultural sectors as compared to manufacturing sectors. They have therefore chosen to use the agricultural sector to portray the manufacturing sector in developing economies. As this is an assumption adopted by multiple papers whom look at Sub-Saharan Africa (Kang, Prati, & Rebucci, 2013; Fielding & Gibson, 2012), this research will use a similar approach.

Taking the above literature into account several observations can be made. First of all, due to the ambiguity of the empirical literature this paper investigates the effect of aid through a fixed panel regression to nullify country specific effect as postulated by (Arellano & Bond, 1991). The second consideration taken from past literature is the notion that long run Dutch Disease effect differ from short run effects. The third aspect incorporated from the literature discussed is the theory that continuous aid is more effective as compared to sudden aid shocks (Davis, 1995). A distinction will be made by replicating the aid shock as a dummy at a given year, while continuous aid is included as an independent variable in the regression equation. This is in accordance with previous statistical literature as stipulated by David, George, Bruce, Layth, & Duckworth (2011). The final assumption incorporated is the notion that Sub-Saharan developing economies are predominantly agricultural intensive.

This paper incorporates the previous empirical literature with the core Dutch Disease model proposed by Cordon & Neary (1982) to construct a general equilibrium model. The predicted outcomes of the theoretical model are used to construct hypotheses which are then tested empirically.

3. The general equilibrium model of the Dutch Disease in a developing economy

3.1.1 One-sector developing country: Assumptions

The general equilibrium model that is going to be used in this paper is based on the Cordon and Neary (1982) core Dutch Disease model. Salter (1989) went on to expand the core model by constructing a general equilibrium model which incorporates description of the spending effect. This model is also known as the Australian model. Before examining the full multi-sector model, this paper first elaborates on the single sector model as it replicates many of the findings which are empirically tested. This allows for a comparison as to whether the theoretical framework of the Dutch Disease, when altered to fit a developing economy, can accurately predict the empirical findings.

Several assumptions have to be made. First of all, the economy used throughout this analysis is modeled as a small, static country which produces only two types of goods, namely traded and non-traded goods (Benjamin, Devarajan, & Weiner, 1989). Furthermore, the current account balance is assumed to be exogenous and tradable goods adhere to world prices. The economy in question is assumed to be small, meaning that there is no influence of the price of tradable goods on the world price (Benjamin, Devarajan, & Weiner, 1989). The non-tradable goods sector on the other hand determines its prices domestically. The flexible factor prices cause the factor markets to clear.

If this economy were to receive aid, the production possibility frontier for this economy will expand and shift to the right. Assuming neither the traded nor non-traded good is relatively inferior, the increase in wealth in this economy leads to increased demand for both goods (Benjamin, Devarajan, & Weiner, 1989). However, as also shown by previous empirical literature, the increase in demand for non-tradable goods is disproportionally larger for non-tradable goods relative to tradable goods. This is reflected in the model as the price of non-tradable is allowed to rise, while the price for tradable goods remains equated to the world price. This can lead to both the *spending effect* and *resource movement effect* as previously depicted (Corden & Neary, 1982)

The core model is characterized by a variety of different assumptions. Incorporating previous empirical literature in developing economies allows for a relaxation of some of these restrictive assumptions as to heighten the representability of this theoretical model. The assumption of world market prices is therefore relaxed. In the core model tradable-goods prices are determined in world market prices while non-tradable goods prices are determined domestically. This hinges on the assumption that the tradable-goods produced by the manufacturing sector are perfect substitutes relative to their foreign counterparts (Hausman, 1996). If this is not the case, and goods are imperfect substitutes, the amount of imports and exports can no longer be directly compared. This is important to note as the *spending effect,* reflected by the appreciation of the real exchange rate, may be dependent on whether an economy is import or export intensive.

3.1.2 One-sector developing country: The model

This theoretical one sector model incorporates the abovementioned changed assumption and as such accurately portrays the underlying economic forces in a developing economy following an inflow of aid. As a reference point, this paper will proceed from the base assumption of an economy that produces a single good with fixed output in the short run and output is either *exported* or *consumed domestically* (F. Bourguignon, 2007). Where $\bar{X}$ represents the production output of a single good, which is consumed domestically, *denoted by C*, or exported to a foreign country as *shown by E*. This yields the following:

$$\bar{X} = C + E \qquad equation\ 2$$

This paper modifies equation 2 to reflect the notion of consumers also purchase imports, a finding also introduced by Oomes & Kalcheva (2007). Consumers are assumed to have CES utility functions over both goods. This means that more variety within an economy is always preferred, and hence consumers prefer consuming both non-tradable and tradable goods as opposed to only one type (Benjamin, Devarajan, & Weiner, 1989). The elasticity of substitution between the two goods is given by σ and M denotes the quantity imported. $P_m$is the price of tradable goods imported expressed in domestic currency, P is the price of domestic goods and k is a constant. Demand is now determined by the relative price:

$$\frac{P}{M} = k\left[\frac{P_m}{P}\right]^{\sigma} \qquad equation\ 3$$

In a small economy, as assumed in the core model (Corden & Neary, 1982), the world price $(\bar{P}_w)$ for tradable importable goods is given by the following:

$$P_m = e\bar{P}_w \qquad equation\ 4$$

It is important to define e, the exchange rate, as the rate between dollars and the respective country currency. The amount of exports demanded is given by equation 5. The demand for exports is downward sloping with the domestic price for exported tradable goods relative to the world market price (Gale & Mendez, 1998). Where η represents the elasticity of demand, which is taken to be greater than unity. E_0 reflects a constant amount of exports.

$$E = E_0 P^{-\eta} \qquad equation\ 5$$

The final equation relates expenditure with income within a developing economy. The national income not only includes the value of output at given world market prices and fixed output (see equation 1), but also *the inflow of foreign currency.* This is crucial within the model*, as it reflects the amount of aid coming into an economy*. If a developing economy receives aid, it is converted to its local currency (Bourdet & Falck, 2007). Therefore this inflow is an accurate representation of the amount of aid coming into a country over a given period of time. This means that if "A" represents the amount of foreign currency flowing into an economy as a result of aid:

$$eA + P\bar{X} = PC + P_m M \qquad equation\ 6$$

This equation gives a good representation of the dynamics in a multi-sectorial model (Benjamin, Devarajan, & Weiner, 1989). Another assumption which has to be made is the fact that as the exchange rate is fixed, it will also act as the numeraire good in the system (Gale & Mendez, 1998) The change in the exchange rate is captured by the relative change in (non)-tradable goods prices, which in turn determine the real effective exchange rate. The spending and resource movement effect is still captured as all good prices are expressed in terms of the exchange rate. This modification allows for the theoretical deduction that the real exchange rate is defined as the relative price of foreign goods to domestic goods which will allow for an easier representation of an appreciation in this model setting (Vos, 1998).

Logarithmically differentiating yields four linear equations. For equation 2:

$$0 = \frac{C}{\bar{\bar{X}}} dln(C) + \left(1 - \frac{C}{\bar{\bar{X}}}\right) dln(E) \qquad equation\ 7$$

For equation 3:

$$dlnC - dlnM = -\sigma dlnP \qquad equation\ 8$$

For equation 4:

$$\frac{A}{A + P\bar{\bar{X}}} dln(A) + \left(1 - \frac{A}{A + P\bar{\bar{X}}}\right) dlnP = \frac{PC}{PC + P_m M}(dlnP + dlnC) + (1 - \frac{PC}{PC + P_m M}) dlnM \qquad equation\ 9$$

And finally for equation 5:

$$dlnE = -\eta dlnP \qquad equation\ 10$$

This system of linear equation allows solving for the percentage change in price ($d\, ln\, P$) in terms of $dlnA$, which represents the percentage change of foreign aid inflow. This allows us to see how the price of goods react to an inflow of aid into an economy. Solving for the general price level in terms of “A” (representing aid) yields:

$$dln\, P = \frac{\frac{A}{(A + P\bar{\bar{X}})}}{\frac{\eta\left(1 - \frac{C}{\bar{\bar{X}}}\right)}{\frac{C}{\bar{\bar{X}}}} + \sigma\left(1 - \frac{PC}{PC + P_m M}\right) + \frac{PC}{PC + P_m M} - (1 - \frac{A}{(A + P\bar{\bar{X}})})} * dlnA \qquad eq.11$$

Certain deductions may be made from equation 11. If imported goods and domestically produced goods are perfect substitutes, σ goes to infinity (Adenauer & Vagassky, 1998). As can be seen above, if this is the case then P will tend to zero. This makes intuitive sense, no real exchange rate appreciation can result if no non-traded goods are in the system and all of the increased income is used on imports.

The second deduction shows that η, which shows the relationship between aid and prices (and subsequently the exchange rate), is positive and greater than one. This means that if η, the export elasticity of demand, is greater than 1, an increase in aid will result in an increase in the general price level P. With our definition of the exchange rate level, this result reflects a real effective exchange rate appreciation, also known as the spending effect (Fisher, 1995). This result is in line with general Dutch Disease literature. These results show that with a relatively simplistic model the spending effect is already captured and as such this paper expects the spending effect to occur empirically as well.

3.2 Three-sector developing country-the model

In this section the supply side of a developing economy is analyzed in accordance with the important findings found in the empirical discussion earlier. Production in a developing economy, when implemented correctly, can offset the Dutch Disease (Bräutigam, 2004). It is therefore crucial to map the migration of factors across and between sectors to capture the *resource movement effect.*

To replicate the effect the following assumptions are made. There are 2 sectors in the economy. This is a deviation from the conventional 3 sector model presented in general literature (Corden & Neary, 1982), but the mechanism through which the manufacturing sector has the potential to stagnate remains the same. *The non-traded good sector is represented by N and the import-competing tradable goods sector is represented by D*. Consequently, P_N and P_D represent the prices for non-tradable and tradable goods respectively. The assumption is made that only tradable goods are exported and are subsequently liable to world market prices (Benjamin, Devarajan, & Weiner, 1989). Labor is the only mobile factor, while under fixed supply $\bar{L}$. The production functions for both the non-tradable and tradable goods sectors are given by Cobb-Douglas functions.

$$D = AL_D^a \quad where\ a < 1 \qquad equation\ 12$$

$$N = BL_N^\beta \quad where\ \beta < 1 \qquad equation\ 13$$

The first order conditions for profit maximizing labor input are therefore:

$$w = \frac{aP_D D}{L_D} \quad (tradable\ goods\ sector) \qquad equation\ 14$$

$$w = \frac{\beta P_N N}{L_N} \quad (non - tradable\ goods\ sector) \qquad equation\ 15$$

Where P_D and P_N represent the respective output prices for both sectors. In line with Jones (1965), the assumption is made that the utility functions also adhere to the Cobb-Douglas assumption. This implies that a constant portion of national income, denoted here by Y, is spent on the non-traded goods industry within this given economy. *Recall that the non-traded goods sector is represented by N as stipulated in equation 12*. This is reflected by the following equality:

$$P_N N = \gamma_N Y \qquad equation\ 16$$

The amount spent on tradable goods is subdivided among domestic produce and imported goods. This division is determined by the elasticity of substitution, which similarly to the one-sector model is given by σ. The amount of domestic goods (D) relative to the amount of imported goods (M) with price $P_M$consumed is given by:

$$\frac{D}{M} = k\left(\frac{P_M}{P_D}\right)^{\sigma} \qquad equation\ 17$$

Apart from determining the share of income spent on respective goods, the national income should also be determined. This is given by:

$$Y = P_N N + P_D D + A \qquad equation\ 18$$

"A" reflects the amount of aid coming into a developing economy, which is modeled by a shock over a given period of time. $\gamma_{(N;D;A)}$ shows the share of national income spent on each sector of the economy. The change in national income in national income is then given by:

$$Y = \gamma_N(P_N + N) + \gamma_D(P_D + D) + \gamma_A A \quad equation\ 19$$

Aid can also be implemented into an economy gradually (Barder, 2006). Another aspect this paper investigates is the relative effectiveness of gradual implementation of aid as opposed to the transfer of a lump sum or shock in aid. The gradual implementation can best be illustrated by a percentage change, which is signified by $\hat{X}$. This yields the following:

$$\hat{Y} = \gamma_N\left(\hat{P}_N + \hat{N}\right) + \gamma_D\left(\hat{P}_D + \hat{D}\right) + \gamma_A \hat{A} \quad equation\ 20$$

The previously mentioned equation $P_N N = \gamma_N Y$ shows that the percentage change in consumption in the non-tradable sector must be equal to the percentage change in income. This relates all three sectors through a single demand equation. By also looking at the portion spent on imports and domestic goods:

$$\frac{D}{M} = k\left(\frac{P_M}{P_D}\right)^{\sigma} \qquad equation\ 21$$

Taking the first order derivative yields:

$$\hat{D} - \hat{M} = -\sigma \hat{P}_D \qquad equation\ 22$$

This equation reflects that unless aid is not used domestically, which is very unusual (Easterly, Levine, & Roodman, 2003), then in order for trade to balance it is required that $P_M M = A$ which in turn implies that $\hat{M} = \hat{A}$. *The percentage change in aid is positively related to the percentage change of the manufacturing sector. This* finding suggests that as the amount of aid into an economy increases, so does the absolute size of the manufacturing sector. Recall that the resource movement effect shows the opposite holds true, as aid increases so does the average level of wealth (Corden & Neary, 1982). As a result, the resource movement effect leads to a contraction of the manufacturing sector ceteris paribus. The fact that a simple multi-sectorial model can already theoretically disprove the resource movement effect heightens the need to test for the ambiguous result empirically.

The one sector model shows the spending effect occurs, while further examination of the multi sector models reveals that the resource movement effect is not backed theoretically when relaxing the world price assumption. The following section outlines the variables used to verify this theoretical result empirically as well as the statistical methods used for analyses.

4. Data

4.1 Hypotheses

This paper aims to establish whether an increased amount of aid flowing into a developing economy can lead to the Dutch Disease occurring. The Dutch Disease may occur through two channels, namely through the spending effect and the resource movement effect (Corden & Neary, 1982). The former can be empirically identified through a real exchange rate appreciation and the latter through a reduction in the absolute size of the manufacturing sector. The effectiveness of aid is investigated by identifying any discrepancies in a country's GDP per capita when it is exposed to an aid shock as opposed to a gradual implementation of aid. In order to identify these effects a fixed-effect panel regression model is constructed containing all 22 Sub-Saharan African countries[3]. In order to verify the theoretical finding that the spending effect; the following hypothesis is examined for Sub Saharan Africa over the period of 1960 to 2013:

H_0: *There will be no change in the Real Effective Exchange rate following an increase in aid.*

H_1: *Following an increase in aid there will be an appreciation of the Real Effective Exchange rate.*

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

H_0: *There will be no change in the real output of the agricultural sector following an increase in aid.*

H_1: *There will be a fall in the real output of the agricultural sector following an increase in aid.*

Finally, this paper examines whether the negative effect of aid on a country's economic performance holds true and whether it can be attributed to the method with which it is implemented. This is done by verifying the following hypothesis:

[3] See Appendix A.1 for a country overview

H_0: *There is no significant difference in the effectiveness of short and long term aid programs.*

H_1: *There is a statistically significant difference in the effectiveness of short and long term aid programs.*

4.2 BLUE estimators

The following section describes the chosen (in)dependent regression variables. The data is collected over the period of 1960 to 2013 for all Sub Saharan countries. In order to ensure no incorrect inference is drawn, first the different level regression models were subjected to a number of tests to verify that they adhere to all OLS assumptions. The different model results appear to be BLUE (Best Linear Unbiased Estimators), which may be observed in Appendix A.2. The issue of stationarity is alleviated by also estimating first difference models as a robustness measure. This is elaborated on in sub-section 5.2 where the robustness checks are discussed. Due to the number of data points available and in accordance with (David, George, Bruce, Layth, & Duckworth, 2011) a 5% significance level is used throughout this paper.

4.2.1 The spending effect: variables

In order to determine whether the Dutch Disease occurs following either an aid shock or a gradual increase in aid both the spending effect as well as the resource movement effect are empirically examined. Several models are estimated in order to control for omitted variables. This model looks specifically at the *spending effect.* As highlighted in the theoretical framework, the spending effect causes an appreciation in an economies real effective exchange rate following a shock in wealth (Andersen, Bollerslev, Diebold, & Labys, 2001). This paper will therefore treat an appreciation of the respective currencies relative to the current value of the US dollar ($) as indicative of the spending effect being present. The following fixed effect panel regression model is used in order to determine whether this effect takes place for the Sub-Saharan countries selected:

$$\begin{aligned} REER_{it} = C &+ \beta_{it} ShareaidGDP + \beta_{it} ShareaidGDP(-1) \\ &+ \beta_{it}(ShareaidGDP * CrisisDummy) + \beta_{it} CrisisDummy \\ &+ \beta_{it} Openness(-1) + \beta_{it} NIPC + \beta_{it} URBAN + +\beta_{it} Education \\ &+ REER_{it}(-1) + \varepsilon_{it} \quad Model\ A \end{aligned}$$

Real effective exchange rate (dependent variable): The real effective exchange rate is defined as the nominal exchange rate weighted relative to a number of other currencies most commonly held as foreign reserves while adjusted for inflation effects (Fernández, Osbat, & Schnatz, 2001). The Sub-African countries used throughout this analysis have overlapping trading partners and use similar foreign currency reserves for monetary economic intervention (Bräutigam & Knack, 2004). Therefore the assumption is made that the currency weights can be treated as being equal. In order to control for inflation the nominal exchange rate is divided by the Consumer Price Index measure for inflation (CPI). The Consumer Price Index is defined as the annual price change per weighted basket of consumer goods (Bategeka & Matovu, 2011). As all data were collected in a homogenous fashion the comparability between countries is viable. This variable gives an indication of the long run equilibrium path the real effective exchange rate should follow. A deviation from its path can be indicative of an aid induced shock, which is subject to observation. To avoid spurious deductions a range of control variables are included which are in accordance with past literature (Copeland, 1991). *This data was obtained from the World Bank online database for all years, while CPI figures were obtained from the UNCTAD database.*

ShareAidGDP: Net total official aid inflow is defined as the total official aid received by a given developing economy as measured in current US dollars. The total amount of aid received is then divided by the country's total Gross Domestic Product to give the share of aid to GDP which yields:

$$ShareAidGDP = \frac{(Net\ total\ official\ aid\ inflow)}{TotalGDP}$$

This measuring metric is used in order to ensure comparability between countries when it comes to the total volume of aid they receive (Adam & Bevan, 2006). This model is considered the core spending effect model. No alterations have been made with respect to the model proposed by Cordon and Neary (1982). With respect to empirical research on the effect of aid on the real effective exchange rate, a negative sign if expected for the coefficient. This is equal to a real exchange rate appreciation following an influx of aid into a given economy (Copeland, 2008). *This data was again obtained from the World Bank online database for all years.*

Mckinnon's Openness parameter: In accordance with previous literature, an estimate of Mckinnon's Openness parameter criterion is included (McKinnon, 1963). This is defined in this paper as:

$$Openness = \frac{Export_{total} + Import_{total}}{GDP_{total}}$$

Export, Gross Domestic Product and Import are all measured in millions of current US dollars. This criterion of openness was used in previous papers to reflect the degree of integration within an optimum currency area (Hyden, 1990). It has since then been applied in multiple empiric papers to capture the degree to which an economy is exposed to trade (Kang, Prati, & Rebucci, 2013). In the classical Dutch Disease setting, this can have a significant effect. Namely, tradable goods prices will be more influenced by the global market. This paper therefore expects the sign of this coefficient to be negative. With an increased exposure to trade, there will be more demand for local currency (Copeland, 2008), and hence the local currency will appreciate respectively. Additionally, in order to capture the long term effect of aid on the Real Effective Exchange Rate, the lagged value of the share of aid to GDP is also included; this is in accordance with previous literature (Easterly, 2003). *This data was obtained from the World Bank online database for all years.*

Net Income per Capita: Another control variable which is added to the core spending effect model is the net income per capita as measured in current US dollars. This variable is added to capture the wealth effect which takes place namely as aid is distributed, or as usually referred to as the trickle- down effect, household experience an increase in disposable income (Work, 1997). This increase in income is measured by the net income per capita. Economic theory depicts that as income increase a subsequent increase in consumption can be seen. Ahuvia & Friedman (1998), described the African economy as being predominantly “consumption oriented” with a very low propensity to save. This again was linked to poor access to banks or other financial instances or to low life expectancy (Lee, 2012). The same notion is reflected by previous empirical literature, which has also found that a wealth shock is largely absorbed by an increase in spending (Michaelowa, 2004). An increase in domestic consumption increases the demand for local currency and hence this paper expects a subsequent appreciation following an increase in income. Therefore the sign of the corresponding coefficient is expected to be negative (Copeland, 2008)**.** *This data was taken from the World Bank online database for all years.*

The final two robustness parameters added control for the general education and domestic migration trends within the individual countries. The first parameter added is the annual total expenditure on education in millions of currently valued US dollars from the period 1960 to 2013. Ajayi (1996), argues that total expenditure on education is a better approximation of the mean level of education within a country as opposed to total school enrollment rates. The latter statistic is usually based on microeconomic surveys which have been liable to inaccuracies. Despite the fact that these figures can also be obtained from World Bank, it is the intrinsic sampling bias that occurs when collecting the data which makes this paper prefer to use total governmental expenditure on education as an alternative approximation. A higher level of average education signals, in line with the previous general equilibrium model, that the ratio of skilled to unskilled labor increases proportionally. As outlined in the theoretical framework, a higher relative proportion of skilled labor means an expansion of the non-tradable sector (or service sector) relative to the tradable goods sector (manufacturing sector). The relative contraction of the manufacturing sector will, ceteris paribus, lead to less tradable goods being exported. The assumption that the service sector is restricted to the domestic economy and hence has no impact on world prices is circumvented by the fact that in the core model the real effective exchange rate is defined as the ratio of the tradable goods price to the non-tradable goods price (Corden & Neary, 1982) *(see equation 1)*. This paper expects a contraction of the manufacturing sector to lead to a subsequent relative price rise in tradable goods. This, in line with equation 1, will result in an absolute increase in the real effective exchange rate, or as noted in previous literature the equivalent of an exchange rate depreciation (Copeland, 2008). The coefficient sign is therefore expected to be positive. *This data was taken from the World Bank online database for all years.*

The second control variable added is the annual percentage of the total population within a country living in an urban environment. This paper defines urban as living in or within the proximity of a city with a population of at least 50000 full time inhabitants. As stipulated by (Edwards & Aoki, 1983), Sub-Saharan Africa is characterized by a large agricultural sector. In many cases, for example Botswana, Ethiopia and Chad, agriculture makes up more than 80% of the economy (Foley & DeFries, 2005). Previous empirical literature has therefore substituted the manufacturing sector for the agricultural sector when investigating whether the Dutch Disease took place as a result of finding natural resources (Rajan, 2005). This paper will also use the empirical specification as the sample set is made up predominantly of agricultural intensive economies; this is elaborated on in the resource movement effect model specification section[4]. Other past empirical literature has described unskilled workers living in rural areas while the skilled labor pool on average resides in urban areas (Bonacich, 1972). The share of skilled to unskilled labor is very difficult to determine, and hence this measure has been used as a valid approximation in the past (Bonacich, 1972). This paper adopts a similar view. The trending migration of rural to urban areas typifies Sub-Saharan Africa. Previous studies have shown that a predominant share of this migration is due to the search of better employability prospects (Adepoju, 2003). Usually the assumption is made that this involves a switch away from the traded goods sector towards the service sector. An increase in the percentage of total population residing in urban areas would then, ceteris paribus, mean an expansion of the non-tradable goods sector relative to the tradable goods sector. This, in accordance with the definition of the real effective exchange rate given in equation 1, should result in a real exchange rate appreciation or a drop in the absolute value of the REER. The expected coefficient sign is consequently negative. *This data was taken from the World Bank online database for all years.*

The final variable which is added is a dummy variable and also the main contribution of this paper. Over the period of 1960 to 2013 every major natural or man-made hazard or disaster was mapped according to the number of individuals displaced. Varley (1994) uses a similar specification in order to estimate the severity of a humanitarian disaster. The threshold of displaced individuals is set at a minimum of 100000. An event which adheres to this threshold has been assigned a value of “1” whereas other years in which smaller events take place have been assigned a value of “0”. These events include drought, floods, earthquakes, locust pest, terrorist threats, civil and international wars (Strömberg, 2007), which have been characterized as being the main reasons as to why large sections of people have been displaced over the last decades in Sub-Saharan Africa. This dummy variable is then multiplied with the *share of Aid to GDP* to see whether an interaction effect takes place. An interaction in statistical terms describes the notion that the effect of a variable on the

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[4] See page 22: *The resource movement effect.*

dependent differs depending on the level of the other variable (David, George, Bruce, Layth, & Duckworth, 2011). It allows one to examine the difference the in total amount of Official Development Aid has on the Real effective Exchange Rate depending on whether a large humanitarian crises occurred as defined previously. This is of great importance to this paper as the implicit assumption is made that as a crisis occurs, the net total amount of aid increases. To verify this assumption the interaction effect is added. *This data was taken from the World Bank online database, UNCTAD database and the KU. Leuven Development Economics database for all years.*

4.2.2 The resource movement effect: variables

The resource movement effect typifies a stagnation of the manufacturing industry following an increase in wealth. This empirical model uses the Share of aid to GDP a country receives at a moment in time. One of the main changes this paper implements with respect to previous classic literature on the Dutch Disease in developed economies is the notion that instead of using the manufacturing sector to represent the sector producing tradable goods instead the agricultural sector is used. Agriculture is the main source of exports and manufacturing of tradable goods, whereas the traditional tradable goods such as clothing and machinery are predominantly manufactured in South-East Asia (Rajan & Subramanian, 2005). This paper therefore treats a *reduction* of agricultural output following an increase in net official development aid received by an economy as indicative of the resource movement effect occurring. To verify this theoretical explanation empirically the following fixed effect panel regression model is used:

$$\begin{aligned} AGRI_{it} = C + &+\beta_{it}ShareAidGDP + \beta_{it}ShareAidGDP(-1) \\ &+ \beta_{it}(ShareAidGDP * CrisisDummy) + \beta_{it}CrisisDummy \\ &+ \beta_{it}GDPpercapita + \beta_{it}CPI + \beta_{it}Urban + \beta_{it}Education \\ &+ \beta_{it}Openness(-1) + \beta_{it}AGRI_{it}(-1) + \varepsilon_{it} \quad Model.B \end{aligned}$$

Net Agricultural output (dependent variable): The net agricultural output is measured in millions of current US dollars annually over the period of 1960 to 2013. This research focuses on Sub-Saharan Africa, which has been described as being relatively agriculturally intensive with the predominant work force in this sector being low skilled. The agricultural sector is expected to decrease in absolute size following an increase in wealth due to a resource find. This paper investigates whether a similar mechanism occurs following a wealth shock induced by an increase in the amount of aid received by a country. To avoid running a spurious regression, again numerous control variables are added. This will be elaborated on below. *This data was taken from the World Bank online database for all years.*

ShareAidGDP: The net total official aid inflow (net ODA) is again used to act as an approximation of the total official aid flowing into a given developing economy. It is worthy to note that this is the same variable used as when investigating the *spending effect*[5]. This is done in order to ensure comparability between the two different channels through which the Dutch Disease takes place. If two separate measures would be used, any resulting discrepancies could simply be due to the intrinsic difference between the measures used rather than their actual effect on the dependent variable in question (David, George, Bruce, Layth, & Duckworth, 2011). A description of the variable may be found under the spending effect. Given the expectations of the general equilibrium model, this paper expects the net agricultural output to rise given an increase in net total ODA. Hence the sign of the coefficient is expected to be positive. *This data was taken from the World Bank online database for all years.*

GDPpercapita: In order to control for the general economic development of an economy the gross domestic product per capita measured in current US dollars over the period 1960 to 2013 is included. This is a common control variable used when testing for the resource movement effect empirically (Jones, 1965). A per capita measure is used in order to control for the relative size per economy. The sample used in this analysis is extensive in order to be able to make a general conclusion about the relative effectiveness of aid flowing into Sub-Saharan Africa. When looking at the general trend of GDP per capita, they appear to be very similar across the sample set as illustrated by the graphs below.

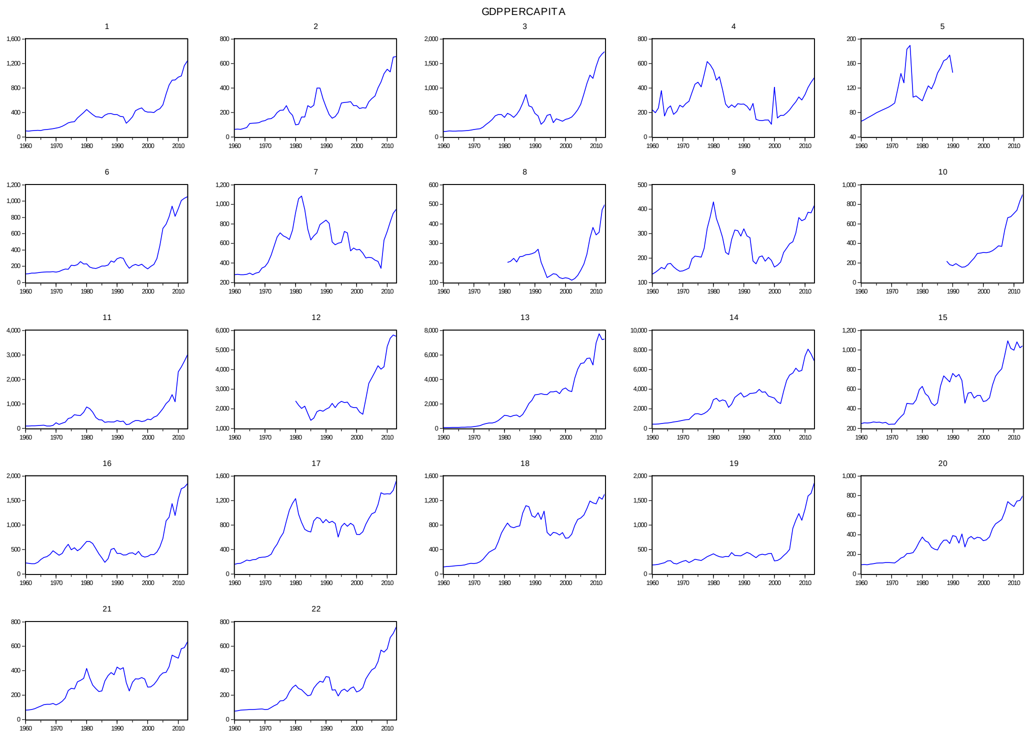

Figure 1, GDP per capita from 1960 to 2013.(Please see appendix A.1 for the corresponding country list)

This rise in GDP per capita over time supports the notion that Sub-Saharan countries are slowly performing better economically. Bennell (1996) went on to explain that together with these increasing levels of GDP several additional effects are observed. Mainly, in countries

[5] See page 20, the spending effect. “Net official aid inflow”.

such as Ethiopia and Sudan an expansion in the amount of tradable goods manufactured is seen due to an expansion of the manufacturing and agricultural sector (Westphal, 1975). Countries such as Kenya however primarily experience a shift from traditional agriculture to an increasingly prominent role of the service industry (Lundvall & Battese, 2000). As this is also a shift which can be caused by the resource movement effect it is vital to also control for this influence. Although a shift to the service sector does occur as a result of increased GDP per capita, the average Sub-Saharan country still sees an expansion in existing manufacturing industries. Hence, the expected sign of the coefficient is positive. Again the lag of the share of aid to GDP is also included in this model in order to capture the long term impact of aid on the agricultural sector. *This data was taken from the World Bank online database for all years.*

Consumer Price Index (CPI): The resource movement effect examines the shift in production from the manufacturing industry towards the service industry due to a higher price for non-tradable goods (Corden & Neary, 1982). In order to control for the general increase in price levels a measure for inflation is included in the model. The Consumer Price Index calculates the percentage change for a basket of representative consumer goods purchased by the average household (Boskin, 1998). An increase in the average price level for tradable goods makes it more attractive for firms to produce in that given market (again the assumption of perfect labor mobility is made in this instance). This is of particular importance given the geographic area of analysis. Sub-Saharan Africa has been characterized by spells of high levels of inflation or even hyperinflation in the case of Zimbabwe (Hanke & Kwok, 2009). Although in the latter case attempts are now being made to dampen inflation with a currency swap to the US dollar. However the sample time used includes the period of hyperinflation and hence it is still included as a control variable. When inflation levels increase there should be a rise in the price of tradable goods, and hence this paper expects a subsequent expansion of the traditional manufacturing sector. The coefficient is therefore expected to be positive. *This data was taken from the World Bank online database for all years.*

Openness: Similar to the spending effect, Mckinnon's openness criteria is again used to approximate the degree of exposure a country is subject to on an annual basis. The estimation technique of this variable is the same as specified previously for the spending effect model[6]. The interpretation of the expected coefficient is however subject to change. As the degree of openness of an economy increases, an economy is subsequently also expected to export relatively more (McKinnon, 1963). In the Dutch Disease model used, only the manufacturing sector has the ability to export as non-tradable goods are subject to domestic consumption (Corden & Neary, 1982). A rise in exports thus is indicative of an expansion of the tradable sector relative to the non-tradable sector. Hence the coefficient is

[6] See *spending effect*, page 20

also expected to be positive in the following regression model. *This data was taken from the World Bank online database for all years.*

The final independent variable added again represents the points in time at which a given Sub-Sahara African country experiences a natural hazard or man-made disaster[7]. The degree to which individuals are displaced is taken to be representative of the severity of the crisis, which is in accordance with previous literature (Mehlum, Moene, & Torvik, 2006). An event for which 100000 individuals are displaced at a given amount in time is seen as a hazard and/or man-made disaster within the context of this research and hence gets assigned a value of one. Other occurrences with a smaller magnitude or in years of relative tranquility the values assigned are zero. As explained previously, it is expected that a natural disaster comes paired with a higher degree of official development aid received. The sign of the coefficient is therefore also expected to be positive. *This data was taken from the World Bank online database for all years.*

4.2.3 The effectiveness of aid: variables

Before this paper goes on to discuss whether the spending and resource movement effect indeed took place, first the general relation between aid and a country's wealth is investigated. In order to verify the relative effectiveness of aid programs, this paper looks at two fundamentally different types of aid implementation. As outlined in the theoretical framework, the main difference which can be observed with aid implementation is the duration of time over which it is transferred to the recipient country (Fisher, 1995). Past literature has shown that sudden shocks in aid can lead to a country experiencing Dutch Disease symptoms such as an appreciating exchange rate or a reduction in the absolute size of the agricultural sector (Fielding & Gibson, 2012). Hence the majority of charitable institutions, the IMF and World Bank advocate a gradual implementation of aid (Crawford & Bryce, 2003). In order to validate this finding for Sub-Saharan Africa, a dynamic fixed effect panel regression model is estimated. The model captures the gradual implementation of aid by treating the official development aid as a continuous variable and aid shocks by looking at a period of time over which high levels of aid were exported towards Sub-Saharan Africa. These shocks are treated as dummy variables which represent the moments in time at which countries experience a sudden disproportionate influx of aid. This paper makes the implicit assumption that such an event is positively correlated with the amount of aid received by the country in question.

Similar to the two latter models, several control variables are added in order to account for additional influence the dependent variable might be subject to. All of the variables used in this model have already been described previously. All the expected beta signs are the same as in previous analysis for the resource movement effect. The following model is used to determine the effectiveness of the respective aid implementation programs:

[7] Please refer to the explanation of the dummy variable under the *spending effect.*

$$GDPCAP_{it} = C + \beta_{it}Shareaidgdp + \beta_{it}(Shareaidgdp * CrisisDummy) + \beta_{it}CrisiDummy + \beta_{it}CPI + \beta_{it}Openness(-1) + \beta_{it}Education + \beta_{it}GDPCAP(-1)_{it} + \varepsilon_{it} \quad Eq.C$$

This concludes the description of the respective models used to empirically verify whether the two propositions deduced from the theoretical discussion. The following section describes the empirical approach this paper takes as well as a description of the numerous robustness specifications used as to ensure the results posed are reliable.

5. Methodology

5.1.1 Dynamic fixed effect panel-regression model

Fixed effects estimation is a statistical technique of estimating regression parameters in a panel data set. The estimator is found by taking ordinary least squares estimation (henceforth referred to as OLS estimation) on the standard deviation from the mean of each unit and/or time period (David, George, Bruce, Layth, & Duckworth, 2011). This method is most commonly used when the average of the dependent variable is expected to be different per cross section or time period while the variance of the errors remains constant (David, George, Bruce, Layth, & Duckworth, 2011). The fixed effects estimator in this case, also known as the within variable estimator, is used throughout this paper to refer to the coefficient in the given fixed effect panel model (Nickell, 1981). If fixed effects are assumed, time independent effects are imposed for each variable that can possibly be correlated with the regression variables (Nickell, 1981). Before assuming a fixed panel regression model should be implemented, a Hausman test is conducted to verify whether this is indeed the case. To test whether the model is appropriate the following test is conducted:

$$H_0: Cov(\alpha_i, x_{it}) = 0$$

$$H_1: Cov(\alpha_i, x_{it}) \neq 0$$

As can be seen in appendix A.1., the Hausman test is highly significant. The null hypothesis is rejected in favor of the alternative hypothesis and a fixed panel regression model is more appropriate as compared to the random effects model. Therefore a fixed effect panel regression will be used throughout this paper. The general fixed effects panel regression equation used can be stipulated as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + \beta_2 Y_{i(t-1)} + u_{it}$$

Fixed effects panel regression models may still be susceptible to autocorrelation (Ord & Getis, 1995). This is especially the case with exchange rates, in which is it frequently observed that the error terms in differing periods are highly correlated (Andersen, Bollerslev, Diebold, & Labys, 2001). This can be addressed by adding the lag of the dependent variable to the regression model. However, Manuel Arellano and Stephen Bond (1991) realized that the included lagged dependent variable would be highly correlated with the idiosyncratic error. This in turn means that the fixed effects panel regression model is inconsistent due to a violation of the endogeneity assumption. This gave way for the Arellano-Bond estimator GMM model (Arellano & Bond, 1991). Anderson and Hasio (1981) proposed a solution to the aforementioned issue through the medium of instrumental variables (IV).By taking the first differences of both the dependent and the independent variables in the regression model, additional lags of the dependent variable can be used as IV for the endogenous differenced lags of the dependent variable (Arellano & Bond, 1991). This paper uses a similar approach as a robustness check to verify whether the results found using the level of the dependent and independent variables hold. These models are presented following the final models to identify the spending and resource movement effect as well as the model highlighting the varying degrees of aid effectiveness.

5.2 Robustness model specifications

This section shortly describes the different robustness specifications the OLS results are subjected to. These Robustness models are used to validate the finding and to ensure that no incorrect deductions are presented throughout this research.

5.2.1 First difference models

The first difference model circumvents the issue of unobserved heterogeneity (Liker, Augustyniak, & Duncan, 1985). In order to reflect this trait of the model the following general specification is used:

$$y_{it} = \beta_0 + \beta_1 X_{it} + \gamma_1 \delta_{2t} + \gamma_2 \delta_{3t} + \cdots + \gamma_{T-1} \delta_{Tt} + \alpha_i + u_{it}$$

In this case Y can be *for example* taken to be GDP per capita and X to represent the inflow of aid. The latter terms ($\gamma_1 \delta_{2t} + \gamma_2 \delta_{3t} + \cdots + \gamma_{T-1} \delta_{Tt} + \alpha_i$) represent time dependent variables which are represented by the various dummy variables. They show, for example, general trends in aid over time. Other specific traits per country which are not dependent on time are represented by the term α_i, and u_{it} shows the idiosyncratic term which is assumed to be uncorrelated with aid flows due to the different control variables included in the later models (Drukker, 2003). The term α_i contains unobserved heterogeneity, comprising terms which only vary across countries and not across time. This has the following negative side effect:

$$Cov(\alpha_i + u_{it}, \beta_1 X_{it}) \neq 0$$

This means that there is an endogeneity issue. An OLS estimate will therefore be biased and inconsistent (Drukker, 2003). The first differences estimator looks at the difference in GDP per capita and aid by taking the difference for both sides of the regression equation:

$$\Delta y_{it} = \beta_1 \Delta X_{it} + \gamma_1 \Delta \delta_{2t} + \gamma_2 \Delta \delta_{3t} + \cdots + \gamma_{T-1} \Delta \delta_{Tt} + (\alpha_i - \alpha_i) + \Delta u_{it}$$

The constant (β_0) remains the same over time. It simply cancels out and is no longer included in the model. An important result is the fact that α_i, much like β_0, also remains constant over time. This means that the α_i term also cancels out. By taking the first difference the unobserved heterogeneity component is therefore in principle removed (Liker, Augustyniak, & Duncan, 1985). This means that:

$$Cov(\Delta u_{it}, \beta_1 X_{it}) = 0$$

Assuming that no correlation and further heteroskedasticity is present within the error terms, the estimated OLS coefficients are now consistent. An important prerequisite to have consistent estimators with OLS is that there needs to be a certain degree of variation between aid levels within a country at a given moment in time. This is needed as otherwise the first difference would remove the terms altogether (Judson & Owen, 1999).

There are a number of drawbacks to this first difference approach however. First of all, even if there are significant differences in aid levels across countries, the first difference might be quite small. Due to this small difference there will be a high standard error, resulting in higher p-values and as such it will become harder to draw inference from these results.

5.2.2 Moving average auto-regressive model

A moving average process is represented by the following model:

$$X_t = \varepsilon_t + \theta\varepsilon_{t-1}$$

Where the X_t represents the moving average term in question. Each of the error terms is:

$$\varepsilon_t \sim IID(0, \sigma^2)$$

Where X_t is of order MA(1) as only one lag is included. When applying this specification to this research means that in order to avoid misspecification the average of three aid periods is taken. This is in turn regressed on the corresponding period for GDP per capita, the Real Effective Exchange Rate or Agricultural output respectively. By doing this the long term dynamics between aid and the respective dependent counterparts are captured, and there is a lower probability of omitted variable bias (Huang, 1984).

The latter specification of this model involves the inclusion of an autoregressive term, which is the lagged value of the dependent variable in that model. This is done to alleviate any potential autocorrelation from the model by capturing it in the lagged term (Bartlett, 1946). Both of these factors allow for clear and robust inference.

5.2.3 Logarithmic model

The final robustness model which is used in this paper is the logarithmic model. This is primarily done in order to verify that the elasticities have the same sign and significance as previous models. Taking the natural log of base ten yields the following model:

$$logy_{it} = \beta_1 logX_{it} + \beta_2 logX_{it} + \cdots + \beta_n logX_{it} + u_{it}$$

The individual coefficients now represent the percentage change in the dependent variable given a one percent change in an independent variable ceteris paribus (David, George, Bruce, Layth, & Duckworth, 2011). This is captured by taking the first difference of each side assuming the remaining variables are constant:

$$\frac{dY}{Y} = \frac{\beta_1 dX_1}{X_1}$$

Which is equivalent to:

$$\beta_1 = \frac{\frac{X_1}{Y} dY}{dX_1}$$

This shows that the β_1 coefficient now reflects the partial elasticity of that independent variable on the dependent variable. This is of significant interest to this paper as it reflects the relationship between aid and its lagged component on GDP per capita, the Real Effective Exchange Rate and Agricultural output *keeping all else constant.*

6. Results

6.1.1 Aid effectiveness baseline model

Before investigating whether the Dutch Disease occurred through either the spending or the resource movement effect, this research first looks at the effect of aid on an economy overall. In order to approximate the state of an economy model C is used.

Table 1.1 Aid effectiveness level results.

Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013			
	Coefficient and significance		
C	26.125 *0.2278*	27.658 *0.2073*	36.286 *0.3233*
ShareaidGDP	-138.973 *0.005***	-152.412 *0.014***	-495.030 *0.001***
ShareaidGDP(-1)	-	40.261 *0.000****	2.24*10^09 *0.005****
ShareaidGDP*CrisisDummy	-	40.261 *0.708*	206.033 *0.432*
CrisisDummy	-	-5.501 *0.771*	-19.534 *0.560*
CPI	-	-	-0.005 0.000***
Education	-	-	-2.91*10^08 *0.160*

Openness(-1)	-	-	97.680 *0.004****
GDPCAP(-1)	1.025 0.000***	1.103 0.000***	0.968 *0.000****
N	1037	1036	708
R^2	0.98	0.98	0.98
Durbin Watson Statistic	1.6	1.6	1.6

*Note: The dependent variable is the gross domestic product per capita. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model. Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value. No inference is drawn from the constant.*

As stipulated in the theoretical framework of this model, the expectation of the effect of aid on the welfare of an economy in the short run is negative, while in the long run the negative effects of aid are counteracted and have a positive result (Fernández, Osbat, & Schnatz, 2001). When looking at the core model in table 1.1., the former expectation is indeed reflected by this panel model. It appears that in the short run, the total amount of official development aid flowing into a country has a negative short run effect on the gross domestic product per capita. This is reflected by the negative coefficient value of -138.973 which is highly significant at a p-value of 0.005. It is important to note that this model also includes the lag of the dependent variable, GDP per capita, as an autoregressive term. The Durbin Watson statistic of 1.6 shows that this prerequisite is indeed fulfilled (Drukker, 2003).

The model is then extended to include the lagged value of the share of aid to GDP, the interaction with the dummy representing crisis periods, the individual crisis dummy and finally the autoregressive term. The short run effect of the share of aid to GDP persists; the coefficient of -152.412 remains highly significant. When examining the long run effect of aid on GDP per capita the opposite effect is witnessed. The coefficient takes a statistically significantly positive value of 40.261. It appears that on aggregate all countries experience a similar trend. This paper set out to investigate whether this negative effect on the economy was significantly correlated with economic distress caused by the frequent disasters experienced by African countries. As can be seen in the second model, neither the interaction term nor the actual dummy is statistically significant. It appears that aid inflows to Sub-Saharan Africa over the period of 1960 to 2013 are not sufficiently correlated with these events. This supports the claim that economic implications are usually not caused by inflows of humanitarian aid but instead the continued stream of development aid aimed at the economic prosperity of these less economically developed economies.

The third and final model goes on to include various control variables which have been highlighted by past literature to have a potential effect, namely the inflation in an economic system, a measure for education and finally Mckinnon's Openness. As can be seen, both the short and long run dynamics deduced in the theoretical model postulated by this research remain the same when controlling for the various effects mentioned previously. Both remain statistically significant at a one percent level. A notable difference however is the change in the magnitude of both effects. It appears that when controlling for the aforementioned variables the core model specification becomes more pronounced. When looking at the coefficient for CPI it may be observed that the value is statistically significant at a 1% confidence level. The marginally negative coefficient magnitude is in line with previous literature, higher levels of inflation tend to dampen consumption and hence reduce over GDP per capita (Michaelowa, 2004).

The total spending on education seems not to have a significant effect on the GDP per capita in the same period. This finding has previously been echoed by other research, and has usually been attributed to the fact that increased spending on education takes time to be reflected in a more productive labor force (Doucouliagos & Paldam, 2006). The final control variable shows the effect of a country's degree of openness on an economy's GDP per capita. Again the positive and significant coefficient is in line with economic intuition and previously conducted research. As an economy opens up, the general trend examined is that the country in question experiences higher levels of economic growth and subsequent welfare (McKinnon, 1963).

This initial model indeed confirms the idea that aid, at least in the short run, can have a negative effect on the welfare within an economy. In order to verify whether the previously estimated model is robust, three additional alternative models are estimated. Namely, a first difference model to address stationarity issues, an ARMA(1) model and finally a logarithmic model to look at the elasticity sign and magnitude of each of the previously used variables.

6.1.2 Robustness specifications Aid Effectiveness

In order to verify whether the initial finding of aid having a negative short term impact on the gross domestic product per capita, three additional models are estimated. The first model which is estimated is the first difference model, for which the specifications were discussed in the methodology section. As can be observed from the first column in table 1.2, the impact aid has on the wealth per capita remains significantly negative at a 10% level.

Table 1.2: Varying model specifications

Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013			
	Coefficient and significance		
Model type:	First Difference Model	ARMA(1) Model	Logarithmic Model
C	-	19.862 *0.603*	-1.135 *0.000****
ShareaidGDP	-390.561	-531.631	-0.117

	*0.025***	*0.025***	*0.002****
ShareaidGDP(-1)	-201.048 0.136	225.345 *0.339*	0.098 *0.000****
ShareaidGDP*CrisisDummy	103.960 *0.553*	93.879 *0.722*	0.005 *0.209*
CrisisDummy	13.320 *0.3069*	-13.545 *0.695*	0.010 *0.786*
CPI	-0.002 *0.074**	-0.005 *0.000****	-0.001 *0.899*
Education	0.207 *0.174*	3.08*10^-08 *0.156*	0.139 *0.000****
Openness	3.01*10^-07 *0.000****	98.688 *0.006****	0.058 *0.041****
GDPCAP(-1)	0.126 *0.245*	0.970 *0.000****	0.716 *0.000****
N	687	703	634
R^2	0.41	0.98	0.98
Durbin Watson Statistic	NA	1.6	1.6
Dependent variable	*GDPCAP-GDPCAP(-1)*	*GDPCAP*	*Log(GDPCAP)*

*Note: The dependent variable is the Gross Domestic Product per capita. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model (source). Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value. No inference is drawn from the constant.*

The remaining control variables have the same sign. It is however important to note the change of sign for the lagged value of the share of aid to GDP ratio. Unlike model C, the coefficient is no longer significantly positive. It appears that, at least in the context of the first difference model, the influx of aid does not have a lagged influence on the GDP per capita. Furthermore, there seems to be no correlation between geographical disasters occurring and the amount of development aid received by a given economy. The main finding which can be taken from this first robustness model specification is the fact that the lagged value of the Share of Aid to GDP no longer has the positive impact it had in model C. This means that the long term predictions made by the theoretical model do not hold according to this specification. In order to verify this finding, this research also includes a moving average model.

This paper uses an average of three year of aid inflows which are then regressed on the GDP per capita. This three year average was chosen in accordance with previous research (Edwards & Aoki, 1983). The autoregressive term remains within the model in order to account for possible autocorrelation which may be present. As can be seen in table 1.2, the negative sign of the aid approximation remains significantly negative and the magnitude of the effect even increases in absolute terms. This finding strengthens the notion that aid has a negative effect on the gross domestic product per capita. In line with the previous model specification the points in time in which a natural or man-made disasters occurred has no effect on the GDP per capita. The inflation rate has a coefficient value of -0.005 at statistically significant at a 1% level, which again suggest that as inflation levels rise that the GDP per capita falls. Previous research has frequently attributed this to decreased consumption levels and investor uncertainty (Kang, Prati, & Rebucci, 2013). Education no longer has a significant effect on GDP per capita, which indicates that when looking over a longer period of time other variables have a larger influence on GDP per capita instead of the amount invested in human capital. The final control variable, McKinnon's Openness criterion has the exact same magnitude and significance as under the levels model, and hence this finding may be treated as being robust thus far.

The final model used as a robustness check is a logarithmic model. Table 1.2 shows that given a 1 percent increase in aid with respect to GDP, GDP per capita decreases by 0.117%. This negative relationship again promotes the existence of a reduction in consumer welfare given an increase in aid. This crucial observation, after having been subjected to numerous robustness specifications, still holds and indeed signifies that through certain channels aid can cause an economy to worsen given certain conditions (Doucouliagos & Paldam, 2006).

The second important observation is that the lagged effect of aid on GDP per capita is positive and highly significant. This is in line with the findings of the levels model, but is in contrast with the first difference and moving average model. This ambiguity reflects the ongoing discussion as to whether effective macroeconomic policy can nullify the negative effects of receiving aid (Kasekende, Kitabire, & M.Martin, 1998). In the long run the effect of aid on GDP seems to be influenced by a greater number of prerequisites as opposed to the short run. This finding has frequently been attributed to the fact that the negative effect of aid can be offset by effective monetary policy (Hyden, 1990).

The remainder of this section is devoted as to whether this negative impact can be attributed to the Dutch Disease. In order to determine whether the Dutch Disease is indeed the cause of this negative relationship, the two channels through which it acts are identified.

6.2 Discussion of the spending effect results:

6.2.1 Spending effect baseline model

In order to verify whether the spending effect took place, defined as a subsequent appreciation of the real effective exchange rate after the implementation of aid, model A is used.

This fixed panel regression estimate examines the *levels* of each variable and the effect it has on the real effective exchange rate. The results for the simple panel level model for the spending effect are as follows.

Table 1.3 Spending effect level results.

Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013				
	Coefficient and significance			
C	2.608 *0.5144*	2.645 *0.532*	0.729 *0.913*	4.269 *0.607*
ShareaidGDP	73.286 *0.1622*	125.648 *0.149*	218.234 *0.139*	218.234 *0.139*
ShareaidGDP(-1)	-	-70.864 *0.124*	-139.244 *0.0384***	-139.244 *0.0427***
ShareaidGDP*CrisisDummy	-	8.181 *0.822*	-34.877 *0.519*	-35.832 *0.5514*
CrisisDummy	-	8.181 *0.822*	7.534 *0.146*	7.542 *0.231*
Income	-	-	-0.001 *0.411*	-0.004 *0.110*
CPI	-	-	-	-0.002 *0.005****
Urban	-	-	-	-5.8*10^-07 *0.024***
Education				3.95*10^-10 *0.457*
Openness(-1)	-	-	-32.553 *0.441*	-26.977 *0.313*
REER(-1)	0.982 0.000***	0.981 0.000***	0.971 *0.000****	0.964 *0.000****
N	1022	1012	762	663
R^2	0.98	0.98	0.98	0.98
Durbin Watson Statistic	1.7	1.7	1.8	1.8

*Note: The dependent variable is Real Effective Exchange Rate. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model (source). Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value. No inference is drawn from the constant.*

As observed in table 1.3, an influx of aid into a developing economy has an insignificant but positive effect on the Real Effective Exchange Rate in the core model. The change of sign suggests that there is a positive relationship between the amount of aid received by a given economy and its real effective exchange rate. As the exchange rate is denoted according to British Notation, an increase of the REER in absolute terms means that the exchange rate actually depreciates. This is contrary to what classical Dutch Disease theory stipulates (Corden & Neary, 1982). This contrary effect can be attributed to the fact that numerous other factors may influence the Real Effective Exchange Rate (Andersen, Bollerslev, Diebold, & Labys, 2001). An example of this may be monetary policies implemented by the different governments included in this panel system. Sub-Saharan Africa has been characterized by several accounts of hyperinflation and other economic unrest which has reflected on the exchange rate (Judson & Owen, 1999). A testimony to this is the fact that until 1980 a lot of African countries maintained a fixed exchange rate policy (Saxegaard, 2006). This means that any fluctuations in the exchange rate as a result of an aid influx are nullified by the buying or selling of foreign exchange rate reserves (Copeland, 2008). Another key insight into the case of Sub-Saharan Africa is that many countries included in the panel are post-colonial countries (Anderson, 2014). This has the consequence that many of the currencies today are or have been pegged to their European colonial counterpart (Copeland, 1991). Examples of this include the pegging to the pound by Nigeria, to the Franc by Congo and Niger (Adenauer, 1998).This was done in order to effectively moderate local disturbances monetarily and can be an explanation as to why the Dutch Disease effect is not captured. The main criticism however postulated by Nkusu (2004) and Barder (2006) is the fact that the influx of aid needs time to be reflected in the exchange rate. Fundamentals in an economy need ample time to have effect on monetary instruments (Copeland, 2008).

This research has therefore also chosen to include the lagged variable of the share of aid to GDP. As can be seen in table 1.3, in the second model the coefficient of this variable takes a value of -70.864 which is insignificant at 0.1622. The change of the coefficient sign suggests that the intake of aid has a lagged effect on the Real Effective Exchange Rate. Aid needs time to trickle down throughout the economy to subsequently alter the consumption behavior of households from tradable goods towards non-tradable goods (Acosta, Lartey, & Mandelman, 2002). This in turn causes an exchange rate appreciation of the domestic currency relative to other country's currencies. This is an important finding as it also explains the frequent ambiguity surrounding previous literature on aid induced Dutch effects. A share of previous literature has not taken the lagged aspect into account and as a result has incorrectly concluded that the Dutch Disease is not present following an increase in received aid (Adam, 2008). *When extending the model to also include the interaction term as well as controlling for income, the lag of the share of aid to GDP increases in magnitude and become statistically significant at a 5% confidence level. This also holds true for the third and the final model with all the control variables included.* At first glance this supports the hypothesis that in the long run the spending effect does occur. However, before deducing this result first the subsequent control variables are examined, followed by a range of robustness checks.

The main contribution of this research is the construction of a dummy variable outlining every major man- made or natural disaster over the period 1960 to 2013 and interacting it with the aid inflows at the time. The expectation is that the appreciation of the Real Effective Exchange Rate will be far more pronounced during these periods of time. When looking at the coefficient value of 8.181 which is insignificant at 0.822, the abovementioned expectation is not reflected. It appears that looking at individual episodes over the period of 1960 to 2013 in which disasters occurred does not have a significant impact on the exchange rate. The rest of the models also reflect this notion. None of the coefficients become statistically significant.

An explanation as to why this occurs may lie in the fact that the assumption of a disaster being paired with increased aid received by these economies is not viable (Pelling & Wisner, 2012). Previous literature has shown that aid expenditures are usually determined by developed economies intrinsically and are not or rarely correlated with disasters experienced by potential aid recipients (Bräutigam & Knack, 2004). Therefore this paper also looks at a dummy which reflects internal aims made by the majority of developed economies. Specifically, the period of 2000 to 2015 was used at this is the period of time over which concrete aims were set in the Millennium goals aimed to eradicate extreme poverty (Gaiha, 2003). This is also reflected by the total aid received by Sub-Saharan countries.

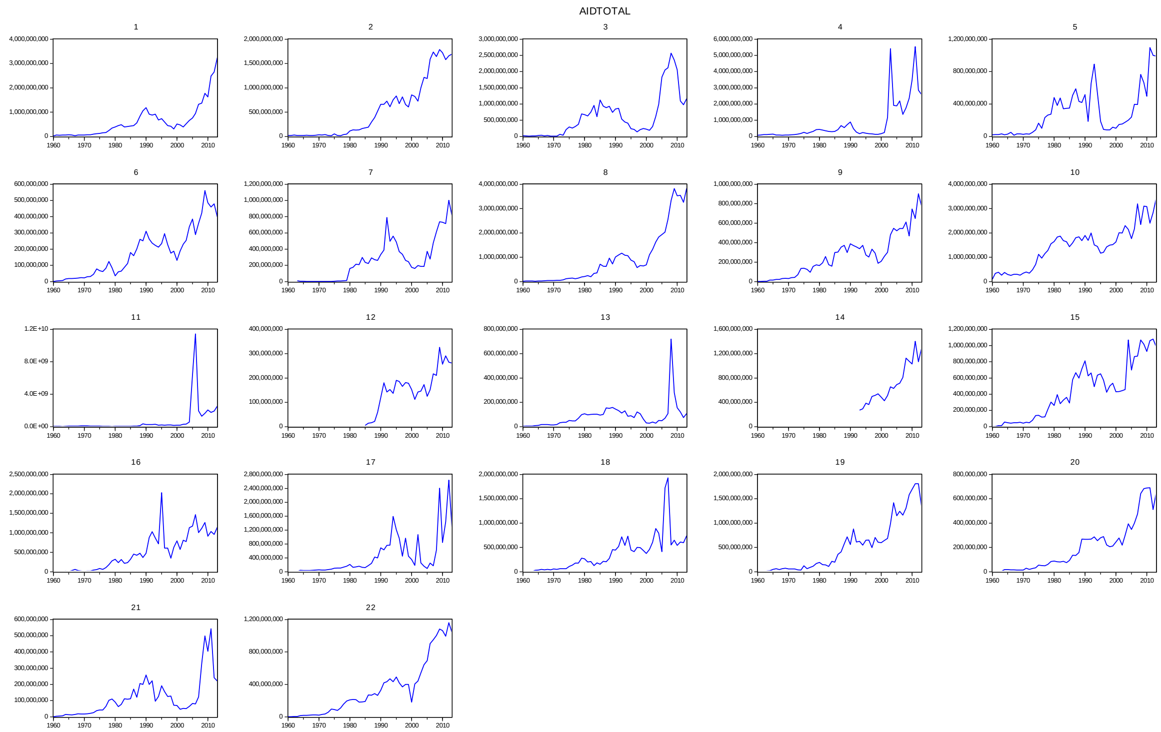

Figure 2, Total Aid inflows per country from 1960 to 2013.(Please see appendix A.1 for the corresponding country list)

As robustness measure of this paper's findings the period of 2000 to 2015 will therefore also explicitly be examined later in this paper. The interaction of aid with the disaster dummy does not support the premise that the Dutch Disease occurs as additional aid flows into an economy.

In order to avoid running a spurious regression control variables were added (David, George, Bruce, Layth, & Duckworth, 2011). The first approximates the net present income within a given economy. The marginal negative magnitude suggests that an increase in income results in a real exchange rate appreciation. This is again in accordance with the predictions made by the core Dutch Disease model (Corden & Neary, 1982). Inference should however be drawn with care, as the coefficient, even in the final model, is marginally significant at a 10% confidence level.

The consumer price index reflects the general increase in price levels. The marginal negative magnitude of the coefficient is not significant at a 10% level and therefore this result has no implications. It is of interest however to note that the sign in is line with general economic theory (Bryan & Cecchetti, 1993). An interesting observation from which economic inference can be drawn is that the share of the population living in urban areas has a marginally negative impact on the real effective exchange rate. In other words, if more individuals were to be living in cities, the domestic currency would subsequently appreciate. The main reason why previous research such as Doucouliagos & Paldam (2006) has accounted for this intra geographical relocation is because this measure is seen as a robust estimation of country development. In general, Sub-Saharan countries which have seen an increase in economic development have also experienced an increased number of individuals migrating from rural to urban areas (Hyden, 1990). A possible explanation therefore as to why this causes the currency to appreciate is that developing metropolitan areas have frequently been targeted by foreign investors and have heightened average consumption levels in the region (Levy, 2006). This, in turn, puts upward pressure on the exchange rate and hence an appreciation, albeit relatively non-pronounced, can be observed.

The lagged openness criterion, as its counterpart in the aid effectiveness model, indicates that a country which actively engages in world-wide trade is prone to experiencing an exchange rate appreciation. As the p-value of these coefficients however exceed the required 5% confidence level as stipulated before, this paper will draw no further inference from this control variable.

From this initial simple regression level estimation one may infer that in the long run indeed a case can be made for the spending effect taking place. Before this research formally rejects the first hypothesis specified earlier in this paper, the results are tested for their robustness through a number of differing models in the following section.

6.2.2 Robustness specification Spending Effect

Table 1.4: Varying model specifications

Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013			
	Coefficient and significance		
Model type:	First Difference Model	ARMA(1) Model	Logarithmic Model
C	-	8.159 *0.391*	-2.789 *0.000****
ShareaidGDP	72.154	-142.940	0.023

	0.5035	*0.556*	*0.626*
ShareaidGDP(-1)	-91.938 *0.0317***	-98.394 *0.603*	-0.084 *0.210*
ShareaidGDP*CrisisDummy	52.894 *0.498*	77.641 *0.094**	-0.013 *0.368*
CrisisDummy	5.208 *0.068**	-0.645 *0.878*	-0.036 *0.429*
CPI	-0.001 0.095*	-0.001 *0.039***	0.167 *0.000****
Income	-0.063 *0.01****	-0.0004 *0.089**	-0.146 *0.007****
Urban	5.335 *0.118*	6.69*10^07 *0.029***	0.316 *0.000****
Education	1.00*10^08 *0.016***	4.2*10^-10 *0.424*	-0.084 *0.0310***
Openness	-42.460 *0.02***	1.142 *0.936*	-0.101 *0.084**
REER(-1)	0.189 *0.215*	0.957 *0.000****	0.995 *0.000****
N	737	658	695
R^2	0.09	0.97	0.98
Durbin Watson Statistic	NA	1.8	2.7
Dependent variable	*REER-REER(-1)*	*REER*	*Log(REER)*

*Note: The dependent variable is the Real Effective Exchange Rate. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model. Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value. No inference is drawn from the constant.*

The robustness specifications are similar as to those used previously. The first measure used is the first difference model. It appears the instantaneous effect of aid on the Real Effective Exchange Rate remains insignificant. No inference may be drawn from this result. The lagged effect remains robust and stays negative and significant at a 5% confidence level. The real shock of the induction of aid seems to need time to trickle down to have a monetary influence on the real effective exchange rate (Work, 1997). The negative sign again shows that there is an appreciation in the exchange rate following a rise in aid which is exactly the prediction made by classical Dutch Disease literature when describing the Dutch Disease.

Another interesting finding lays in the fact that the Dummy representing Crisis periods becomes significant at a 10% level, despite the interaction term with aid being insignificant. This suggests that following a major crisis the real effective exchange rate depreciates. This result is not surprising. Exchange rates are known to be liable to both real and monetary shocks and usually accurately reflect the economic situation of an economy (Acosta, Lartey, & Mandelman, 2002). Economic uncertainty caused by crises more often than not come paired with subsequent exchange rate depreciations (Breisinger, XinshenDiao, Schweickert, & Wiebelt, 2009).

The remaining control variables continue to have the same sign and magnitude and can hence be treated as being robust until now. The fact that income persists to have a negative and statistically significant sign shows that an increase in income is associated with a robust exchange rate appreciation, which is a prediction made by classical Dutch Disease literature (Corden & Neary, 1982). *When looking at the level model, as soon as income is included as a control variable, the effect of aid on the real exchange rate becomes statistically significant.* This signifies that the change in income has significant explanatory value when it comes down to clarifying the subsequent exchange rate appreciation.

When looking at the moving average model, it immediately becomes apparent that the effect of aid on the Real Effective Exchange Rate is much less pronounced and is therefore also not significant. The dissipation of the general effect of aid on the exchange rate is instead replaced by period of economic distress. This is signified by the fact that the interaction term is significant at a 10% level. The sign of the coefficient is however not in line with the predictions made by the Dutch Disease. The expected deprecation during crisis periods can be caused by the fact that the economic distress experienced exceeds the appreciation caused the Dutch Disease (Calvo & Mishkin, 2003). The remaining control variables included in the moving average model remain of the same sign and significance and hence do not require any further inference. The main finding which should be taken into account from this robustness specification is the fact that the spending effect is no longer observed. Domestic currency depreciates instead of appreciates as Dutch Disease literature depicted (Corden & Neary, 1982). It may therefore be concluded that the moving average model does not reflect the spending effect findings found in the previous two models.

The final robustness model used is the logarithmic model, again to verify the percentage change in a given independent variable has an effect on the Real Effective Exchange Rate. The exchange rate is not impacted by the inflow of aid. Neither the non-lagged nor lagged aid component has a significant impact on the real effective exchange rate. What we observe instead is that the spending effect component is largely captured by the income control variable. As households hold 1 percent income the exchange rate is expected to appreciate by 0.146 units. This is quite a steep appreciation, but this change in income can also be caused by other factors except for aid (Bourguignon, 2007). *This is a crucial finding made by this research.* The spending effect mechanism accurately depicts the impact a rise in income has on the exchange rate of an economy. However this rise in income does not have to be caused by aid. This focal point has also been elaborated on by previous research, which list resource findings, business cycles, macroeconomic and political stability as important determinants of income levels in Sub-Saharan Africa (Adam, 2008; Fielding & Gibson, 2012; Benjamin, Devarajan, & Weiner, 1989).

To summarize the findings for the spending effect, the level and first difference model indicated that there is indeed a lagged negative statistical relationship between aid inflows and the real effective exchange rate. While the moving average and logarithmic model show that this is not always the case, and that a rise in income can also be attributed to other sources as mentioned previously. It is therefore not clear whether all cases in which aid is received are indeed accompanied by a real effective exchange rate appreciation. Therefore this paper cannot reject the first null hypothesis in favor of the alternative hypothesis. An exchange rate appreciation does not always occur following an increase in aid. However, a case can be made for the mechanism of the spending effect being present following a rise in wealth caused by a different source. Another important result to take away is the fact that if the spending effect was to occur, it would do so in the long run as fundamentals need time to adjust; a finding which is also echoed by the theoretical model.

6.3 Discussion of the resource movement results

6.3.1 Resource movement effect baseline model

In order to verify whether the resource movement effect took place, which in this research is defined as a reduction in agricultural output after the implementation of aid, model B is used. This fixed panel regression estimate examines the *levels* of each given variable and the effect it has on real agricultural output. The results for the simple panel level model for the spending effect are as follows.

Table 1.5: Resource Movement level results.

Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013				
	Coefficient and significance			
C	-43723534 *0.5649*	-4690584 *0.6184*	-2.88*10^08 *0.090**	-1.96*10^08 *0.289*
ShareaidGDP	-3.04*10^08 *0.266*	-1.87*10^09 *0.003****	-2.87*10^09 *0.028***	-3.33*10^09 *0.016***
ShareaidGDP(-1)	-	1.59*10^09 *0.000****	2.24*10^09 *0.005****	-1.09*10^09 *0.258*
ShareaidGDP*CrisisDummy	-	8.37*10^08 *0.264*	1.7*10^09 *0.252*	1.62*10^09 *0.2995*
CrisisDummy	-	-70286112 *0.5551*	-1.32*10^08 *0.491*	2.22*10^08 *0.2710*
GDPCAP	-	-	84478.75 *0.232*	49631.99 *0.295*
CPI	-	-	-96355.59 0.000***	-88230.61 *0.000****
Urban	-	-	-	166.627 *0.000****
Education	-	-	-	-0.085 *0.027***

Openness(-1)	-	-	3.81*10^08 *0.3248*	-8.81*10^08 *0.089**
Agri(-1)	1.106 0.000***	1.107 0.000***	0.103 *0.000****	1.01 *0.000****
N	998	992	752	695
R^2	0.98	0.98	0.98	0.98
Durbin Watson Statistic	2.7	2.7	2.7	2.7

*Note: The dependent variable is total agricultural output. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model. Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value.*

The core model seen in table 1.5 is in line with previous research conducted by Bräutigam, (2004) and Levy (2006). In the initial model, the share of aid to GDP is regressed on total agricultural output and an autoregressive term to control for potential autocorrelation is added. This yields an insignificant effect at all three confidence levels. Subsequent models do yield significant results at a 5% level respectively. The negative sign of the coefficient suggests that as an increase in aid occurs there is a reduction in the absolute size of the agricultural sector as measured by output. This is in contrast with previous findings, which either found the opposite effect (Gaiha, 2003) or found to be ambiguous (Acosta, Lartey, & Mandelman, 2002). What makes this finding especially interesting, apart from its high statistical significance and large magnitude, is that the effect appears to be instantaneous. In contrast to the *spending effect* which takes an additional period to have an influence on the Real Effective Exchange Rate as shown previously, the addition of aid seems to decrease agricultural output within the same period. A certain degree of caution has to be taken when interpreting this result however, as the data used to conduct this research is annual (David, George, Bruce, Layth, & Duckworth, 2011). The long period of time over which aid is observed can be subject to a multitude of fluctuations, and therefore the cause of the decrease in agricultural output can also be attributed to other factors (Doucouliagos & Paldam, 2009).

Another interesting finding is the impact the lagged value of the share of aid to GDP has on agricultural output. The strictly positive and highly significant coefficients seem to suggest that following a period of relatively high inflows of aid, and after a reduction in the overall size of agricultural output, a large increase can be observed. The spending effect shows that the theory of monetary shocks takes additional time to have an impact on real economic fundamentals, while the resource effect seems instantaneous. The subsequent positive shock has empirically not been previously witnessed. Calvo & Mishkin (2003) however have attributed less economically developed regions to be more prone to economic shocks and external influences such as failed harvests and natural disasters. The latter of which should than be captured in the crisis term, however none of the coefficients are statistically significant in any of the models. The same holds for the individual dummy terms. This change of sign in the agricultural sector has also been attributed by past research to seasonality cycles (Hansen, Mason, Sun, & Tall, 2011). This geographical specific phenomenon occurs when crops can only be harvested during a certain season (Hansen, Mason, Sun, & Tall, 2011). The calendar year does not accurately reflects the time schedule in which this harvesting takes place, and hence it may be observed *that every other year* there is a peak in agricultural output. This ambiguity as to whether the Dutch Disease is indeed the cause of the instantaneous drop in agricultural output observed previously is elaborated on in the *robustness discussion*.

Although GDP per capita seems to have no significant effect on agricultural output, there is a strong negative correlation present with inflation levels. The negative coefficients suggest that higher levels of inflation negatively impact agricultural production. Although the direct relationship is still a question at large, a majority of research attributes it to an indirect effect (Thiele, 2002; Doucouliagos & Paldam, 2009). Higher inflation levels, especially in Africa over the past century, have become associated with increased instability and generally poor macroeconomic policy implementations. A classic example of such a phenomenon is the hyperinflation observed in Zimbabwe over the past decade. The sample used in this research is similarly also characterized by a multitude of hyperinflation periods, defined as a period in which inflation levels exceed the value of 100% (Frenkel, 1979). This can also be observed in figure 3.

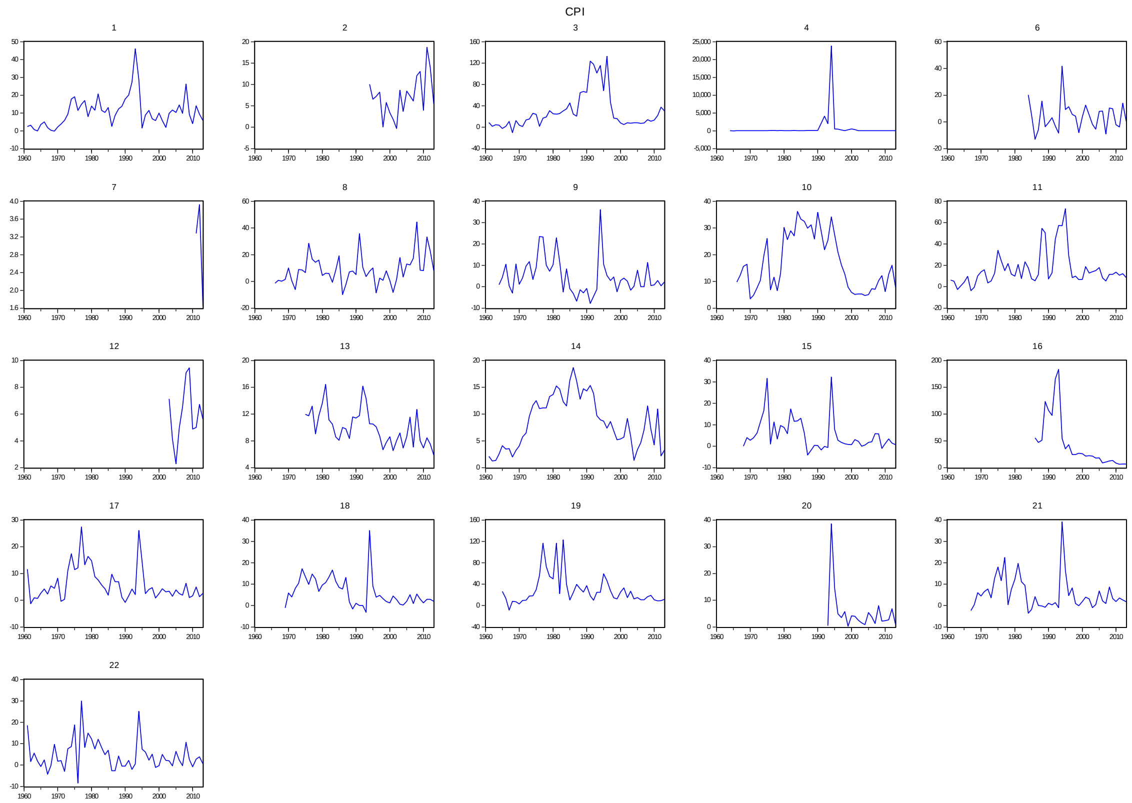

Figure 3, Consumer Price Index inflation level from 1960 to 2013. (Please see appendix A.1 for the corresponding country list)[8]

An additional finding of interest is the impact the share of the urban population within a given economy has on agricultural output. It appears that as more inhabitants move to the city, there is actually a rise in the overall agricultural productivity. This counterintuitive finding has been observed by pervious research (Hansen, Mason, Sun, & Tall, 2011). Although agriculture is still predominantly labor intensive, a large majority of Sub-Saharan African youth migrates toward urban areas to seek employment. Over the same period of time African agriculture has been subjects to a multitude of technological advances, the most prominent of which is improved fertilizing capabilities (Braun & Webb, 1989). This may be an explanation to an at first glance improbable relationship. The rise in urban inhabitants comes paired with an increase in agricultural output and they appear to be significantly positively correlated. However, previous research has shown that the omitted variable within this context in this case is the technological advances experienced by African agricultural market which allows them to produce more despite a dwindling available labor force (Braun & Webb, 1989).

The second to last control variable captures the effect education has on agricultural output. Although the magnitude of the effect is marginal, its sign and statistical significance make it a good candidate for further analysis. The negative sign of the coefficient imposes the assumption that as there is a rise in spending on education the agricultural sector will decrease in absolute terms. This is in line with both economic theory and previously conducted research (Barder, 2006). Typically, as a labor force becomes more educated, the share of skilled labor rises (Gale & Mendez, 1998). Agriculture is, in this research and in classical literature, defined as the sector which is relatively abundant with unskilled labor. This in turn means that as more individuals become educated, the labor force available to work in the agricultural sector falls. This causes overall productivity to drop and consequently also the amount of output produced by this given section of industry.

The final control variable captures the Openness criteria posed by McKinnon (1963). The negative influence it appears to have on agricultural output, as can be seen in table 1.4, may be explained through several different channels. The exposure to world markets means that domestic prices for agricultural goods are set according to world prices (Corden & Neary, 1982). In order to influence the domestic tradable goods price a certain degree of importation and exportation is assumed to occur. If this is the case then local farmers are not only competing domestically but also with world players, who usually have access to better technology and subsequently have a lower marginal cost of production. This

[8] This paper has chosen to use the Consumer Price Index to represent inflation rates due to data availability. The Worldbank provides extensive figures on CPI measures, however actual inflation figures which are provided by local governments (Worldbank, 2015) have too many missing observations to examine a clear trend. Additionally, the trustworthiness of these non-weighted inflation percentage figures have been questioned (Worldbank, 2015).

generally translates into having a lower price (Corden & Neary, 1982). This forces the less productive domestic firms out of the market, and meets the excess demand with foreign products (Banerjee & Newman, 2003).

6.3.2 Robustness specification Resource Movement Effect

Table 1.6: Varying model specifications

Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013			
	Coefficient and significance		
Model type:	First Difference Model	ARMA(1) Model	Logarithmic Model
C	-	-1.04*10^09 *0.001****	3.403 *0.000****
ShareaidGDP	1.12*10^08 *0.9345*	8.23*10^08 *0.402*	-0.061 *0.002****
ShareaidGDP(-1)	30035689 *0.9804*	6.76*10^08 *0.603*	0.105 *0.000****
ShareaidGDP*CrisisDummy	-2.01*10^09 *0.3120*	3.65*10^08 *0.3861*	0.0002 *0.9809*
CrisisDummy	-1.98*10^08 *0.097**	-78331599 *0.733*	0.010 *0.786*
CPI	-41235.39 *0.2602*	-67634.44 *0.000****	0.009 *0.372*
GDPCAP	2821968 *0.000****	99056.97 *0.3952*	0.333 0.0000***
Urban	94356242 *0.282*	13453420 *0.2573*	0.113 *0.001****
Education	0.207 *0.174*	0.129 *0.3472*	-0.007 *0.7418*
Openness	1.11*10^09 *0.163*	1.47*10^09 *0.000****	-0.011 *0.613*
AGRI(-1)	0.189 *0.215*	0.957 *0.000****	0.675 *0.000****
N	672	681	634
R^2	0.16	0.98	0.98
Durbin Watson Statistic	NA	2.7	2.7
Dependent variable	*AGRI-AGRI(-1)*	*AGRI*	*Log(AGRI)*

*Note: The dependent variable is Agricultural output. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model. Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value. No inference is drawn from the constant.*

The first difference model shows that aid inflows do not have a negative effect on agricultural output. This is in stark contrast with the observed effects in the level panel model. The only variable of interest which is significant at a 10 percent confidence level is the crisis dummy. This finding suggests that the agricultural sector decreases in absolute size during a man-made or natural crisis. Sub-Saharan Africa has been frequent witness to a number of events displacing a large amount of individuals (Gaiha, 2003). During these periods of time the agricultural sector, which is heavily depended on by a majority of Sub-Saharan African countries, is highly limited in its production capabilities (Braun & Webb, 1989). This is a potential reason as to why the coefficient sign for the Crisis Dummy takes a negative sign. Another highly significant control variable is the GDP per capita. Its positive coefficient is in line with economic expectations, as general economic growth in countries which are relatively abundant in low skilled laborers usually see an increase in the sectorial productivity which mostly uses that factor of production (Banerjee & Newman, 2003). The main finding which can be taken away from first difference model therefore is the fact that the resource movement effect is not reflected by this specification.

The moving average model reproduces similar results to that of the first difference model. None of the previously observed correlations between the aid and agricultural output persist. In order to avoid misspecification due to theoretical deductions the model was also re-run using manufacturing output as the dependent variable which yielded similar results**.** It has become evident that also this model does not accurately reflect the dynamics witnessed with the resource movement effect when estimated according to a level fixed-effects model. The only two significant control variables with the moving average model are the consumer price index and McKinnon's degree of openness criteria. Both control variables have the expected sign, as highlighted in the previous discussion of the level model result. It appears that observing the impact of aid on the agricultural sector output dissipates the effect. In contrast to the spending effect, this finding was also reflected by the theoretical model previously. Barder (2006) has also discussed the fact that the numerous factors which impact agriculture over a longer period of time make it very difficult to capture the stand-alone effect aid has on agricultural output.

The final logarithmic model tells a different story however. As can be observed in the final column of table 1.6, there does appear to be a negative correlation between aid inflow and the agricultural sector. However, as also observed with the previous model there is a significant lagged positive shock, with a coefficient value of 0.105 and a p-value of 0.000. Previous literature has attributed this finding to seasonality influences (Thiele, 2002). However the robustness of this result does raise some additional questions. Aid which flows into the agricultural sector is invested in machinery, fertilizer and crops for the majority of the time (Thiele, 2002). This investment however takes an additional time period before the benefits can be reaped. This could explain as to why numerous research has found the negative instantaneous impact aid has on agricultural output. The lag merely reflects the actual investment of goods, and the subsequent positive effect shows the result of improved productivity as a result of this investment. This research therefore concludes that it is not aid that causes the instantaneous contraction of the agricultural sector, but it is actually the investment in machinery that causes the initial drop in productivity*. This leads this research to not reject the third null hypothesis in favor of the alternative.* Aid seems to have a positive effect in the long run on agricultural output.

7. The Millennium Goals

Previously this paper investigated the effect development aid has had on Sub-Saharan economies over the period of 1960 to 2013. It was observed that the exchange rate depreciated after a time lag. At first glance this seemed to be attributable to the spending effect channel in the Dutch Disease. However, after numerous robustness test it became evident that that this effect cannot be attributed fully to the inflow of aid. Instead a rise in income is the true robust determinant of a real exchange rate appreciation. This rise in income can however also be caused by other determinants, for example resource findings and improved macroeconomic policy as proposed by (Davis, 1995) and (Doucouliagos & Paldam, 2009).

The resource movement effect was subject to previous research as a reduction in agricultural output was observed following an influx of aid. This observation is frequently attributed to the Dutch Disease. However, this research has shown that another robust result is the lagged positive effect aid has on agricultural output. This implies that after a reduction in agricultural output after a rise in aid, a subsequent rise in output is to be expected in the following period. Although previous research has often attributed this to seasonality, this paper concludes that this finding can also reflect the time it takes for agricultural investments to yield benefit. Therefore is cannot be directly concluded that the resource movement effect does take place.

Despite the fact that the Dutch Disease seems not be present under all macroeconomic environments, this research has shown that there are indeed instances where economies emit signs that the Dutch Disease can persist. This is reflected by the fact that the lagged monetary effect is indeed a real exchange rate appreciation, and the initial effect of aid investments in the agricultural sector is indeed negative. This means that considerable care has to be taken when developed economies take it upon themselves to set humanitarian goals on behalf of the developing world (Easterly & Pfutze, 2008). One such campaign to eradicate extreme poverty are the Millennium goals (Majid, 2004). The Millennium Development Goals (MDGs) are eight international development goals set by the United Nations in 2000, which were to be achieved by 2015. One of these goals was the eradication of extreme poverty and hunger, which was mainly done by heavily investing in the agricultural sector of these less developed economies which primarily also included Sub-Saharan countries (Majid, 2004). This surge of aid is a prime example of an instance in history where a large flow of aid from the developed world to Sub-Saharan Africa can be observed. In order to capture the time-specific effect of the inflow of aid on Sub-Saharan Africa, a dummy is created for the period of 2000 to 2015. This dummy is then interacted with aid inflows in similar models to the specifications estimated previously. The results can be observed in table 1.7.

As can be seen in the model specification for aid effectiveness, the negative effect of aid on GDP per capita persists in this period. In the level interaction model, the magnitude of the effect is enhanced in absolute terms. This result suggests that in the period of 2000 to 2015 the increased amount of aid caused a larger decrease in GDP per capita than before. However, the other models do not share this result and the effect dissipates to the extent that it becomes insignificant.

The spending effect models yields similar results as before. There seems to be a lagged influence on the real effective exchange rate following an inflow of official development aid. A surprising result which is in stark contrast to the model estimated previously is the fact that the logarithmic model echoes the same result. Over the period that the Millennium goal measurements were implemented there was a significant appreciation of the real effective exchange rate following an aid inflow. Although the first difference and moving average model do not share this finding, the sign of the coefficient is negative. This raises the intriguing notion that whether the Dutch Disease occurs depends solely on the magnitude of aid volumes received. This has very important policy implications. In the past, governments have frequently sent aid packages in large quantities to developing economies at a single point in time (Doucouliagos & Paldam, 2009). This result suggests that a preferred approach would be to spread the amount of aid over a longer period of time, in order to give the recipient economy time to process the aid and to counteract any negative monetary or real side effects which is a finding shared by (Gaiha, 2003).

The resource movement effect is not reflected by any of the models except for the latter logarithmic model. The effect of aid and the lagged component of aid on agricultural output is again in accordance with the previously estimated models which reinforces the previously advocated theory of an investment lag (Benjamin, Devarajan, & Weiner, 1989). A key finding which can be observed from the Millennium Dummy is that it reflects the heightened level of investment in the agricultural sector to meet the Millennium goals.

These results reflect a number of important implications this paper has brought forth. The main determinant as to whether the Dutch Disease occurs is the volume of aid an economy receives at a given moment in time, paired with its macroeconomic ability to counteract the spending and resource movement effect. It is therefore of crucial importance for net exporters of development aid to realize that sending excess aid to receiving economies can also have negative effects. Although the spending effect is less pronounced as seen by previous literature, the effect of increased household income on the real effective exchange rate is robust. This ties in with the fact that with the responsibilities experienced by African governments. It is apparent that when windfall gains such as resource discoveries occur, it is in a government’s best interest to regulate the benefits experienced by sector of an economy (Edwards & Aoki, 1983). Although consumers will experience a heightened leveled of income in the short run, in the long run an appreciated exchange rate and a subsequent worsening exporting position could cause a decrease in consumer wealth in the long run (Fan, Hazell, & Thorat, 2000).

8. Conclusion

This research paper set out to investigate whether the Dutch Disease took place over the period of 1960 to 2013 in Sub- Saharan Africa due to increased aid levels by net aid exporters. The classical Dutch Disease occurs when an economy experiences a wealth shock which is most commonly associated with a discovery of natural resources. This windfall gain has two separate effects, namely a spending and a resource movement effect.

The spending effect occurs due to a heightened level of disposable income available to households within this economy. As households have more disposable income they prefer to spend it on non-tradable goods, which are also known as services. The Dutch Disease model assumes that the real effective exchange rate is given by the ratio of the price of non-tradable goods to tradable goods. This means that the increased demand for services as a result of increased income results in an exchange rate appreciation. This in turn translates to a worsening export position for developing economies which results in lower economic growth.

The resource movement effect states that following a windfall gain a contraction of an economy's manufacturing sector follows. This contraction occurs as prices in the non-tradable sector rise and hence firms prefer operating within this sector. This shift in production preferences means that factor of production experience a similar shift. Labor and capital will shift to the non-tradable sector. To summarize, an increase in aid will result in a reduction in the absolute size of the manufacturing sector ceteris paribus.

This paper first determines whether there is indeed a negative relationship between aid received and the subsequent welfare change experienced by a given developing economy. After estimating a fixed effects level panel model with three robustness measures, it became apparent that this correlation is indeed there. Following an increase in aid there is a fall in GDP per capita. This research then continued to verify whether this drop in GDP per Capita could have been caused by the two effects stipulated in classic Dutch Disease literature.

This paper concludes that a case could be made for a lagged appreciation in the real effective exchange rate following an induction of aid into an economy. This result however became ambiguous when subjected to numerous robustness specifications. One relationship which did remain constant was the fact that a rise in income caused an exchange rate appreciation. This is the first important finding this research deduced empirically. It appears that a rise in income, regardless whether aid is the source, causes a subsequent appreciation of the real exchange rate. This is in line with previous literature, which has found similar results for countries experiencing economic growth through the discovery of oil fields (Corden & Neary, 1982) and other natural resources (Adenauer & Vagassky, 1998). As aid can act as a medium through which disposable income is increased per household, the Dutch Disease can occur given the right economic conditions. This paper however rejects the first hypothesis which states that a real exchange rate appreciation occurs when aid is received. The effect appears to be much more nuanced, which is also explored later in the paper.

The resource movement effect, unlike the spending effect, appears to have an instantaneous negative effect on agricultural output. This has led previous research to believe that the Dutch Disease was actually present (Edwards & Aoki, 1983). However, a closer look harbors a different explanation. Another robust result is the fact that the lagged effect of aid on agricultural output is strongly positive. Previous research has attributed this to seasonality (Lundvall & Battese, 2000), however this paper draws other inference. Namely, the instantaneous decrease in agricultural output can be attributed to the large investments which are made with finances made available through development aid. These investments takes time however to be reflected in higher levels of productivity and subsequent output. The initial drop is therefore not due to an inherent Dutch Disease, but instead merely due to a lagged effect of the benefits reaped by these given investments.

The final proposition which is investigated within this research paper is the notion that development aid is better induced over a longer period of time as opposed to over a short time. An example of a period with a sudden shock in aid levels was the period 2000 to 2015, which is the period over which the Millennium goals were set by the UN. Through the use of a Dummy variable for this period, it has become apparent that for both the spending effect and the resource movement affect the negative effects become much more enhanced. The real effective exchange rate appreciates by more and the fall in agricultural output is much greater. The aggregate result of these observations has therefore formulated an answer to the following research question:

"Did the Dutch Disease occur in Sub-Saharan Africa over the period 1960-2013 following increased levels of development aid and what are the policy implications?"

This research paper concludes that Sub-Saharan Africa *did not always* experience the Dutch Disease following an increase in development aid received, but the symptoms were there. The spending effect was observed but also quickly dissipated while the resource movement effect only became pronounced during very high levels of induced aid, namely during the 2000 to 2015 Millennium goal time frame. An important implication of this result is that developed economies should be wary about exporting large amounts of development aid at a single point in time, as it may enhance Dutch Disease symptoms to the extent that effective macroeconomic policy can no longer counteract it.

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10. Appendix:

Appendix A.1.

Number:	*Country:*	*Time period:*
1	Kenya	1960-2013
2	Uganda	1960-2013
3	Sudan	1960-2013
4	Democratic Republic of Congo	1960-2013
5	Somalia	1960-2013
6	Chad	1960-2013
7	Zimbabwe	1960-2013
8	Ethiopia	1960-2013
9	Niger	1960-2013
10	Tanzania	1960-2013
11	Nigeria	1960-2013
12	Namibia	1960-2013
13	Botswana	1960-2013
14	South Africa	1960-2013
15	Senegal	1960-2013
16	Zambia	1960-2013
17	Cote D'ivoire	1960-2013
18	Cameroon	1960-2013
19	Ghana	1960-2013
20	Benin	1960-2013
21	Togo	1960-2013
22	Burkina Faso	1960-2013

Country corresponding intersection list

Appendix A.2.

Table B1: Hausman test for consistent efficiency

Test	Test name	Test statistic	p-value
Hausman test	Aid Effectiveness (level)	7.858	0.000
	Spending Effect (level)	4.759	0.000
	Resource Movement (level)	2.378	0.000
	Aid Effectiveness (F.D)	19.83	0.000
	Spending Effect (F.D)	8.625	0.000
	Resource Movement (F.D)	9.737	0.000
	Aid Effectiveness (ARMA)	4.241	0.000
	Spending Effect (ARMA)	8.653	0.000
	Resource Movement (ARMA)	3.633	0.000
	Aid Effectiveness (log)	3.353	0.000
	Spending Effect (log)	7.747	0.000
	Resource Movement (log)	5.224	0.000

Note: H_0:Consistent Efficient & H_1:Consistent Innefficient

Appendix A.3.

Table B1: Tests performed on ordinary least squares assumptions and mis-specification of Aid Effectiveness level

Test	Test name	Test statistic	p-value
Heteroskedasticity	Breusch-Pagan-Godfrey	3.03	0.01
Serial Correlation	Breusch-Godfrey	5.13	0.06
Normal Distribution	Jarque-Bera	13.5	0.00
Mis-specification	Ramsey RESET	0.77	0.57

Table B2: Tests performed on ordinary least squares assumptions and mis-specification of Spending Effect

Test	Test name	Test statistic	p-value
Heteroskedasticity	Breusch-Pagan-Godfrey	7.49	0.03
Serial Correlation	Breusch-Godfrey	4.50	0.05
Normal Distribution	Jarque-Bera	4.13	0.34
Mis-specification	Ramsey RESET	6.71	0.01

Table B3: Tests performed on ordinary least squares assumptions and mis-specification of Resource Movement Effect

Test	Test name	Test statistic	p-value
Heteroskedasticity	Breusch-Pagan-Godfrey	3.17	0.06
Serial Correlation	Breusch-Godfrey	7.43	0.00
Normal Distribution	Jarque-Bera	17.2	0.00
Mis-specification	Ramsey RESET	0.45	0.66

Table 1.7.	Fixed Effect panel estimate for Sub-Saharan Africa period 1960-2013 with Millennium Dummy Coefficient and significance											
	Aid effectiveness				Spending Effect				Resource Movement Effect			
Model type:	Level	F.D.	ARMA(1)	Logarithmic	Level	F.D. Model	ARMA(1)	Logarithmic	Level	F.D. Model	ARMA(1)	Logarithmic
C	12.586 0.669	-	19.862 0.603	-1.135 0.000***	-8.279 0.380	-	-8.357 0.061	-3.642 0.000***	-8.23*10^08 0.000***	-	-7.85*10^08 0.012	4.212 0.000***
ShareaidGDP	-215.882 0.270	-369.561 0.014*	-531.631 0.025**	-0.061 0.002***	210.038 0.000***	155.578 0.349	188.181 0.515	0.033 0.4982	-6.50*10^08 0.674	-5.37*10^08 0.301	2.34*10^09 0.652	-0.073 0.000***
ShareaidGDP(-1)	123.641 0.476	-198.031 0.129	225.345 0.339	0.105 0.000***	-136.277 0.001***	-87.151 0.021**	-58.261 0.793	-0.097 0.152	1.40*10^09 0.303	-3.22*10^08 0.758	1.52*10^09 0.337	0.117 0.000***
ShareaidGDP*Millenium	-577.812 0.011**	103.960 0.553	93.879 0.722	0.005 0.209	-54.340 0.160	-107.467 0.558	-33.703 0.734	-0.032 0.043**	-1.44*10^09 0.427	-6.25*10^08 0.628	-3.38*10^09 0.149	0.023 0.210
MilleniumDummy	122.085 0.000	35.320 0.3069	-13.545 0.695	0.010 0.786	0.675 0.919	3.135 0.577	-6.886 0.475	-0.205 0.004	2.83*10^08 0.173	3.19*10^08 0.000***	5.44*10^08 0.039**	0.170 0.026**
CPI	-0.006 0.424	-0.002 0.153	-0.005 0.000***	-0.001 0.899	-0.002 0.308	-0.073 0.058*	5.54*1-^-05 0.790	0.159 0.000***	-86017.22 0.115	-42892.42 0.179	-65277.98 0.000***	0.017 0.063*
GDPCAP	-	-	-	-	-	-	-	-	118431.6 0.258	2568565 0.000***	81686.20 0.509	0.360 0.000***
Education	2.77*10^08 0.000***	0.207 0.000***	3.08*10^-08 0.156	-0.150 0.000***	2.8*10^09 0.157	1.2*10^-08 0.030**	-4.23*10^-10 0.236	-0.052 0.257	-0.070 0.2022	0.212 0.144	0.134 0.344	-0.034 0.177
Openness(-1)	4.228 0.9332	3.01*10^-07 0.000***	98.688 0.006***	0.058 0.010***	-24.592 0.075	-47.661 0.018**	-13.599 0.269	-0.091 0.112	1.12*10^09 0.005**	9.56*10^08 0.211	1.24*10^09 0.000***	-0.031 0.149
GDPCAP(-1)	0.944 0.000***	0.126 0.245	0.970 0.000***	0.716 0.000***	-	-	-	-	-	-	-	-
DREER(-1)	-	-	-	-	0.959 0.000***	0.199 0.202	1.012 0.000***	0.996 0.000***	-	-	-	-
DAGRI(-1)	-	-	-	-	-	-	-	-	1.098 0.000***	0.161 0.251	1.071 0.000***	0.676 0.000***
N	708	687	703	634	652	642	659	674	695	673	680	635
R^2	0.98	0.41	0.98	0.98	0.98	0.10	0.97	0.99	0.98	0.17	0.98	0.99
Durbin Watson Statistic	1.7	NA	1.6	1.6	1.7	NA	1.8	1.3	2.7	NA	2.7	1.6
Dependent variable	GDPCAP	GDPCAP-GDPCAP(-1)	GDPCAP	Log(GDPCAP)	REER	REER-REER(-1)	REER	Log(REER)	AGRI	AGRI-AGRI(-1)	AGRI	Log(AGRI)

Note: See footnote next page

*Note: The dependent variable is Agricultural output. The confidence level at which this paper concludes is 5% corresponding to a 95% confidence interval. This is dictated by the number of observations used in this panel regression model (source). Results which are significant at a one percent confidence level are signified by ***, 5% by ** and at 10% by *.The first number indicates the absolute value of the coefficient while the bottom number shows the p-value. No inference is drawn from the constant.*