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Aid Effectiveness on Living Standards:

How Does Aid Affect Human Development Index (HDI) in Sub-Saharan Africa?

Bachelor thesis, 15hp

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List of acronyms

CPI	Corruption Perceptions Index
CPIA	Country Policy and Institutional Assessment
CRS	Creditor Reporting System
DAC	Development Assistance Committee
IDA	International Development Association
GDP	Gross Domestic Product
GNI	Gross National Income
HDI	Human Development Index
HDR	Human Development Report
HDRO	Human Development Report Office
IDA	International Development Association
NGO	Non-Governmental Organization
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
USD	United States dollar

Abstract

This study looks at whether aid affects Human Development Index (HDI), focusing on the geographical region of Sub-Saharan Africa. Aid effectiveness is often measured in economic growth, why we choose to see how aid affects the standards of living instead. Data on HDI have been collected from the HDRO, both from their database and their annual reports, while data on aid come from the OECD database DAC2a. We experienced the HDI definition changing over time as well as general data availability to be a problem. We performed two different econometric analyses, the first ranging between the years 1993-2007 and the second between the years 2005-2011. The study finds that the aggregate term for aid, ODA excluding debt, has a significant positive effect on the HDI of the aid recipient within the first year of receiving it. We also find evidence of effects of different aid variables that are lagged 1-3 years. These are humanitarian aid and technical cooperation as well as ODA excluding debt. The coefficients of these lagged variables vary between positive and negative, showing differences in the effect of different types of aid as well as differing effects over time. Our findings suggest that the overall effect of aid is positive. We recommend further research on a country-specific level as well as adding corruption as a further influence.

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I. Introduction

Our objective is to find out whether foreign aid affects the standard of living in developing countries, namely Sub-Saharan Africa. To answer this question we will look at how the Human Development Index (HDI) develops when aid is received. Furthermore, we want to investigate what the discussion has been like regarding the rationale of developed countries for giving aid.

HDI is a well-recognized country-specific measurement for the standard of living. This index is in turn composed of three other indices; health index, education index and income index.

The Sub-Saharan African countries differ vastly in terms of ethnicity, culture, geography and history. This leaves us with different stories of how these countries ended up where they are today. Many tend to consider the whole African continent as having the same characteristics, but there are many differences that we have tried to consider in order to produce an applicable analysis. The answer to the question why these countries have fallen into poverty is widely discussed by many economists.

There is an ongoing debate about the efficiency of aid where some of the most prominent economists have been Easterly, Collier, Sachs and Moyo, we have focused on their findings. In brief, Sachs argues for a moral responsibility in providing aid to the developing world. Moyo argues against aid as a tool for development, especially in Sub-Saharan Africa. Easterly has been voicing the view that aid is a poor instrument in relieving poverty. Collier takes a more moderate position while still promoting aid. He also argues for the existence of poverty traps, which Easterly is skeptical about.

We will look at countries within the Sub-Saharan African region. This geographical area is the most affected region in the world when it comes to poverty and low levels of population well-being, and it shows up in the HDI indices. Being the most exposed area in the world, it also receives the most aid. In 2011 the continent of Africa received 37% of total aid given in the world and Sub-Saharan Africa received 88% out of the total aid going to Africa (DAC2a, to find these figures; "all donors"; "aid type: ODA total excl. debt"; "constant prices").

There are different kinds of aid given to these countries, and we will address this later in this study.

The aid debate has received increased attention since the beginning of the 21st century. This is much due to the Millennium Development Goals set up at the Millennium Summit in the year 2000. These goals include increased resource transfers as well as extending the effectiveness of donor coordination. Further, specific debt relief institutions have been introduced to cut the debt burden of developing countries (UN, 2013b).

The efficiency of aid is often estimated by its impact on GDP growth. It is our belief that the utmost importance of aid should be to improve the standard of living of the citizens of developing countries. Assuming this viewpoint, what we are interested in looking at is how the lives of the population are changed, and possibly improved, when aid is introduced or intensified. The information captured by HDI is valuable as it records indices that estimate the life expectancy, level of education as well as income. These are all key factors in determining the standard of living. We therefore think that it is more appropriate to look at HDI rather than to just look at the economic growth, the approximate effect or essence of which is captured in GDP/capita or GNI/capita and therefore in HDI.

There are potential problems using HDI as a measurement. As always when using measures including GNI/capita or GDP/capita, there is the issue of the distribution of income not being taken into account. When it comes to the other two indices, education and health, this is not a problem to the same extent. Although the distribution of education and health might not be perfect, it seems more reasonable to believe it is more accurate than measuring economic wealth, as the spectrum from minimum to maximum is far greater when talking about income than when we are looking at education and health. The largest difference in years of education could only be about 20 years and the same principle would hold true for health as well, as it measures life expectancy, whereas the difference in income could easily be measured in millions. However, when it comes to education there could be differences in quality that would then be unaccounted for in HDI, due to the ways of measuring the education index.

In countries that are recipients of aid we believe that there will be a positive correlation between aid received and an increase in HDI. It seems obvious that the countries that receive aid already have a low HDI, and in this sense there is a negative correlation between a high HDI and receiving a lot of aid. In this sense, the causality between aid and economic growth is the same. From our point of view, this is not a problem for our research.

We divide this essay into six different sections, excluding the first and last sections; introduction and references. In the second section we present theories and discussions on poverty and aid from some of the most well recognized economists and their theories. This provides a necessary background and justification for our study. The third section includes definitions of different categories of aid. In the fourth section we introduce our methodology together with the variables and the econometric models. In the fifth section, we present the regression results. In the sixth and penultimate section we analyze and discuss the results to arrive at a conclusion on how aid affects HDI.

II. Theory and background

In this section we present the opinions of four economists on the aid debate. Further, we look at aid dependency.

2.1 Aid Effectiveness

There is an ongoing discussion about the effectiveness of aid, which is seemingly unresolved.

The main focus in this debate has been the effectiveness of aid concerning economic growth, but there have also been discussions on the effect of aid on social development indicators such as child and infant mortality. What we are interested in looking at is whether aid helps to increase HDI for developing countries. We have not seen a lot of research linking HDI with aid. The fact that this potential link seems to remain somewhat unexplored sparked our interest in this field.

For the sake of our research, it is important to know what sort of aid might contribute to an increase in the value of HDI. Previous research has concluded that not all aid given is meant to increase the economic growth of developing countries. One example of this is emergency relief and humanitarian aid (Veiderpass and Andersson, 2011). It is reasonable to believe that these types of aid could affect HDI since two of the indices are not related to income. One might argue that economic growth will indirectly increase the well-being of the population and thus the HDI value, considering the income index in HDI. That is the reason why aid given to directly support economic growth is interesting for our research as well. Keep in mind, the three indices that compile HDI are directly or indirectly affected by the countries' economic growth.

We have chosen to look closer at the views of four of the main economists within this debate: Jeffrey Sachs, William Easterly, Paul Collier and Dambisa Moyo. The reason we choose to include these economists is because of their wide array of opinions. This creates a spectrum of attitudes towards aid and its place in defeating poverty.

2.2 Jeffrey Sachs

Sachs, Director of The Earth Institute at Columbia University, argues in his book *The End of Poverty*, published in 2005, that extreme poverty, i.e. less than one dollar per day, could be overcome by the year 2025. The concrete solutions he offers are increased use of malaria bednets, debt forgiveness and a twofold increase of the total developmental aid provided between the years 2002 and 2015. He stresses the importance of achieving the Millennium Development Goals, especially the estimation that the countries in the developed world need to commit 0.7% of their GNP to alleviating the ailments of the poor through the channel of developmental aid. Several studies support his claims of the effectiveness of aimed developmental aid in constraining the spread of diseases such as malaria.

Demombynes and Trommlerova (2012) found that the child mortality in Kenya had decreased from 47 to 22 per 1000 live births between 2003 and 2008. The explanation they give for this is the improved access to water and sanitation as well as an increase in the use of malaria bednets. They claim that these insecticide-treated bednets account for 39% of the drop in child mortality and 58% of the drop in infant mortality.

Furthermore, Murray et. al. (2012) found that the global malaria related mortality decline can be largely attributed to the increase in humanitarian aid to afflicted regions.

In his book Sachs also argues for the existence of "poverty traps". These would be cyclical chains of events that keep countries in poverty. He argues that it is essential for these chains of perpetual poverty to be broken so that the countries can rid themselves of poverty. Sachs suggests that this can be done only by intensifying aid. To break these poverty traps, he prescribes what he calls the big push where the cyclicity of the trap is discontinued by one generation lifted out of poverty. Hence, the next generation will not grow up in extreme poverty.

Sachs says in an interview about his book *Common Wealth*, published in 2008, on CBC (2009) that there is an ideological opposition to aid where the skeptics of aid think that the free market should take care of all problems. The problem with this view, he says, is that it

is not rooted in empirical findings. Sachs writes in a response to Moyo's book Dead Aid (2009), that the opponents of aid, especially Moyo and Easterly are hypocritical in their stance as they both received scholarships to pay for their studies (The Huffington Post, 2009).

To put things into perspective he claims in his CBC (2009) interview that at the time his book was released the spending on the Pentagon in one year exceeds the amount that has ever been given in aid to Africa by the whole world. He goes on to point out that the funding needed to provide sufficient anti-malaria bed nets to last five years in Sub-Saharan Africa is exceeded by the daily spending on the Pentagon. What Sachs is arguing for is an ethical responsibility of the developed world to shift their priorities to reach the, in Sachs opinion very tangible, Millennium Development Goals. The way to follow through on this is to focus on results-based aid. He is a strong proponent of developmental aid and claims that measles was brought down by 91% since the year 2000 across Sub-Saharan Africa and that this is attributable to aid activities. Sachs thinks that the focus of aid should lie on agriculture, education and infrastructure and not on handouts.

Sachs argues that there obviously exists a place for aid. In an article for Project Syndicate (2012) he sums up with: "A decade of significant progress in health outcomes has proved the skeptics wrong. Aid for health care works – and works magnificently – to save and improve lives. Let us continue to support these life-saving programs, which uphold the dignity and well-being of all people on the planet."

2.3 William Easterly

Easterly wrote his book, *The White Man's Burden* (2006)*,* as a critical response to Sach's book *The End of Poverty* and to the growing paternalistic mentality in the west*.* The New York University professor criticizes the modern look on aid to Africa. He argues that the western world sees itself as the mighty savior for the poorest of the poor. The "it is up to us"-mentality of the west is a paternalistic view that is patronizing and insulting to Africans. One view is that rather than causing Africa to westernize, the west should help them to modernize. The general issue being, that the west are forcing the developing countries to

change into something that the west believes to be the best way to go. This is a destructive way of development to any country, according to Easterly.

Another big problem that Easterly proclaims is about how the west have donated 2,6 billion dollars over the last fifty years, without being able to relieve even the most basic needs of the poor, for example malaria nets and medicine. Basicly, the effectiveness and fallout of aid has not succeeded. Easterly's vision is not to withdraw aid to the poorest in the world, but rather make sure it reaches their hands (Al Jazeera, 2007).

Easterly (2006) argues that all parts involved need a lot less bureaucracy and more entrepreneurs to beat extreme poverty. He is accusatory of world leaders trying to solve poverty behind desks or at large summits. He refers to two different types of advocates to explain why the aid industry has failed, and what is needed for it to be successful; "planners" stand for the traditional approach and "searchers" for the alternative approach. When it comes to development aid, the planners have good intentions but do not motivate anyone to complete them. They raise expectations and set goals, but take no responsibility to fulfill them. They decide what is needed from a distance instead of asking it locally. Searchers, on the other hand, take responsibility for their actions. They find solutions that work, but also give something in return for them. They work locally and make sure the recipients get what they need and are pleased.

2.4 Paul Collier

Paul Collier is a professor at Oxford University as well as a former professor at Harvard University and is working at the World Bank's research department directing focus on the poorest countries in the world. In his book *The Bottom Billion* from 2007, he explains that the poorest bottom billion people live in countries which have stagnated in growth and are now stuck at that level. Compared to the majority of the world who is moving forward, these countries mostly have declining numbers when it comes to growth. The developed world, the development agencies and governments around the world must re-think and build a new unity of purpose for helping these countries that are stuck. If we do not act, Collier argues that the whole issue will become a security nightmare for future generations and thus affect the whole world at a much larger scale. Collier describes his research as a

quest; having a tough question to investigate and answer. Collier describes the condition among the bottom billion countries to be as living in the fourteenth-century; civil war, fatal diseases, ruling ignorance and more. The biggest problem, thus, being that they are developing in an opposite direction from the rest of the world.

Furthermore, he introduces four different traps which conclude most of the developing countries' problems. These are: the conflict trap, the natural resource trap, landlocked with bad neighbors and bad governance. When discussing how aid could be an instrument to increase development and help countries out of these traps, he concludes that there is a big political debate going on but, all in all, aid for development should be motivated as follows: "We used to be that poor once. It took us two hundred years to get to where we are. Let's try to speed things up for these countries."

He identifies the four traps and suggests solutions. To summarize his views on how aid can be an instrument to help these countries, one can state that Paul Collier is positive towards it. However, when it comes to giving aid; one size does not fit all. The results from aid can both be negative or positive depending on when and how it is given. In some cases, aid might finance military budgets, capital flight or a corrupt leader. In the end, Collier believes aid is part of the solution, not the problem. However, there are limitations which require further reforms if a country should start its development.

2.5 Dambisa Moyo

The Zambian economist Dambisa Moyo studied at both Harvard and Oxford and is a former employee of the World Bank and of Goldman Sachs. Dambisa Moyo places herself on the opposite side of the spectrum compared to Sachs when it comes to aid efficiency. Moyo argues against aid to Africa in her book "Dead Aid", from 2009, where she points out that there are certain things that aid cannot achieve and that the idea that aid could provide a sustainable long-run growth is a myth. Moyo sees aid as more of a "band-aid solution". To back up this argument Moyo claims that over 1 trillion USD has been given in aid to Africa over the past 50 years and that this has had a negative impact on African growth and claims that Africa is poorer now than it was two decades ago.

Moyo (2009) describes an "aid industry" which she thinks wants Africa to be dependent on aid because they have vested interests and through this dependency would justify their existence. Included in this industry are aid agencies, policy makers, politicians as well as academics, Moyo claims. Contrary to Jeffrey Sachs, Moyo argues that the west has no moral obligation to send aid to Africa. She argues that it is the responsibility of the African governments to provide public goods and services, not the developed world through aid and that the African governments should be held accountable to the African voters and not to the aid agencies. Moyo instead argues that the free market policies implemented by other countries around the world to achieve economic growth should also be implemented in the African economies and that it is hypocritical to argue otherwise. The more specific solutions she offers lie in the African stock and bonds markets. According to Moyo, in three of the five years prior to her book being published the African stock markets were among the best places in the world to invest in averaging a return of 40%.

A working paper by Juselius et. al. (2013) found positive effects of foreign aid and found almost no harmful effects of aid. Their data range from mid-1960s to 2007. They found ODA to have a long-run positive impact on the macroeconomy. In 33 out of 36 of the Sub-Saharan African countries that received aid, the authors found positive evidence of an increase in investment and no evidence of any negative effects of aid.

2.6 Aid Dependency

Some of the critics of aid argue that giving aid creates dependency on future aid. This could, for example, mean that certain developmental goals would not have been possible to reach without aid, and this will create obstacles for a country to manage on their own in the future. It might also mean that the country does not have enough requirements imposed on them in return to receive funding, that the receiving country's innovation, productivity or efficiency might stagnate and in turn might perhaps not facilitate long-term growth.

Bräutigam (2000) writes about aid dependency being a direct consequence depending on institutional power. She states that depending on the aid recipients institutional stability, the country may become aid dependent. With weak institutions, a low-income country might

develop a laid-back adaption towards aid. Weak governance often comes with low or almost no budgeting and accountability.

Economics editor at The Guardian, Larry Elliott argues in a blog post for The Guardian, published in 2013, that "smart aid" can work, without creating dependency. In countries that were not dependent on extractive industries, qualified for debt relief and not involved in civil conflict, the aid flow tripled on average between 2000 and 2010, without a crowding-out effect. The "smart aid" that Elliott endorses includes the provision of know-how and best practice.

Loxley and Sackey (2008) examine the effectiveness of aid estimating fixed-effects growth models. With the research covering 40 member states of the African Union, they find a positive and statistically significant effect from aid on economic growth. In an extended analysis they find aid, workers' remittances, domestic savings and debt-services to boost several important sectors which are important for development finance. Later, they conclude on aid dependency: "However, given the apparent donor aid fatigue and the debt servicing implications of concessional loans, the paper supports the need to strategize to reduce future dependence on aid."

III. Definitions

To better understand what types of aid there are, we will now introduce some different distinctions of aid.

ODA and DAC

Development Assistance Committee (DAC) is a forum where certain OECD member states discuss aid and poverty reduction. ODA is an abbreviation of "Official Development Assistance". The DAC defines this as aid going to countries and organizations eligible to receive aid from OECD. This is an aggregate measurement of aid and consists of multiple types of aid including, among others, humanitarian aid and technical cooperation. There are however further restrictions on these countries and organizations:

I) ODA must be provided by official agencies, including state and local governments or, in the case of an organization, by their executing agencies.

II) The main goal of aid received must be to promote economic development and welfare. Furthermore, the work must be concessional with a grant element of at least 25% (OECD, 2013d).

The following are distinctions of aid compiled by the OECD and found in the CRS database, however, we are limited by data as the data only exists for 2010 and 2011. Therefore, we have to use another database from OECD called DAC2a which has a better availability although it is less specific.

The types of aid that are distinguished in the OECD database CRS are the following:

Budget Support (General and Sector)

Monetary aid injected into the recipient budget or to a specific sector budget of the recipient. Here the donor loses the exclusive control of what happens with the donated funds as the responsibility is now shared with the recipient (OECD, 2009).

Core Contributions and Pooled Programmes and Funds

As in budget support, donors lose the exclusive control of their contribution as they share the responsibility of the funds with other stakeholders. These stakeholders could be NGO:s, multilateral institutions, private donors and various other organizations. The contributions are often divided into different categories whether the funds are paid to NGO:s or multilateral institutions. Further classification can be made depending on how the funds are to be used, on specific-purpose programmes or a pooled funding with a clear goal on how to use their resources on certain aid activities (OECD, 2009).

Project-type Intervention

The projects that fall under this category are well-defined and specified in terms of objective, budget, duration and geographical context. The conditions of the project must be agreed upon by both the donor and the receiving parties prior to initiation. Examples on different projects could be interventions to reduce AIDS/HIV, building schools, hospitals, health clinics or similar societal welfare institutions. In the events of equity investment, humanitarian aid or any aid channelled through NGO's, projects are classified as project type interventions even if there was no agreement between the donor and the recipient party.

The definition of this category is quite broad as it also includes studies, evaluations of projects as well as the costs of running NGO's (OECD, 2009).
Approximately two thirds of all aid distributed in 2011 falls under this category according to OECD data (OECD, 2013a; "popular queries"; "aid activities"; "C: project-type interventions" divided by "all types of aid").

Technical Assistance

Experts or skilled personnel are provided to developing countries in order to give advice and to monitor reforms or other transitions in the economy. This category covers provisions outside the context of projects covered in project-typed interventions above (OECD, 2009).

Administrative Costs Not Included Elsewhere

This category includes various costs of delivering aid to developing countries which are not included in other categories. The salaries for in-house agency staff and contractors are included here; external costs associated with donor experts and consultants are not included (OECD, 2009).

Debt Relief

This is also referred to as debt forgiveness. For example, the IDA of the World Bank Group provides concessional loans to many developing countries with relatively low interests and long maturities. These loans are sometimes dropped and the debtor does not have to pay it back (OECD, 2009).

Scholarships

This category includes financial aid towards individual students and trainees (OECD, 2009).

Millennium Development Goals

In september 2000, the leaders of the world came together for a summit at United Nations Headquarters in New York to put together the United Nations Millennium Declaration, committing their nations to a new global cooperation to cut extreme poverty in half and to set up a series of goals, including the most troublesome issues regarding poverty and development, with a deadline of 2015. These goals are known as the Millennium Development Goals. The goals include reducing child mortality by two thirds, combat HIV/AIDS, malaria and other diseases, ensuring a primary schooling for all boys and girls around the world, developing a global partnership for development and more (UN, 2013a).

IV. Methodology and Data

When constructing our econometric model we use panel data since we are examining several countries and variables over time. We are using a fixed effects model to account for the unobserved constant effects that may be present and vary across countries. As these effects are unobserved we do not know exactly what they entail for our different countries but they would consist of innate characteristics such as culture or regime. When the fixed effects model is used we eliminate these constants and this allows us to more accurately represent the effects of our explanatory variables without these innate country-specific constants disturbing the results of our regressions. We performed the regressions in the statistical software program Stata.

4.1 Data

As mentioned earlier, we use data from the databases of OECD, UN and the World Bank, as well as the UNDP report on HDI - HDR.

When selecting the time frame for our research the main restriction has been the lack of available data. The latest data that is available on HDI is from 2011 and that is what sets the upper limit of our second regression. The dataset consists of the countries in Sub-Saharan Africa and ranges from 1993 to 2011.

We have excluded Somalia from both of our regressions due to the severe lack of data in all our areas of interest. This is most likely due to the fact that there is an ongoing civil war in Somalia that began in 1991. We have also excluded Liberia from our first regression for the same reason; there is almost no data from the 1990's. This is probably due to the fact that there was a civil war in Liberia from 1980 to the peace agreement in 2003. This leaves us with 43 countries in the first regression and 44 countries in the second regressions.

HDRO states the following concerning the data collecting process: "To be of relevance, the data in the Report requires the highest standards of data quality, consistency, transparency and accountability. Several steps are taken each year to ensure that the Report maintains

high quality and reliability. These steps include partnering with many national and international statistical agencies...Several mechanisms have also been adopted by the Human Development Report Office (HDRO) to ensure that the data we publish is of high quality and relevance. In addition to the small in-house team of qualified statisticians, a Senior Statistical Advisor reviews all of HDRO's statistical work." (HDRO, 2013b). The data used to calculate the HDI comes from several major data agencies (HDRO, 2013c).

4.2 The Dependent Variable - HDI

During our research we noticed a problem with how the HDI was calculated. In the 2010 HDR, the definition of HDI had changed from the previous report in the years before that. Later, we noticed another change in the definition of HDI used in the report of 1995. The following changes in the 2010 definition were made: The education index from the 2010 report is determined by the mean years of schooling combined with the expected years of schooling, whereas it was previously determined by the adult literacy rate and the gross enrolment ratio. The income index also changed at the same time, from previously using GDP/capita it went to GNI/capita. Before 1995, there was a third definition in place. However, we consider the use of the even older definition redundant as it does not add new valuable dimensions to our analysis (HDRO, 2009) (HDRO, 2010).

These changes in definitions are problematic since we cannot mix the various definitions in the same regression as we would be measuring different things and the results would therefore not be reliable. What we have decided to do is to perform two separate regressions; we exclude the years after 2007 from our first regression because we use the old definition of HDI here. In order to perform the regression with the old definition we look at the HDR and manually acquire all the values from the HDI tables. We do this for the reports from 1995 to, and including, 2009. There is a data lag of two years in the reports, i.e 2007 report has 2005 values. Therefore the data ranges from 1993 to 2007 in the first regression.

The UN database, from which we draw our data on HDI for the second regression (HDRO, 2013a), has retrospectively corrected for the data each year back to 2005. This facilitates a

second regression with the new definition, however, the number of years included in the regression is effectively cut by 8 years, since the years 1993-2004 is dropped and 2008-2011 are added. In the second regression the data then ranges from 2005 to 2011, where the latest released data is included.

As we expect the effects of aid to be slow (Clemens et al. 2012) we need to include time lags to account for the effects. This is the main reason for including the older definition and running two regressions; 8 additional years of data to allow for the possible effects of lags to be noticed.

The reports state that the data from different years is not strictly comparable: "As a result of revisions to data and methodology, Human Development Index values are not strictly comparable with those in earlier Human Development Reports". These sorts of warnings can be read on every HDR in our research. This calls for caution when interpreting the results of the first regression and the interpretation we make cannot in any sense be conclusive (HDRO, 2007) (HDRO, 2008).

E.g.: "Data refer to national literacy estimates from censuses or surveys conducted between 1995 and 2005, unless otherwise specified. Due to differences in methodology and timeliness of underlying data, comparisons across countries and over time should be made with caution" (HDRO, 2007) (HDRO, 2008).

We think this might be a reason as to why many choose to use economic growth as a measurement of aid effectiveness instead of HDI. Because of the retrospective correction of data back to 2005, this is not a problem in our second regression.

4.3 Explanatory Variables and Their Justifications

When considering variables in our regressions we have deliberately omitted the three indices that make up HDI as explanatory variables. If we would not have considered this, both sides of the equation would have been exactly the same and the R^2 would have been very close to 1. To avoid this we look for other variables that fulfill either one or both of the following criteria; they seem likely to affect at least one of the three indices that construct

HDI or in some way allude to the standard of living. An example of the latter would be sanitation or diseases.

We also had to consider the accessibility of data. There are a few large organizations in the world who compile these sorts of massive international data collections and many countries have missing data on various years because of conflicts or some other national crises. Additionally, we had to make sure that we had data for all the variables for the years we wanted to include. For some of the years we might have data on aid but not on HDI or vice versa. When we noticed the change in the definition of HDI, as mentioned above, this was one of the main issues.

The following is a list of our explanatory variables:

Mortality Rate Between the Ages 0 to 5, per 100 000 Live Births
This will most likely affect the health index of HDI, which measures life expectancy at birth. It is reasonable to believe that the higher the mortality rate of children is, the lower the life expectancy will be. This issue is closely related to human development and the fight to eradicate poverty. The reduction of child mortality is one of the Millennium Development Goals stated by the UN in 2000. We believe we might see a shift in this variable for the better after the year 2000 and possibly affecting HDI in our regressions (World Bank, 2013e).

Prevalence of HIV, In Percentage of Population Between Ages 15 to 49
The rationale for including this variable is similar to that of the mortality rate above; the health index is likely affected along the same lines. Being one of the most destructive diseases in Sub-Saharan Africa the prevention of HIV/AIDS is also a big part of the Millennium Development Goals set up by the UN (World Bank, 2013f).

Incidence of TBC per 100 000 People
The TBC disease is typical for developing countries and poverty stricken parts of the world and therefore an indication of the country's health standard. In Swaziland, for example, it is

the most common cause of death (UN, 2012). The data is taken the World Bank database (World Bank, 2013d).

Access to Sanitation Facilities, In Percentage of Total Population
This variable measures the percentage of the population that has adequate access to excreta disposal facilities. These facilities are defined as flushing toilets with a sewerage connection and must be correctly constructed and maintained. Access to this sort of facilities improves sanitation and prevents the spread of diseases (World Bank, 2013c).

Inflation, Measured Annually In Percentage of Average Consumer Prices
This variable is only included in the first regression as the HDI of the second regression is adjusted for inflation through the income index.
We included this variable because we believe it has an impact on the income index of HDI. There might not exist a direct causal relationship with well-being although the people's private economy will be negatively affected when inflation becomes too high (IMF, 2013).

Aid: ODA Disbursements Excluding Debt
There are many different types of aid and they could affect HDI through various channels. The ODA data are the aggregate numbers of aid given to the different countries in Sub-Saharan Africa. In order to get the most accurate figures it is a good idea to exclude debt, since loans have to be repaid, and use figures on disbursement instead of commitment because they signify actual transfers and not only what has been promised (OECD, 2013b). The data on this variable comes from the OECD database DAC2a. The data we used includes data from all donors and not only the aid given by the DAC member countries. We use constant prices, the figures are in millions of 2011 USD. The same settings apply for other aid variables from DAC2a (OECD, 2013c).

Aid: Technical Cooperation
This is also sometimes referred to as technical assistance, as it is in CRS (OECD, 2009). Either way, in our research this includes two occasions: the first one is grants to citizens from an aid recipient country receiving education or any sort of training at home or abroad. The second one is payments to consultants, advisers, teachers, administrators or any other

personnel serving in an aid recipient country, including any equipment costs. In case of certain projects or programmes these costs are not recognized as technical cooperation but instead considered included in the project or programme expenditures (OECD, 2013c).

Aid: Humanitarian aid

The OECD defines humanitarian aid as being: "assistance designed to save lives, alleviate suffering and maintain and protect human dignity during and in the aftermath of emergencies. To be classified as humanitarian, aid should be consistent with the humanitarian principles of humanity, impartiality, neutrality and independence." Their definition covers aid in the forms of: "disaster prevention and preparedness; the provision of shelter, food, water and sanitation, health services and other items of assistance for the benefit of affected people and to facilitate the return to normal lives and livelihoods; measures to promote and protect the safety, welfare and dignity of civilians and those no longer taking part in hostilities and rehabilitation, reconstruction and transition assistance while the emergency situation persists. Activities to protect the security of persons or property through the use or display of force are excluded. Includes aid to refugees in developing countries, but not to those in donor countries" (OECD, 2013c).

IDA Resource Allocation

This variable is an index ranging between 1-6 depending on the amount of resources the IDA of the World Bank has allocated to each specific country, where 6 is high and 1 is low. This variable is only used in the second regression with the years ranging from 2005-2011, the reason being lack of data for earlier years. IDA is an organization branch from the World Bank focusing on grants and loans towards the poorest countries in the world (World Bank, 2013b).

Lagged Variables of Aid and IDA

The effects of aid are likely to take time and we think that it would be unreasonable to expect immediate visible effects in any of the indices other than the income index. We added three years of lag because when we first added the fourth year of lag, there was an issue with too few observations. We want to refer to Clemens et al. (2012) and their article about the timing and lag of aid when measuring its effectivity in terms of economic growth.

Although we are examining the effect on HDI, we believe there are great similarities in the lagged effect of aid: "Funding for a new road might affect economic activity in short order, funding for a vaccination campaign might only affect growth decades later and humanitarian assistance may never affect growth."

4.4 Summary Statistics and Description of Variables

The following tables are variable descriptions and summary statistics on our datasets. Table 1 and 3 presents the detailed description for the variables in the first and second regression respectively. Table 2 and 4 presents number of observations, the mean value, standard deviation, and the minimum and maximum value of the variables in the first and second regression respectively.

Table 1: Description of the variables of the first regression:

```
Contains data from C:\Users\xhaman\AppData\Local\Temp\HDI 93-07-1.dta
  obs:            645
  vars:            21                              14 May 2013 13:55
  size:         65,145 (99.4% of memory free)
```

variable name	storage type	display format	value label	variable label
country	str24	%24s		Country
year	int	%8.0g		Year
TBC	int	%8.0g		Incidence of TBC (per 100 000)
HIV	float	%8.0g		Prevalence of HIV (% of population ages 15-49)
ChildMortality	float	%8.0g		Mortality 0-5 year olds (per 1000 live births)
ODA	float	%8.0g		ODA excl. debt (all donors, constant prices, USD millions)
HumanitarianAid	float	%8.0g		Humanitarian aid (all donors, constant prices, USD millions)
TechnicalCoop~n	float	%8.0g		Technical Cooperation (all donors, constant prices, USD millions)
hdiindex	float	%8.0g		HDI (index)
Sanitation	byte	%8.0g		Access to sanitation facilities (%)
Inflation	float	%8.0g		Inflation, average consumer prices (index)
country1	long	%24.0g	country1	Country
ODAlag1	float	%9.0g		ODA lagged one year
ODAlag2	float	%9.0g		ODA lagged two years
ODAlag3	float	%9.0g		ODA lagged three years
HAlag1	float	%9.0g		Humanitarian Aid lagged one year
HAlag2	float	%9.0g		Humanitarian Aid lagged two years
HAlag3	float	%9.0g		Humanitarian Aid lagged three years
TClag1	float	%9.0g		Technical Cooperation lagged one year
TClag2	float	%9.0g		Technical Cooperation lagged two years
TClag3	float	%9.0g		Technical Cooperation lagged three years

```
Sorted by:  country1  year
```

Table 2: Summary statistics for the first regression:

Variable	Obs	Mean	Std. Dev.	Min	Max
TBC	645	351.9845	277.4365	35	1826
HIV	630	5.707778	6.606844	.1	27.3
ChildMorta~y	645	137.7726	48.5964	26.3	299
ODA	645	519.0107	485.0368	-29.57	2685.22
Humanitari~d	621	45.53002	124.9449	0	1406.99
TechnicalC~n	645	110.9844	83.90901	5.16	430.64
hdiindex	640	.4469531	.1165891	.176	.763
Sanitation	636	30.26572	19.47686	4	89
Inflation	635	115.793	116.5885	.001	1078.457
ODAlag1	602	506.4984	465.1964	-29.57	2660.41
ODAlag2	559	498.1982	448.9563	-29.57	2660.41
ODAlag3	516	489.3798	434.4533	-29.57	2660.41
HAlag1	578	43.0692	115.0162	0	1406.99
HAlag2	535	39.98966	101.8877	.01	1406.99
HAlag3	492	35.57722	79.11364	.01	890.4
TClag1	602	113.284	85.08438	5.16	430.64
TClag2	559	111.9457	82.89375	5.16	388.37
TClag3	516	112.1839	82.82042	5.16	388.37

Table 3: Description of the variables of the second regression:

variable name	storage type	display format	value label	variable label
country	str24	%24s		Country
year	int	%8.0g		Year
TBC	int	%8.0g		Incidence of TBC (per 100 000)
HIV	float	%8.0g		Prevelance of HIV (% of population ages 15-49)
ChildMortality	float	%8.0g		Mortality 0-5 year olds (per 1000 live births)
ODA	float	%8.0g		ODA excl. debt (all donors, constant prices, USD millions)
HumanitarianAid	float	%8.0g		Humanitarian aid (all donors, constant prices, USD millions)
TechnicalCoop~n	float	%8.0g		Technical Cooperation (all donors, constant prices, USD millions)
hdisindex	float	%8.0g		HDIs (index)
Sanitation	byte	%8.0g		Access to sanitation facilities (% of total population)
IDA	float	%8.0g		IDA resource allocation index (1= low, 6=high)
country1	long	%24.0g	country1	Country
ODAlag1	float	%9.0g		ODA lagged one year
ODAlag2	float	%9.0g		ODA lagged two years
ODAlag3	float	%9.0g		ODA lagged three years
HAlag1	float	%9.0g		Humanitarian Aid lagged one year
HAlag2	float	%9.0g		Humanitarian Aid lagged two years
HAlag3	float	%9.0g		Humanitarian Aid lagged three years
TClag1	float	%9.0g		Technical Cooperation lagged one year
TClag2	float	%9.0g		Technical Cooperation lagged two years
TClag3	float	%9.0g		Technical Cooperation lagged three years
IDAlag1	float	%9.0g		IDA resource allocation lagged one year
IDAlag2	float	%9.0g		IDA resource allocation lagged two years
IDAlag3	float	%9.0g		IDA resource allocation lagged three years

Sorted by: country1 year

Table 4: Summary statistics for the second regression:

Variable	Obs	Mean	Std. Dev.	Min	Max
TBC	308	335.3344	275.2444	33	1393
HIV	301	5.633555	6.760215	.1	26
ChildMorta~y	308	111.0344	40.4017	21.3	214.4
ODA	308	749.5233	758.7016	-20.7	4070.93
Humanitari~d	307	88.93746	216.3218	0	1429.52
TechnicalC~n	308	91.50938	76.66003	5.46	430.64
hdisindex	298	.4278557	.0940327	.258	.679
Sanitation	258	32.25194	18.49162	9	89
IDA	262	3.176972	.5332548	1.4	4.2
ODAlag1	264	735.7296	750.0893	-20.7	4070.93
ODAlag2	220	710.6492	725.4651	-20.7	4070.93
ODAlag3	176	670.5648	667.4452	-20.7	3391.18
HAlag1	263	90.70125	225.803	0	1429.52
HAlag2	220	92.14536	233.0529	0	1429.52
HAlag3	176	89.67705	229.8186	0	1429.52
TClag1	264	93.4639	77.33381	5.47	430.64
TClag2	220	95.08932	79.31386	5.47	430.64
TClag3	176	98.38159	82.60835	5.47	430.64
IDAlag1	224	3.171689	.54106	1.4	4.2
IDAlag2	186	3.168907	.546783	1.4	4.2
IDAlag3	148	3.165315	.5516193	1.4	4.2

In the first regression, we notice that the minimum value is negative, -29.57. After further investigation we find that this number comes from the country Gabon in the year 2001. We also find that Gabon has a negative value of ODA, of -24.04, for the year 2003. The Republic of Congo also shows a negative value, -20.7, for the year 2006. This shows up in both regression and is the minimum observed value in the second one. We do not know why this is but we believe it could only be the case if this was net values. However, this variable is listed as the total amount of ODA excluding debt received.

The fact that the averages are not consistent over the time lagged variables might seem peculiar at a first glance, however, this is not strange when thinking about the mechanism in place. For every one year lag added to variable, the data entries of that variable are shifted one year forward in time and one missing data entry is generated for the first year of that variable. For the data entries not to overlap onto the next country in the dataset, one data entry is dropped. This means that there are fewer observations resulting in a different mean value. As observations are dropped and missing data entries are generated in this manner it is possible for the maximum and minimum observed values to change as well.

4.5 Models

The functional form of our model uses HDI as the dependent variable and aid-variables among others as independent variables. The models we use are based on the standard fixed effects model assumptions that can be found in Wooldridge (2009), "Introductory Econometrics".

For our first regression the functional form is:

$HDI_{it} = \beta_0 + \beta_1 ODA_{it} + \lambda_1 ODAlag1_{it+1} + \lambda_2 ODAlag2_{it+2} + \lambda_3 ODAlag3_{it+3} + \beta_2 HumanitarianAid_{it} + \lambda_4 HAlag1_{it+1} + \lambda_5 HAlag2_{it+2} + \lambda_6 HAlag3_{it+3} + \beta_3 TechnicalCooperation_{it} + \lambda_7 TClag1_{it+1} + \lambda_8 TClag2_{it+2} + \lambda_9 TClag3_{it+3} + \beta_4 TBC_{it} + \beta_5 HIV_{it} + \beta_6 ChildMortality_{it} + \beta_7 Sanitation_{it} + \beta_8 Inflation_{it} + \alpha_i + u_{it}$

(Equation 1)

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For our second regression the functional form is:

$$HDIs_{it} = \beta_0 + \beta_1 ODA_{it} + \lambda_1 ODAlag1_{it+1} + \lambda_2 ODAlag2_{it+2} + \lambda_3 ODAlag3_{it+3} + \beta_2 HumanitarianAid_{it} + \lambda_4 HAlag1_{it+1} + \lambda_5 HAlag2_{it+2} + \lambda_6 HAlag3_{it+3} + \beta_3 TechicalCooperation_{it} + \lambda_7 TClag1_{it+1} + \lambda_8 TClag2_{it+2} + \lambda_9 TClag3_{it+3} + \beta_4 IDA_{it} + \lambda_{10} IDAlag1_{it+1} + \lambda_{11} IDAlag2_{it+2} + \lambda_{12} IDAlag3_{it+3} + \beta_5 TBC_{it} + \beta_6 HIV_{it} + \beta_7 ChildMortality_{it} + \beta_8 Sanitation_{it} + \alpha_i + u_{it}$$

(Equation 2)

Where, β_0 is the constant and β_1, β_2,...,β_k are the coefficients of the explanatory variables. Lambda (λ) represents the coefficients of the lagged variables and α is the unobserved constant specific for the fixed effect model. The residual is denoted by **u**.

The following is our question formulation expressed in hypotheses:

Null hypothesis (H_0): the coefficients of the aid variables $= 0$

Alternative hypothesis (H_1): the coefficients of the aid variables $\neq 0$

V. Regressions and Results

In this section we present the results from the regressions, which will be analyzed and discussed in the next section. We examine what variables are significant at the 1%-, 5%- and 10%-level looking at the t-value and the p-value.

5.1 The First Regression, 1993-2007

The first regression covers the years 1993-2007 and is not using adjusted HDI:

$HDI_{it} = \beta_0 + \beta_1 ODA_{it} + \lambda_1 ODAlag1_{it+1} + \lambda_2 ODAlag2_{it+2} + \lambda_3 ODAlag3_{it+3} + \beta_2 HumanitarianAid_{it} + \lambda_4 HAlag1_{it+1} + \lambda_5 HAlag2_{it+2} + \lambda_6 HAlag3_{it+3} + \beta_3 TechnicalCooperation_{it} + \lambda_7 TClag1_{it+1} + \lambda_8 TClag2_{it+2} + \lambda_9 TClag3_{it+3} + \beta_4 TBC_{it} + \beta_5 HIV_{it} + \beta_6 ChildMortality_{it} + \beta_7 Sanitation_{it} + \beta_8 Inflation_{it} + \alpha_i + u_{it}$

(Equation 1)

```
Fixed-effects (within) regression              Number of obs     =        462
Group variable: country1                       Number of groups  =         42

R-sq:  within  = 0.4606                        Obs per group: min =          1
       between = 0.3947                                        avg =       11.0
       overall = 0.4207                                        max =         12

                                               F(17,403)         =      20.24
corr(u_i, Xb)  = 0.1185                         Prob > F          =     0.0000
```

hdi index	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
ODA	-3.90e-06	.000012	-0.33	0.745	-.0000275	.0000197
ODAlag1	-.0000101	.0000105	-0.96	0.337	-.0000307	.0000105
ODAlag2	-.0000106	9.87e-06	-1.07	0.283	-.00003	8.80e-06
ODAlag3	.0000158	9.32e-06	1.69	0.092	-2.56e-06	.0000341
Humanitari~d	.0000556	.00003	1.85	0.064	-3.34e-06	.0001145
HAlag1	-.0000462	.0000366	-1.26	0.207	-.0001181	.0000257
HAlag2	.0000433	.0000357	1.21	0.226	-.0000269	.0001135
HAlag3	.0000807	.0000391	2.06	0.040	3.79e-06	.0001576
Technicalc~n	-.0000752	.0000554	-1.36	0.176	-.0001842	.0000337
TClag1	-.0001099	.0000775	-1.42	0.157	-.0002622	.0000424
TClag2	.0002052	.0000992	2.07	0.039	.0000101	.0004003
TClag3	-.0001482	.00008	-1.85	0.065	-.0003054	9.05e-06
TBC	-1.45e-06	.0000226	-0.06	0.949	-.0000458	.0000429
HIV	-.0016797	.0018502	-0.91	0.364	-.005317	.0019576
ChildMorta~y	-.0013376	.0001372	-9.75	0.000	-.0016073	-.0010679
Sanitation	-.0004716	.0008297	-0.57	0.570	-.0021026	.0011595
Inflation	.0001246	.0000365	3.41	0.001	.0000528	.0001963
_cons	.6581978	.0385258	17.08	0.000	.5824613	.7339344

```
sigma_u |  .08432104
sigma_e |  .03027287
    rho |  .88582215   (fraction of variance due to u_i)
```

F test that all u_i=0:   F(41, 403) =   25.04   Prob > F = 0.0000

The R^2 of this regression is 0.4207.

The degrees of freedom and significance level are as follows:

1st regression: (n-k-1) = (462-17-1) = 444 → ∞

This gives us significance levels:

1%: t-value ≥ |2.326|

5%: t-value ≥ |1.960|

10%: t-value ≥ |1.564|

The only two variables that are significant at the 1%-level are inflation and child mortality.

- Inflation is significant at the 1%-level as |3.41|>|2.326| and the p-value is 0.001|. The variable has a positive effect on HDI, which means they are positively correlated. For every increase in the inflation index by one unit, HDI increases by 0.0001246.

- Child mortality is significant as |9.75|>|2.326| and the p-value is 0.000. The coefficient is negative which means that there is a negative correlation between this variable and the dependent variable. As the rate of child mortality between the ages 0-5 goes down 1 death per 1000 live births, the HDI goes up 0.0013376.

We find two variables that are significant at the 5%-level. These are HAlag3 (Humanitarian aid lagged three years) and TClag2 (Technical cooperation lagged two years).

- We find HAlag3 is significant at the 5%-level as |2.06|>|1.960| and the p-value is 0.040. Humanitarian aid has a positive effect on HDI three years after the aid is received, and these are therefore positively correlated. For each million in 2011 US dollars in humanitarian aid, HDI increases, three years after aid was received, by 0.0000807.

- TClag2 is found to be significant as |2.07|>|1.960| and the p-value is 0.039. The coefficient of TClag2 is 0.0002052 meaning that there is a positive correlation between this variable and the dependent variable, HDI. As technical cooperation lagged two years increases by one unit of measurement, millions of 2011 USD, the HDI increases by 0.0002052.

There are three variables significant at the 10%-level: Humanitarian aid, TClag3 and ODAlag3.

- We find Humanitarian aid significant at the 10%-level due to its t-value being |1.85|>|1.564| and the p-value is 0.064. The variable is positively correlated with HDI; For every million in 2011 US dollars in humanitarian aid the country receives, HDI increases within the first year by 0.0000556.

- The lagged variable ODAlag3 is significant at the 10%-level as |1.69|>|1.564| and the p-value is 0.092. The coefficient is positive which implies a positive correlation. Ergo, as the aid received in terms of ODA excluding debt shows an effect on HDI three years after the year aid was received. As ODAlag3 increases by 1 unit; 1 million 2011 USD, the HDI increases by 0.0000158.

- The variable TClag3 is significant at the 10%-level as |1.85|>|1.564| and the p-value is 0.065. The variable is negatively correlated with the dependent variable, HDI. This means that for every additional million of 2011 US dollars received in Technical cooperation aid, deteriorates HDI by 0.0000158 units three years after aid was received.

At the significance levels presented above, the following variables were not found significant: ODA, ODAlag1, ODAlag2, HAlag1, HAlag2, Technical Cooperation, TClag1, TBC, HIV and Sanitation.

5.2 The Second Regression, 2005-2011

The second regression covers the years 2005-2011 and is using adjusted HDI:

$HDIs_{it} = \beta_0 + \beta_1 ODA_{it} + \lambda_1 ODAlag1_{it+1} + \lambda_2 ODAlag2_{it+2} + \lambda_3 ODAlag3_{it+3} + \beta_2 HumanitarianAid_{it} +$

$\lambda_4 HAlag1_{it+1} + \lambda_5 HAlag2_{it+2} + \lambda_6 HAlag3_{it+3} + \beta_3 TechicalCooperation_{it} + \lambda_7 TClag1_{it+1} + \lambda_8 TClag2_{it+2}$

$+ \lambda_9 TClag3_{it+3} + \beta_4 IDA_{it} + \lambda_{10} IDAlag1_{it+1} + \lambda_{11} IDAlag2_{it+2} + \lambda_{12} IDAlag3_{it+3} + \beta_5 TBC_{it} + \beta_6 HIV_{it} +$

$\beta_7 ChildMortality_{it} + \beta_8 Sanitation_{it} + \alpha_i + u_{it}$

$$(Equation\ 2)$$

Table 6: The second regression:

```
Fixed-effects (within) regression            Number of obs      =        103
Group variable: country1                      Number of groups   =         35

R-sq:   within  = 0.8139                       Obs per group: min =          1
        between = 0.2245                                       avg =        2.9
        overall = 0.1769                                       max =          3

                                               F(20,48)           =      10.50
corr(u_i, xb)  = -0.6646                        Prob > F           =     0.0000
```

hdisindex	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
ODA	.000017	5.78e-06	2.95	0.005	5.41e-06	.0000286
ODAlag1	4.77e-06	5.75e-06	0.83	0.411	-6.79e-06	.0000163
ODAlag2	6.39e-06	6.92e-06	0.92	0.360	-7.52e-06	.0000203
ODAlag3	8.71e-06	6.54e-06	1.33	0.189	-4.43e-06	.0000219
Humanitari~d	-.0000121	.0000153	-0.79	0.431	-.0000428	.0000186
HAlag1	-.0000366	.000017	-2.15	0.037	-.0000708	-2.35e-06
HAlag2	-.0000167	.0000167	-1.00	0.321	-.0000503	.0000168
HAlag3	2.45e-06	.0000209	0.12	0.907	-.0000395	.0000444
Technicalc~n	.0000383	.0000622	0.62	0.541	-.0000868	.0001635
TClag1	8.59e-06	.0000527	0.16	0.871	-.0000974	.0001146
TClag2	.0000151	.000022	0.69	0.494	-.0000291	.0000594
TClag3	7.78e-06	.00002	0.39	0.699	-.0000325	.000048
IDA	.0088357	.0077417	1.14	0.259	-.00673	.0244014
IDAlag1	-.0107697	.0086409	-1.25	0.219	-.0281434	.006604
IDAlag2	-.0245586	.0123803	-1.98	0.053	-.0494508	.0003336
IDAlag3	-.0049261	.0114294	-0.43	0.668	-.0279064	.0180543
TBC	-.0000626	.0000641	-0.98	0.334	-.0001914	.0000662
HIV	-.0052151	.005702	-0.91	0.365	-.0166796	.0062495
ChildMorta~y	-.0008719	.0002638	-3.31	0.002	-.0014023	-.0003415
Sanitation	.004011	.0014654	2.74	0.009	.0010645	.0069575
_cons	.5006845	.0828585	6.04	0.000	.3340863	.6672828

```
sigma_u |  .07949589
sigma_e |  .00429863
    rho |  .99708457   (fraction of variance due to u_i)

F test that all u_i=0:     F(34, 48) =    323.66              Prob > F = 0.0000
```

The R^2 of this regression is 0.1769.

The degrees of freedom and significance level are as follows:

2nd regression: (n-k-1)=(103-20-1)=82

This gives us significance levels:

1%: t-value ≥ |2.373|

5%: t-value ≥ |1.989|

10%: t-value ≥ |1.664|

We find three variables significant at the 1%-level: ODA, Sanitation and Child Mortality.

- The variable ODA is found to be significant at the 1%-level as |2.95|>|2.373| and the p-value is 0.005. The effect of ODA on HDI is positive, i.e. there is a positive correlation between the two. When ODA is increased by 1 unit, again 1 million 2011 USD, HDI is increased by 0.000017.

- Sanitation is significant at the 1%-level as |2.74|>|2.373| and the p-value is 0.009. The correlation between Sanitation and HDI is positive. The coefficient can be interpreted as the following: for each one percentage increase of the population having access to a sanitation facility, HDI increases by 0.004011.

- The variable for child mortality is significant at the 1%-level as |3.31|>|2.373| and the p-value is 0.002. The correlation between child mortality and HDI is negative. This implies that as the rate of child mortality between the ages 0-5 goes down 1 death per 1000 live births, the HDI goes up by 0.0008719.

The only variable that we find significant at the 5%-level is HAlag1, which is significant since |2.15|>|1.989| and the p-value is 0.037. The coefficient is negative and thus implies a negative correlation with HDI. For every additional unit of humanitarian aid, which is 1 million 2011 USD, HDI decreases by 0.0000366 one year after the aid is received.

We find one variable being significant at the 10%-level; IDAlag2.

This variable has a t-value of |1.98| which puts it just outside the 5% significant level, but in the 10% level as |1.98|>|1.664| and the p-value is 0.053. This variable has a negative correlation with HDI. For each more million 2011 US dollars the country lends from IDA, the HDI decreases by 0.0000626 after two years.

At the significance levels presented above, the following variables were not found significant: ODAlag1, ODAlag2, ODAlag3, Humanitarian aid, HAlag2, HAlag3, Technical cooperation, TClag1, TClag2, TClag3, IDA, IDAlag1, IDAlag3, TBC, HIV.

For both our regressions, we find significant coefficients of aid variables and so we can safely reject the null-hypothesis that the coefficients of the aid variables are equal to zero.

VI. Analysis & Discussion

In this section we will analyze and discuss the results from the regressions.

6.1 The First Regression, 1993-2007

The R^2 of this regression is 0.4207 as we stated briefly above in the result section. What this means is that the variables of our model accounts for 42.07% of the outcome. This is a reasonable outcome as there are many variables that are not included in the regression that could have explanatory power regarding HDI, and therefore a much higher R^2 would have been indicative of something being wrong with the model.

Since the HDI values in this regression are not adjusted retrospectively for inflation, as the second regression is, we believe that the significance of this variable should not be interpreted as a pure effect on HDI, but rather shows the unaccounted inflation in the income index. This is the case as we are using current prices instead of constant prices, and the fact that inflation is significant here suggests that what we should have relied on is constant prices. However, as mentioned earlier, the constant prices were not available to us since we took the data from the annual reports rather than from the database where the data is adjusted for inflation. This clearly calls for caution when attempting to establish anything conclusive from this regression as HDI is not adjusted for inflation.

The fact that child mortality is significant in explaining HDI is not surprising. A high child mortality number per live births is a symbol of poverty. In the most developed countries in the world, systematic child mortality is close to none while in developing countries it is a large problem. The fact that the coefficient is negatively correlated with HDI proves that the less children that die before the age of five, the higher HDI will be. We find the fight against child mortality important to increase the standards of living, we also find it among the top prioritized topics in the Millennium Development Goals.

Significant at the 5%-level we have the lagged variables HAlag3 and TClag2. These findings are in line with what Clemens et al. (2012) find in their study; the effects of aid are not immediate, it takes time for efforts to aggregate and to have an impact. The lagged effect of both humanitarian aid and technical cooperation are positive and increase HDI.

Humanitarian aid is not really meant to increase the economic growth but rather to act as emergency relief when disaster strikes. It may therefore be less unexpected to find a positive effect when looking at HDI rather than economic growth, as HDI takes the health index and the education index into account. The more lives that are saved from a premature death the higher the life expectancy would be. This, of course, would be in the long run which might be why it only shows up three years after the actual aid was given. The finding that technical cooperation has a positive effect two years after initiation seems perfectly reasonable as it involves education and training which of course takes some time to apprehend and to implement into functioning policy.

At the 10% significance level we find Humanitarian aid, TClag3 and ODAlag3. TClag3 is an interesting variable since we find it negatively correlated with HDI, contrary to TClag2. We think this could have a connection to aid dependency. As many economists, including Collier, say, after receiving foreign technical cooperation for some time, the recipient country must contribute by themselves. Three years might be the breakpoint of this state where foreign consultants and teachers cannot achieve more success without the locals contributing. Another reason for the shift from a positive to a negative effect might be that the consultants the recipient relied upon leave the country and the recipient then falls back into old routines and habits, and does not manage to incorporate the advice received into effective policies.

Humanitarian aid is not as big in numbers as ODA or technical cooperation. However, it is interesting to see it is somewhat significant immediately after the effort. Humanitarian aid can help to prevent deaths in emergencies, and it is easy to imagine that the impact of these emergencies could have been much worse without aid. This suggests that the effects of humanitarian aid can be immediate as well as show up in the future as we mentioned above.

The fact that ODAlag3 is significant shows once again that it takes a few years for aid to have an impact on the recipient country, as Clemens et al. (2012) suggest. However, we find both HAlag3 and TClag2 more significant than the lagged effect of ODA. This does not necessarily in itself imply that humanitarian aid and technical cooperation contributes to the

increase of HDI more than ODA does, but as the coefficients of HAlag3 and TClag2 are greater than that of ODAlag3, we can say that the lagged effect of both humanitarian aid and technical cooperation is greater than the lagged effect of ODA. This is an interesting conclusion when looking at which type of aid is the most effective in terms of increasing HDI and living standards.

It is important to remember that ODA is an aggregate measurement of aid, which includes both humanitarian aid and technical cooperation as well as other types of aid. The effects we observe for the other types of aid included in this regression suggest the possibility that there are other types of aid that are less effective than humanitarian aid and technical cooperation that bring the overall effect of lagged ODA down.

6.2 The Second Regression, 2005-2011

The R^2 of this regression is 0.1769 which means that the variables in this regression accounts for 17.69% of the outcome. This is a reasonable result and we are content with this value as the variables of e.g. life expectancy could be countless. Although the years we observe are fewer, we believe this regression to be more accurate than the first one since its HDI values have been adjusted retrospectively for inflation and use the same definition of HDI.

The most significant variables in the second regression are ODA, sanitation and child mortality. We find child mortality just as significant as in the first regression and this confirms the importance of this issue. ODA is far more significant in this regression. We think the explanation lies in what was mentioned above; this regression is more accurate and therefore more reliant. The immediate effect of aid is both more significant and more contributing towards a higher value of HDI. None of the lagged variables of ODA were significant in this regression.

Sanitation was not significant at all in the first regression, but it is significant at the 1%-level in the second. As we see it, there might be two explanations for this; the first one being that this regression is more accurate and having more reliant results. This would imply that these results, where the sanitation variable is positive and significant, are more reasonable.

The second one being that sanitation as such has improved, so that it has in later years made a larger difference in living standards for people living in Sub-Saharan Africa.

On a 5% significance level we find HAlag1. The coefficient is negative, which may seem surprising although other research has reasoned along the same lines concerning humanitarian aid and economic growth (Veiderpass and Andersson, 2011).

Another explanation for humanitarian aid having a negative impact on HDI is the timing of emergency relief. Humanitarian aid is always given after natural disasters, conflicts or other similar catastrophic events. In these times the indices that make up the compound index of HDI are likely negatively affected by the events themselves. The effect of humanitarian aid might therefore be coupled with the negative effect of these disasters, mistakenly attributing these negative effects on HDI to humanitarian aid. The decrease in HDI might then not be a direct effect of the humanitarian aid, but rather the disaster itself.

IDAlag2 has a negative effect on HDI. The coefficient is relatively high in this regression. Our variable ODA excludes debt whereas the variable IDA does not, so the difference between the variables ODA and IDA in this regression are, at least to some extent, due to debt. We believe that the loans become difficult for countries to repay, and therefore worsen the economic state of the country. The funds that are spent on repaying loans might instead be more effectively used to further the social development.

6.3 Differences Between the Regressions

The problem with comparing these two regressions, as we have mentioned before, is that the definitions of HDI are different and that the first regression does not take inflation into account. However, there are some differences in the variables that are not affected by this problem. These include all the aid variables, TBC, HIV/AIDS, child mortality and sanitation. When looking at the summary statistics (see tables 2 and 4, page 21-22 for respective regression) we can see that the observed minimum and maximum values as well as the mean values have changed between the two regressions and so over time.

What we see is that the mean ODA excluding debt received per country has gone up from 519.0107 to 749.5233 and that the maximum observed value has increased from 2685.22

to 4070.93. The minimum value has increased from -29.57 to -20.7 which is percentual increase of 30%. The only difference in recipient countries is that in the second regression Liberia is included. Even though there is one more country included, the mean value of ODA excluding debt has gone up by 51.61%.

When it comes to TBC, HIV/AIDS, child mortality and sanitation we are less interested in looking at the minimum observed values as these cases are the least exposed to these issues.

-The maximum observed value of the incidence of TBC per 100 000 has decreased by 23.71% and the mean value has decreased by 4.73%.

-The maximum observed value of prevalence of people with HIV/AIDS has decreased by 4.76% and the mean value has decreased by 1.3%.

-The maximum observed value of child mortality has decreased by 28.29% and the mean value has decreased by 19.41%.

-The maximum observed value of the sanitation variable has remained unchanged, but the mean value has increased by 6.56%.

This is an overall improvement in all the health indicator variables between the two periods, 1993-2007 and 2005-2011.

6.4 Continued Analysis

We surprisingly find humanitarian aid to have a negative impact on HDI in the second regression. We analysed it above, but want to further investigate its effect on health indicators. We choose child mortality as the dependant variable because of its clearly significant impact on HDI in both of our regressions. When running this new regression, we notice some interesting results on some of the other variables as well:

Table 7: Child mortality regression:

```
Fixed-effects (within) regression          Number of obs      =        106
Group variable: country1                   Number of groups   =         36

R-sq:  within  = 0.7481                     Obs per group: min =          1
       between = 0.0003                                    avg =        2.9
       overall = 0.0006                                    max =          3

                                            F(19,51)           =       7.97
corr(u_i, Xb)  = -0.7737                    Prob > F           =     0.0000
```

ChildMorta~y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TBC	-.0508145	.032847	-1.55	0.128	-.1167577	.0151286
HIV	9.209094	2.741359	3.36	0.001	3.705587	14.7126
ODA	.0036465	.0029433	1.24	0.221	-.0022625	.0095554
Humanitari~d	-.0184518	.0075942	-2.43	0.019	-.0336978	-.0032058
Technicalc~n	-.0502951	.0320677	-1.57	0.123	-.1146737	.0140835
Sanitation	-1.68876	.6068096	-2.78	0.008	-2.906981	-.4705391
IDA	-3.942732	4.082171	-0.97	0.339	-12.13803	4.252569
ODAlag1	.0034886	.0030016	1.16	0.251	-.0025373	.0095146
ODAlag2	-.0065433	.00355	-1.84	0.071	-.0136702	.0005836
ODAlag3	-.0061156	.0033732	-1.81	0.076	-.0128876	.0006564
HAlag1	.0086663	.0089419	0.97	0.337	-.0092854	.0266179
HAlag2	.0160069	.0085583	1.87	0.067	-.0011746	.0331883
HAlag3	.0041728	.0107099	0.39	0.698	-.0173283	.0256738
TClag1	-.0318879	.0270867	-1.18	0.245	-.0862666	.0224909
TClag2	.0415273	.0098248	4.23	0.000	.0218032	.0612513
TClag3	.0303721	.0097395	3.12	0.003	.0108192	.0499249
IDAlag1	.0972205	4.575543	0.02	0.983	-9.088565	9.283006
IDAlag2	2.820872	6.385635	0.44	0.661	-9.998826	15.64057
IDAlag3	-1.25611	6.063709	-0.21	0.837	-13.42951	10.91729
_cons	147.6301	34.97872	4.22	0.000	77.40735	217.8528

```
sigma_u |  60.037406
sigma_e |  2.2883641
    rho |  .99854931   (fraction of variance due to u_i)
```

F test that all u_i=0:   F(35, 51) =   564.93   Prob > F = 0.0000

First of all, we find humanitarian aid to be significant. Its coefficient value indicate that for every additional million 2011 US dollars received, child mortality between the ages 0-5 decreases by 0.0184518. This indicates that humanitarian aid does have a large impact on child mortality which, shown by our earlier regressions, has a large impact on HDI.

Other interesting variables we find significant are HIV, sanitation, TClag2 and TClag3. HIV has a very large impact on child mortality. For every additional one percent of the population between the ages 15-49 that is inflicted with HIV, child mortality increases by 9.209094 deaths. Sanitation was not at all significant in the first regression, while very

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significant in the second regression. Here, we can see that it plays a big role in reducing child mortality. Technical cooperation has a positive correlation with child mortality, which seems odd. We believe, however, that one must separate correlation from causation. Just as in the humanitarian aid variable in the second regression, we believe there is a correlation between these two variables since a high child mortality indicates an area in great need.

One of the problems facing us in the analysis of this data is corrupt leadership. Our fear is that the aid given does not reach its desired destination and instead ends up in the hands of dictators and the like. A way of estimating the level of corruption is by use of the indicator CPI (Corruption Perceptions Index). This is an index that is based solely on the perception of corruption and the accuracy is therefore questionable. We have found two versions of this index; CPI from Transparency International (Transparency International, 2012) and CPIA (Country Policy and Institutional Assessment) on transparency, accountability, and corruption in the public sector from the World Bank (World bank, 2013a). What could perhaps be done with these indicators is to add the risk of corruption skewing the results of our regression by including these indices as weights in the regression. Another way of analyzing corruption could be to look at the coefficients of the different types of aid to the indices of corruption over time and compare them looking for correlations. This could be an interesting topic to look at in a future study.

VII. Summary and conclusion

Due to the various changes in the definitions of HDI over the years it was difficult to compare HDI values over a greater period of time. This problem of definitions was solved by running two different regressions with different data on HDI, separating the two definitions we chose to use. However, the time period, and therefore the number of observations, was severely decreased when using the later definition, which is why we chose to keep the first regression as well.

We can safely reject the null-hypothesis claiming that the coefficients of aid are equal to zero. Our results indicate that the aggregate term of aid, ODA excluding debt, has a positive impact on HDI. As can be seen in the results of our second regression, the variable ODA is found to be significant at the 1%-level and has a positive effect within the first year of receiving it. When getting specific on different types of aid and what works and has the largest significant coefficient it is much harder to determine. The main problem we face with the issue of distinguishing types of aid is the lack of accessible data we see from the OECD databases. The World Bank database has not been helpful in this regard either. However, we do find in both regressions that many lagged aid variables are significant but vary in the sign of the coefficient. In our first regression we found that both ODA and Humanitarian aid had a significant positive effect three years after it was received. On the other hand we found that Technical cooperation had a significant negative effect three years after it was received. In our second regression we found that Humanitarian aid had a significant negative effect on HDI one year after the aid was received. This surprised us, and so we conducted a regression with child mortality as the dependent variable, a variable significantly influencing HDI. In this regression we found that Humanitarian aid significantly reduced child mortality which we do not think is surprising.

It is important to note here that we cannot claim the first regression we conducted to be conclusive as it, contrary to our second regression, relies on current prices - it is not adjusted for inflation. This affects one of the three indices composing HDI, namely the income index, measuring GDP/capita in our first regression and GNI/capita in our second regression. It was also difficult to know what variables to use as explanatory variables, other

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than aid, prior to seeing the results and finding out which the important variables were. We did not choose variables that affected HDI directly, such as the health index itself, but rather variables affecting HDI indirectly. For example, we did not want to include life expectancy as a variable since it is a part of the HDI Health Index. We instead choose to include the child mortality rate since it affects life expectancy, which in turn, affects the health index of HDI. This prevents an unreasonably high R^2-value.

Our results align with various previous studies which can be found in the background discussion section of this paper. We find a positive correlation between aid and HDI, whereas, Loxley and Sackey (2008), Juselius et al. (2013), found a positive connection between aid and economic growth. Our results are more in line with the theories and arguments of Sachs, Collier and to some extent Easterly. The reason being our findings concerning the positive correlation between aid and HDI. Further, Sachs argues for the effectiveness of aid when it comes to preventing the spread of diseases, which is in line with what we find about the negative effect of humanitarian aid on child mortality. However, our results are quite contrary to the arguments of Moyo who argues that aid is not a part of the solution and should be decreased over the coming decades.

As mentioned in the beginning, it is difficult to find the causal relationship between aid and HDI.
It would have been easier to compare our findings to the previously presented theories if we would have conducted one regression per country. As it is now, it is more of an aggregated result for the whole Sub-Saharan Africa. We have not conducted all these regressions as we consider this to be too much for our time frame. Another interesting approach would be to incorporate corruption into the model and to look for patterns pertaining to the effectiveness of aid on increasing HDI. We believe these to be interesting approaches for further research.

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