THE EFFECTIVENESS OF DEVELOPMENT AID IN SUB-SAHARAN AFRICA

Jorrit Noortman,
S2940116

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Human Geography and Urban and Regional Planning
Faculty of Spatial Sciences
University of Groningen
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Abstract

As development aid has faced a large amount of critique in the last decade, this research focuses on the question whether the relative amount of development aid influences the change in infant mortality and maternal mortality in Sub-Saharan countries and how governmental factors in receiving countries influence this relation. Change in infant mortality and change in maternal mortality have been chosen as outcomes, as both groups are more likely to be a victim of communicable diseases: the type of diseases that is a main driver for a country to improve stages in the Demographic Transition Model, the Epidemiological Model and the Global Health Transition Theory. To create a statistically powerful database, this research will look at 48 countries in three different time periods, creating a database of 144 cases. This research makes use of simple linear regression analysis to test whether there is a relation between the rate of received development aid and the gross domestic product (GDP) of a country on the one hand, and changes in both mortality rates on the other. To test whether the level of corruption and the level of freedom in a country have a negative impact on the effectiveness of development aid on changes in both mortality rates, a mediation analysis has been done. Concluding for the simple linear regression analysis, the relative amount of aid appeared to have a positive effect; both mortality rates are likely to decline more rapidly as a country receives relatively more development aid. However, unlike the level of freedom, the level of corruption appeared to have a negative impact on this relation. The effect of the relative amount of development aid on change in both mortality rates decreases as countries face a high level of corruption. This effect appeared to be stronger for maternal mortality than for infant mortality.

Jorrit Noortman
S2940116

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1 – Introduction

1.1 – Background

Development aid has existed since colonial times. Colonies received money from their colonial overlords to support development (Harman et al., 2014). Between 1945 and 1960 large parts of Asia and Africa decolonized. However, these flows of money kept existing. The reason for this is that development aid has not always been used for developmental purposes only; it can be used as a political motive as well (Fielding, 2011). Wealthier countries may offer more development aid to countries that are more open to governmental reform than to dictatorial countries. A well-known example of this phenomenon is the Marshall Plan, introduced by the Truman Administration in the years after the Second World War. This plan provided financial support for European countries to prevent them from becoming communist. More recently, development aid is often used as an incentive for countries to democratize, resulting in large inequalities between countries open to reform and countries not open to reform (Fielding, 2011).

Over the years, criticism on development aid has continued to grow. Carbonnier (2010) points out three major critiques. First, he states that development aid contributes to the ongoing colonial domination of the poor countries by the wealthier countries. Although former colonies are independent now, the wealthier countries still influence what happens in their former colonies by giving development aid. This can be linked to Fielding's theory about using development aid as an incentive for democratization. Second, Carbonnier states that it is better to invest tax payers' money into the national economy, rather than wasting it in a foreign one. This argument is often used by populist parties to gain support; exemplified by Donald Trump in his 2016 election campaign. The current President of the United States often made threats to reduce the budget for foreign aid and to put "America first" (Jakupec, 2018). Carbonnier's last critique involves the fact that development aid distorts the local economy and stimulates corruption and administrative inefficiency. Research by Action Aid International (2005) showed that large parts of development aid resulted in becoming 'phantom aid'; aid that does not contribute anything to the fight against poverty and the protection of human rights.

1.2 – Research Problem

Data from the World Bank (2019) showed that in 2017 all countries below the Sahara received a total of 43.6 billion USD in foreign development aid. The amounts received are immense and, as stated above, criticism on the functioning of development aid is fierce. Therefore, this research will focus on the following question:

What influence does development aid have on change in infant and maternal mortality and to what extent do governmental factors influence this relation?

To answer this question, this research provides a theoretical framework about how mortality rates develop over time and on how development aid may carry out influence on these rates. Normally the focus of the debate about the effectiveness of aid is on economic growth (Ziesemer, 2016). However, the focus of this research will be on relative changes in infant mortality and maternal mortality, measured within periods of five years. This research makes use of relative changes in these mortality rates, as the continent of Africa is known for its large inequalities. Focusing on relative changes will increase the comparability of a more developed country with a less developed country, given the methodology of this research. Second, the research will test whether there is a significant relation between the ratio of the amount of development aid a country receives and a country's gross domestic product (GDP) on the one hand and both the mortality rates on the other hand by using a simple linear regression analysis. Third, this research will provide a visual representation of the appearance of these mortality rates and the rate between the amount of development aid a country receives and their GDP. By doing so, the geographical pattern of this relation will be pictured. Lastly, a mediation analysis will be done to examine the influences of the level of corruption and the level of freedom in receiving countries on this relation.

2 – Theoretical Framework

2.1 – Literature review

Before focusing on what influence development aid can have on mortality, it is important to understand how population demographics of societies have developed in the past. The Demographic Transition Model shows how these demographics evolve using birth and death rates (Rimashevskaia et al., 2013). The model consists out of five stages (see Figure 1). In the first stage, birth and death rates are high, causing a consistent population size. In the second stage, death rates decline due to medical progresses. Because birth rates do not change, the population size grows rapidly. In stage 3, birth rates decrease, because economic conditions have improved; there is access to contraception and the status of women in society has improved. Population growth continues at a slower rate. Stage 4 is known for its stable population size, as birth and death rates are both low. In the scientific world, there is no consensus about what drives birth rates to decline, as there is no general and regular driver for all regions in the world (Caselli et al., 2006). Nonetheless, Galor (2011) analysed all possible drivers and advocates that the main trigger for declining birth rates is the increase in demand for human capital. This, combined with the improving status of women, drove women to join the labour market. As a result, women had less time and less ambition to have and take care of their offspring. Stage 5 is a possible future stage. In this stage, birth rates drop below a two children per woman replacement level, causing populations to decline.

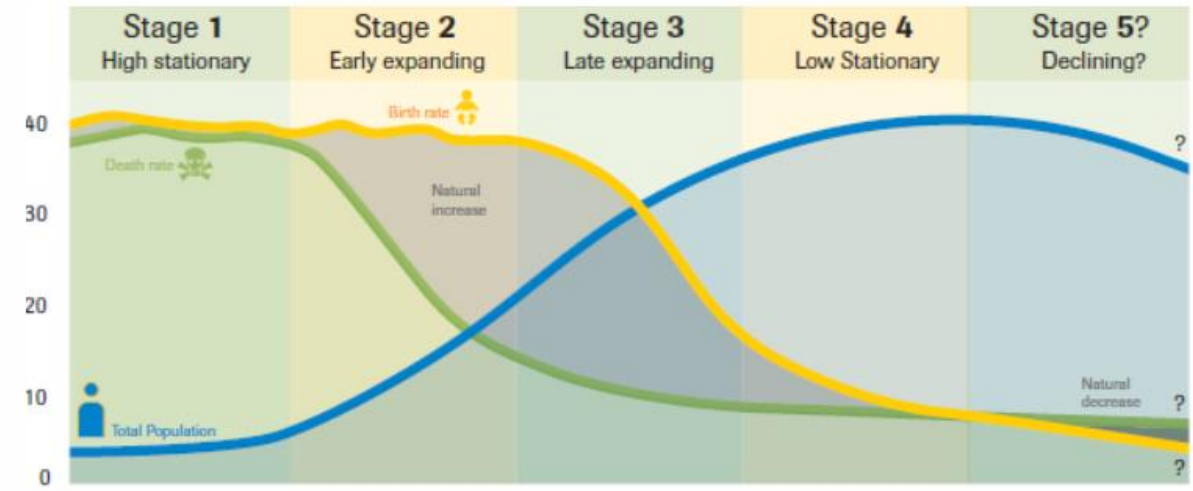

Figure 1: The demographic transition model. This graph first shows a declining mortality rate in green, second a declining birth rate in yellow, causing a population size in blue that increases en stabilizes over time (Grover, 2013).

However, the Demographic Transition Model does not provide a thorough explanation for the drop in mortality rates. To frame this phenomenon, this research will use the Epidemiological Transition Model (Omran, 1971) and the Global Health Transition Theory (Vallin and Meslé, 2002), which developed from the former. The Epidemiological Transition

Model tried to model social and medical improvements into three ages. The first age is the Age of Pestilence and Famine. In this age, life expectancy is low and mortality high, due to the high prevalence of infectious diseases (now referred to as communicable diseases) and deaths by malnutrition and famine. The second age, the Age of Receding Pandemics, is characterized by a declining mortality rate, causing the average life expectancy to go up. Omran's last age is the Age of Degenerative and Man-made Diseases. In this age, mortality reaches a low and stable level. In contrast to the former two stages, deaths are not primarily caused by communicable diseases, but are rather explained by changes in human behavioural patterns, like smoking and consumption of unhealthy food. Life expectancy increases to an even higher level in this stage.

Vallin and Meslé (2002) tried to integrate Omran's Epidemiological Transition Model into a broader, "updated" scheme of medical improvements. Their Global Health Transition theory is also structured into three stages. These stages are based on so-called trends of divergence and convergence in life expectancy rates. The first stage contains the whole Epidemiological Transition Model, in which, as Vallin and Meslé state, communicable diseases are vanquished. In the second stage, communicable diseases are replaced by cardiovascular diseases, due to an improving quality of health care and mankind taking up harmful habits. The last stage in the Health Transition is characterized by the fight against ageing; a stage in which society has found a successful treatment against cardiovascular diseases, but people find their cause of death in mental disorders, like Alzheimer's disease, and other diseases caused by old age.

There are three important side notes for Vallin and Meslé's theory. Firstly, many countries have incomplete historical databases, if any are even present. This makes the identification of the three stages nearly impossible on a global scale. Secondly, events of improvements in health care vary in place and over time, resulting in these observed divergences and convergences of life expectancy between countries. In other words, the stage in which a county fares, may vary between countries. Thirdly, it is possible for a country to have for example a more adequate health care for ageing than for cardiovascular diseases, and thus, experience a different order of the stages. These last two side notes are influenced by the country's ability to benefit from improvements in health.

The more developed countries in the world are in the later stages of the Demographic Transition Model (Warf, 2010). This is due to an adequate health care system and services, resulting in a high life expectancy rate and a low mortality rate. In earlier stages, deaths used to be caused by communicable diseases. Now deaths are mainly caused by consequences of ageing and cardiovascular diseases. Infant and maternal mortality rates are low, because both are preventable with adequate health care (Geubbels, 2006).

The countries emphasized in this research are predominantly moving towards stage three of the Demographic Transition Model; countries in which the overall mortality rate has decreased recently and the birth rate is declining (Anheiner et al., 2012). However, when looking at the Global Health Transition, Robinson (2018) states that many countries are still in the first stage of this Transition, while these countries also face the challenges of the second stage already. He speaks of a so-called double burden; countries facing the

challenges of cardiovascular diseases already, but at the same time lacking an adequate health care system to combat communicable diseases.

Thus, the amount of deaths by communicable diseases is one of the indicators whether the emphasized countries are transitioning to a different stage in the Global Health Transition. Infants and pregnant women are vulnerable population groups for communicable diseases (Salkind, 2005). This is mainly caused by three phenomena (Markides, 2007, Anheiner et al., 2012). Firstly, the lack of nutritious food makes the immunity of infants and pregnant women more vulnerable to infections. Secondly, the high population density of developing regions increases the chance of infection. Thirdly, the available health services in densely populated regions cover more people than it is able to handle. As a result, the developing regions in the world account for most maternal and infant deaths. A relatively small proportion occurs in the developed world, underlining even more that these deaths can be prevented when health services and resources are adequate (Geubbels, 2006).

Development aid can play an important role for the above mentioned concepts. It can function as a financial or technological push for developing countries towards the stage in which the more developed countries are situated. In other words, it can function as a driver for convergences in the Global Health Transition. Abeselom (2018) defines development aid as "a transfer of goods and services from one country to another, directly or indirectly." He distinguishes three types: military aid, humanitarian aid and Official Development Assistance (ODA, in this research referred to as 'development aid'). The focus of this research will be on the latter, as ODA is most common for African countries and has the largest impact economically (Abeselom, 2018).

Using data about development aid, Ziesemer (2016) tested if development aid indeed has a positive effect on life expectancy (and thus, decreases mortality rates), and it has. Life expectancy significantly increases when a country receives more development aid. Furthermore, research by Bendavid et al. (2014) concluded that on average the under-five mortality rate decreases by 0.14 per 1000 children when a country receives 1% more health aid. This relation appears to be growing over time, as the largest increase in the time frame 1974-2010 was detected within the last 10 years.

However, in his case study about Ethiopia, Abeselom (2018) also noticed a growing dependency on donating countries. He states that development aid is used by developed countries to preserve the existing economic and social structures in the world in which wealthy countries dominate the poor. This is at the expense of the autonomy and sovereignty in developing countries. These structures cause large global inequalities over the world. To break this cycle, not only are exogenous factors important, but also endogenous factors. Especially the governance of receiving countries is crucial, as the level of corruption mostly determines the effectiveness of development aid (Fielding, 2011).

2.2 – Conceptual Model

As countries transferred from stage one to stage two in the Global Health Transition, deaths by communicable diseases decreased, while deaths caused by other diseases increased. Mortality rates decreased and life expectancy increased. However, this pattern differs for African countries below the Sahara; these countries are less developed, and thus, their health care systems and services are less developed as well. This makes these countries lagging behind in the Global Health Transition. One way to trigger convergences between the developing world and the developed world is through investing in development aid.

Research has proven that a higher amount of Official Development Aid results in more effective health care systems and services. This causes mortality rates that are sensitive to communicable diseases, like infant mortality and maternal mortality, to decrease significantly. However, development aid has two downsides as well. Firstly, receiving aid from a developed country causes an increasing dependency on that country, which is at the expense of the level of freedom in the receiving country. Secondly, development aid is deemed to be less effective when the receiving country is more corrupt. Both have been proven likely to have a negative impact on the effect of development aid on improving health care, which is indicated with the red arrow in Figure 2.

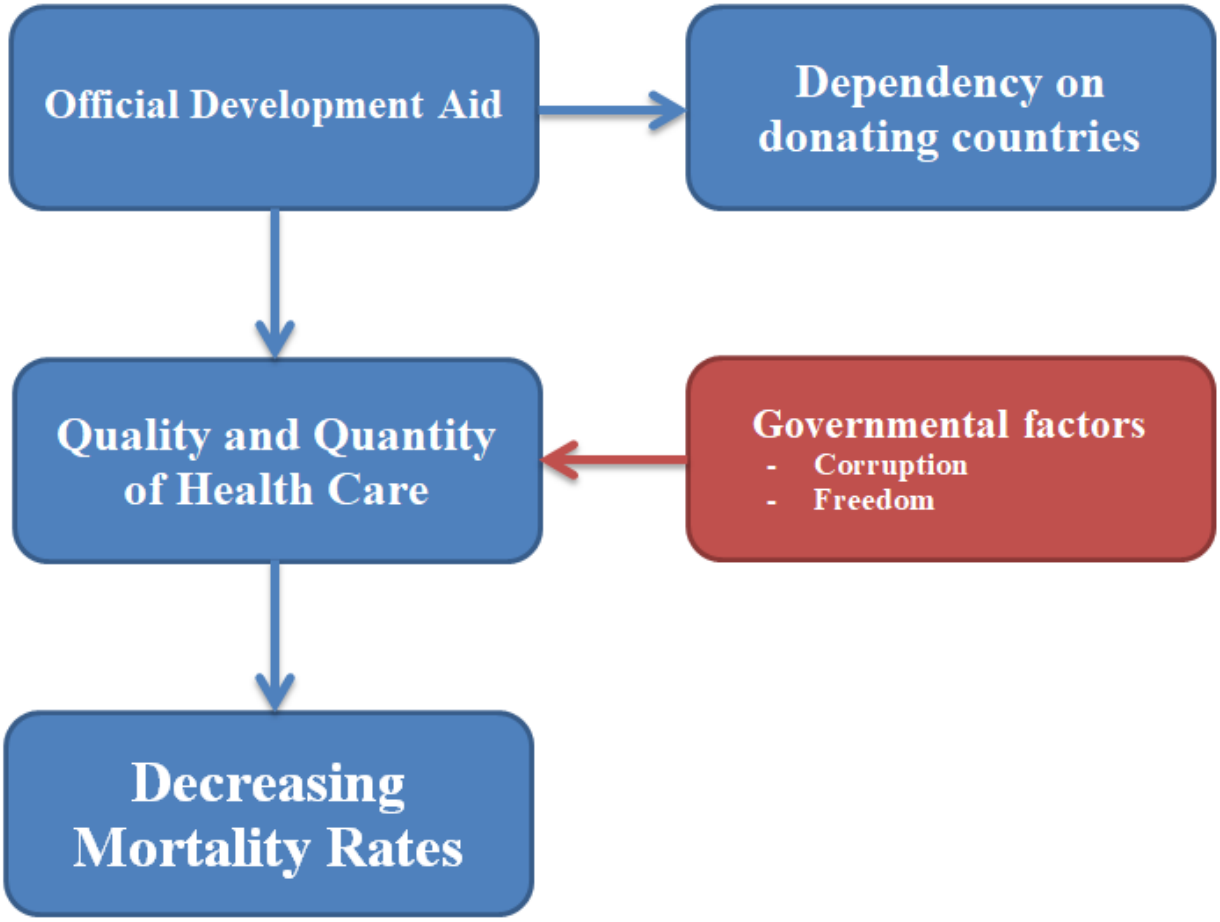

Figure 2: The conceptual model of how development aid may lead to decreasing mortality rates and the influence of corruption and freedom on this relation.

2.3 – Hypothesis

It is to be expected that there is a relation between the relative amount of development aid a country receives on the one hand and change in both mortality rates on the other. Infant mortality and maternal mortality will decrease more as countries receive a relatively higher amount of development aid, as these groups are more vulnerable to diseases that are preventable when the quality of health care systems and services is higher. However, this relation may be influenced negatively by a high level of corruption and a low level of freedom in a receiving country, as this degrades the effectiveness of development aid.

3 – Methodology

3.1 – Variables

The cases that this research studies are all African countries south of the Sahara (see Appendix 1 for a complete list of all countries), as these countries receive relatively more development aid than other countries in the world (World Bank, 2019). However, using only these cases would decrease the statistical power of the research, as this would be only 48 cases. For this reason, this research will look at these 48 cases in three different time periods, creating a total of 144 cases theoretically. In practice, this amount is lower, due to in that time not existing countries and missing data caused by other reasons. The variables that will be used in this research are summarized in Table 1 showing absolute data and Table 2 showing continuous data below.

Variable:	Source:	Years used:
Net official development assistance and official aid received, ODA (current US$)	*Organisation for Economic Co-operation and Development (OECD)*	2000, 2005, 2010
GDP (current US$)	*The World Bank*	2000, 2005, 2010
Corruption Perceptions Index	*Transparency International*	2000, 2005, 2010
Freedom in the World Index	*Freedom House*	2000, 2005, 2010

Table 1: Absolute data, measured at one point in time

Variable:	Source:	Time period used:
Maternal mortality rate (modelled estimate, per 100,000 live births)	*World Health Organization (WHO)* and *United Nations International Children's Emergency Fund (UNICEF)*	2000-2005, 2005-2010, 2010-2015
Mortality rate, infant (per 1,000 live births)	*World Health Organization (WHO)* and *United Nations International Children's Emergency Fund (UNICEF)*	2000-2005, 2005-2010, 2010-2015

Table 2: Continuous data, a calculated change between periods of five years in percentage

3.2 – Background of the Dataset

Table 1 and Table 2 show that this research will make use of five data sources: the *World Bank*, the *Organisation for Economic Co-operation and Development (OECD)*, a shared database from the *World Health Organization* and *United Nations International Children's Emergency Fund (UNICEF)*, *Transparency International* and *the Freedom House*.

The *World Bank* is a group of institutions with two common goals: ending extreme poverty and promoting shared prosperity (World Bank, 2019). One of the things this group does is collecting primary and secondary data and putting it together in one clear database. The *World Bank* works together closely with both the private sector as well as national governments. The dataset is based on "the gross value of products and services added by all resident producers in the economy" and shows the GDP of a country in American Dollars (World Bank, 2019).

Organisation for Economic Co-operation and Development (OECD) is an organization that advocates for policies creating better lives for all people (Organisation for Economic Co-operation and Development, 2019). The *OECD* works together with national governments, policy makers and citizens to establish an environment in the world for better economic performance. The focus is primarily on developing countries. The dataset includes all flows of bilateral aid, multilateral aid and private providers' aid to developing countries for a specific year in American Dollars (Organisation for Economic Co-operation and Development, 2019).

World Health Organization and *United Nations International Children's Emergency Fund (UNICEF)* are both closely interrelated with the United Nations. The *WHO* is an agency that is concerned with combatting diseases, both communicable as non-communicable (World Health Organization, 2019). The Agency has been established by the United Nation and is part of the United Nations Development Group. UNICEF is a fund established by the United Nation with the goal of providing emergency food and health care to children and mothers in need and to defend their rights and safeguard their potential (United Nations International Children's Emergency Fund, 2019). The data for maternal mortality is an estimated amount, created with a regression model, based on the proportion of non-AIDS deaths (World Bank, 2019). The data for infant mortality is based on the number of deaths below the age of one year per 1.000 infants (World Bank, 2019).

Transparency International is a non-governmental organization fighting against and documenting corruption in the world (Transparency International, 2019). To map the level of corruption, the NGO created the Corruption Perception Index. For this the NGO used thirteen surveys from ten independent institutions (see Appendix 2: Sources used for the Corruption Perception Index for a list of surveys). All surveys are standardized into a common scale from 1 to 100, and by taking the average of this, the index for each country is created. When a country scores high on the scale, the corruption in that country is high as well.

Freedom house is an organization focused on analysing challenges to freedom (Freedom House, 2019). This organization created the Freedom in the World Index, based upon the

Universal Declaration of Human Rights signed in 1948. The index consists of a total of 100 points a country can score based on the political rights and civil liberties in the country (see Appendix 3: Criteria of the Freedom in the World Index for all the criteria). This score is converted to the index and determines whether a country is free, partly free or not free. A high score equals a high level of freedom.

3.3 – Data Analysis

This research consists of two models; Model A will be focused on change in infant mortality and Model B will be focused on change in maternal mortality. Each model will make use of two analyses. Firstly, a simple linear regression analysis will be done. Change in the above mentioned mortality rates will be taken as the dependent variable in each models. The rate between the Official Development Aid a country receives and a country's GDP will be used as explanatory variable. Instead of taking absolute amounts of development aid, this rate creates relative amounts, making comparison between countries more feasible. The years examined are 2000 to 2015, resulting in a maximum amount of cases of 144. The data analysis scheme will look as following:

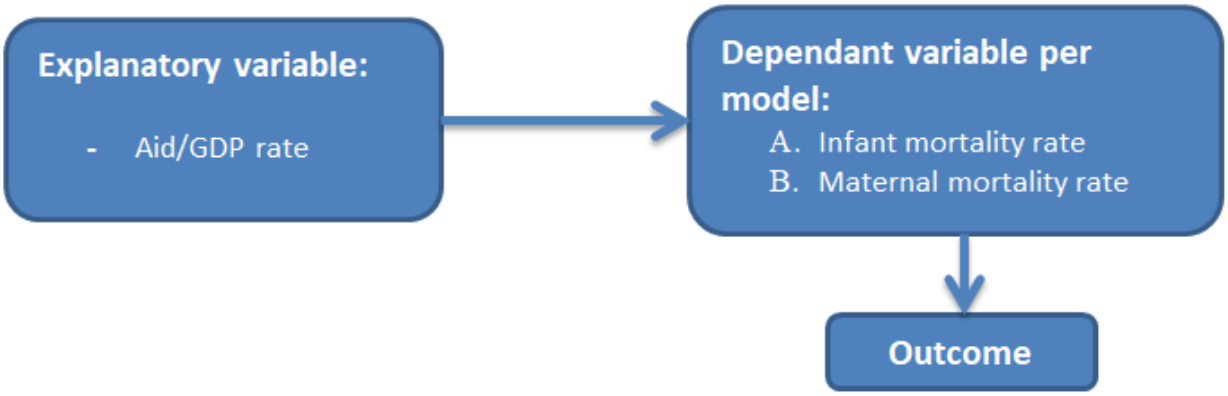

Figure 3: Data analysis scheme of simple linear regression

The second part of this research will focus on variables mediating the relation between the Aid/GDP rate and both mortality rates. The variables examined are the level of corruption and the level of freedom in a receiving country. As discussed in the theoretical framework, the amount of development aid is partly influenced by political motives of donating countries. These countries are more likely to give a larger amount of development aid to countries in which the level of freedom is high and the level of corruption is low (Fielding, 2011; Abeselom, 2018). Thus, donating countries may use development aid as a political incentive for receiving countries to democratize, which might have an effect on the geography and intensity of changing mortality rates.

Both datasets of the mediating variables are relatively young and thus, lack coverage for each country in the earlier years of the data accumulation. As a result, the second part of this research will focus on a maximum amount of cases of 144 and a minimum of 99 of the years 2000 to 2015. To test whether these variables are mediating the relation, a mediation analysis will be carried out. This analysis will try to find an underlying mechanism between the Aid/GDP rate as explanatory variable and one of the mortality rates as dependent variable in both models. The mediator ought to clarify the relationship between the explanatory variable and the dependent variable. The data analysis scheme will look as following:

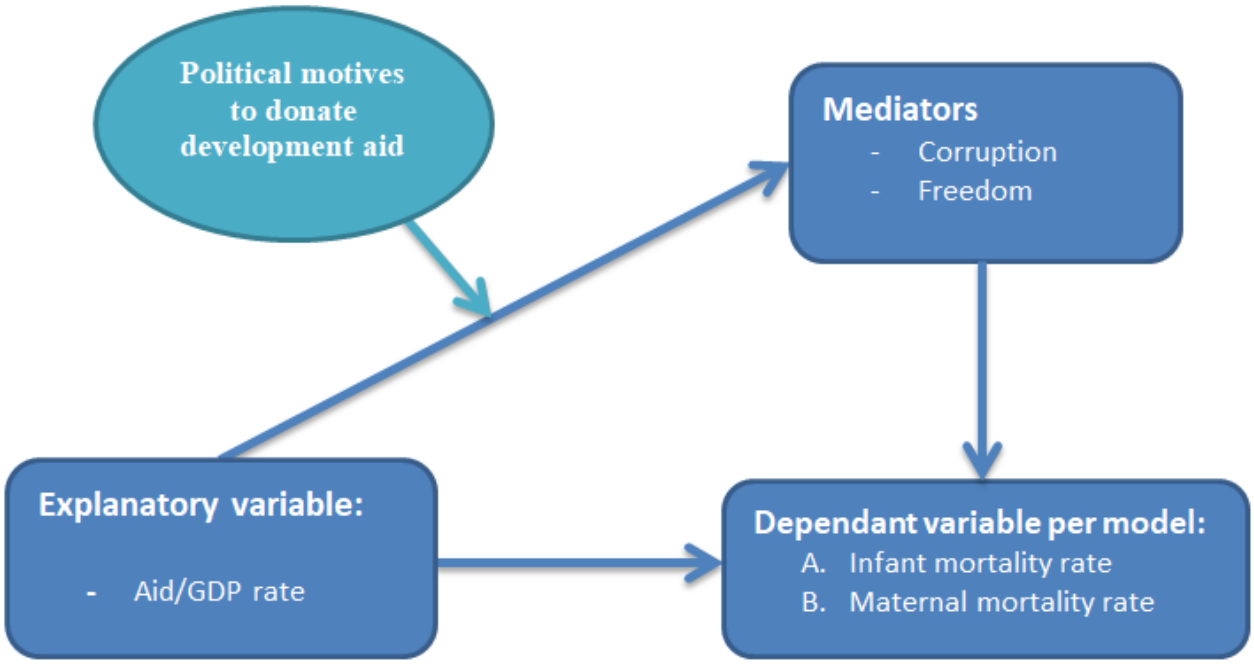

Figure 4: Data analysis scheme of mediation analysis

4 – Results

4.1 – Simple Linear Regression

In this section, this research will test whether there is a relation between the Aid/GDP rate and change in both mortality rates. This will be done by using a simple linear regression analysis.

4.1.1 – Model A: Infant Mortality

In a 95% confidence interval it can be concluded that there indeed is a significant relation between the Aid/GDP rate on one hand and the change in infant mortality on the other (Significance = 0.000). This is corresponding with the findings of Bendavid et al. (2014) that infant mortality decreases as the amount of development aid increases. For each percentage point the Aid/GDP rate increases, the change in infant mortality increases with 0.269 percentage point (Coefficient = 0.269), meaning that the absolute infant mortality rate decreases. The correlation between both variables is weak (R = 0.399) and the Aid/GDP rate accounts for 11.1% of the variability of the change in infant mortality (R-Square = 0.111), entailing that there are more factors influencing change in infant mortality. This is underlined when looking at the regression line. The point where the line intercepts the Y-axis is 12.730, which indicates that without development aid, the infant mortality rate would still decrease with 12.7% in a period of five years (see Table 3).

Infant Mortality	R	Strength correlation	R-Square	Intercept	Coefficient	Significance
Model A	0.399	Weak	0.111	12.73	0.269	0.000

Table 3: Simple Linear Regression Results for Model A: Infant Mortality

4.1.2 – Model B: Maternal Mortality

When looking at Model B, it can also be concluded in a 95% confidence interval that there is a significant relation between the Aid/GDP rate and change in maternal mortality (p = 0.027). The correlation is very weak (R = 0.191). The change in maternal mortality rate increases with 0.247 percentage point for each percentage point the Aid/GDP rate increases, meaning that the absolute maternal mortality rate decreases. Only 3.9% of the variability of change in maternal mortality can be accounted for by the Aid/GDP rate. When comparing this with the 11.1% R-Square of infant mortality, the change in maternal mortality is influenced more by other factors than change in infant mortality. The regression line indicates a 9.9% decrease in maternal mortality in a five-year period of time when the Aid/GDP rate would be 0. Comparing this to the regression line of Model A, infant mortality experiences more change than maternal mortality when the Aid/GDP rate is 0 (see Table 4).

Maternal Mortality	R	Strength correlation	R-Square	Intercept	B	Significance
Model B	0.191	Very weak	0.039	9.90	0.247	0.027

Table 4: Simple Linear Regression Results for Model B: Maternal Mortality

4.2 – Visual Representation

In the previous section, this research established that there is a relation between the relative amount of development aid and change in both mortality rates in a five-year period of time. To further examine this relation, the geographic scale will be taken into account in this section. By doing so, this research will show what regions in Sub-Saharan Africa experienced a large change in both mortality rates and at the same time received a relatively large amount of development aid. For each period of time, three maps have been put next to each other to create a visual representation; two maps showing the change in infant and maternal mortality over a period of five years and one map showing the Aid/GDP rate at the starting point of that period.

Countries in north-western Sub-Saharan Africa and eastern Sub-Saharan Africa received relatively more development aid in 2000 than the other countries. Comparing this with the change in infant mortality between 2000 and 2005, both the west and the east did indeed experience a relatively larger decrease in infant mortality than the rest of Africa (see Figure 5). However, this cannot be said about change in maternal mortality, as decrease for this mortality rate happened more in central and east Africa.

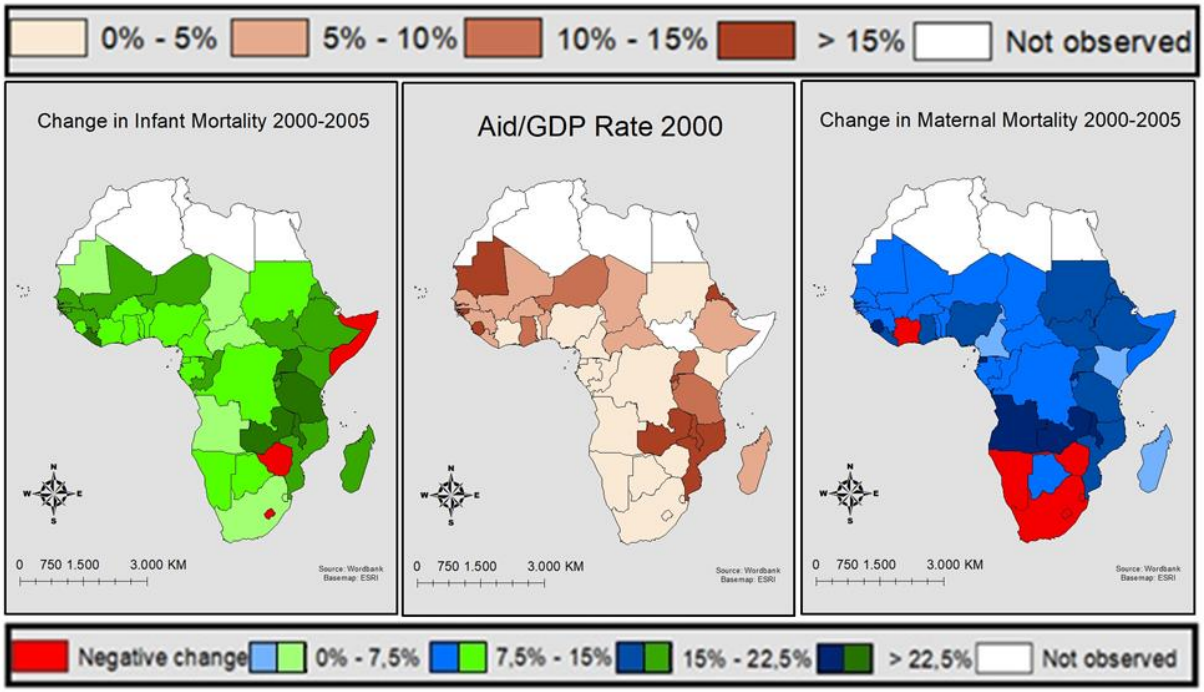

Figure 5: Visual representation of the change in infant mortality in green, the Aid/GDP rate in red and the change in maternal mortality in blue of the years 2000 to 2005.

In 2005 (see Figure 6), the Aid/GDP rate increased in size for most Sub-Saharan African countries. The west and the east were still receiving most development aid, but mid Africa started receiving more as well. Again, both the west and east experienced the strongest decrease in infant mortality, while mid Africa experienced a more modest decrease. Looking at maternal mortality, most countries receiving a large relative amount of development aid experienced a large decrease in maternal mortality as well, except for the Democratic Republic of the Congo. For this country, maternal mortality even increased.

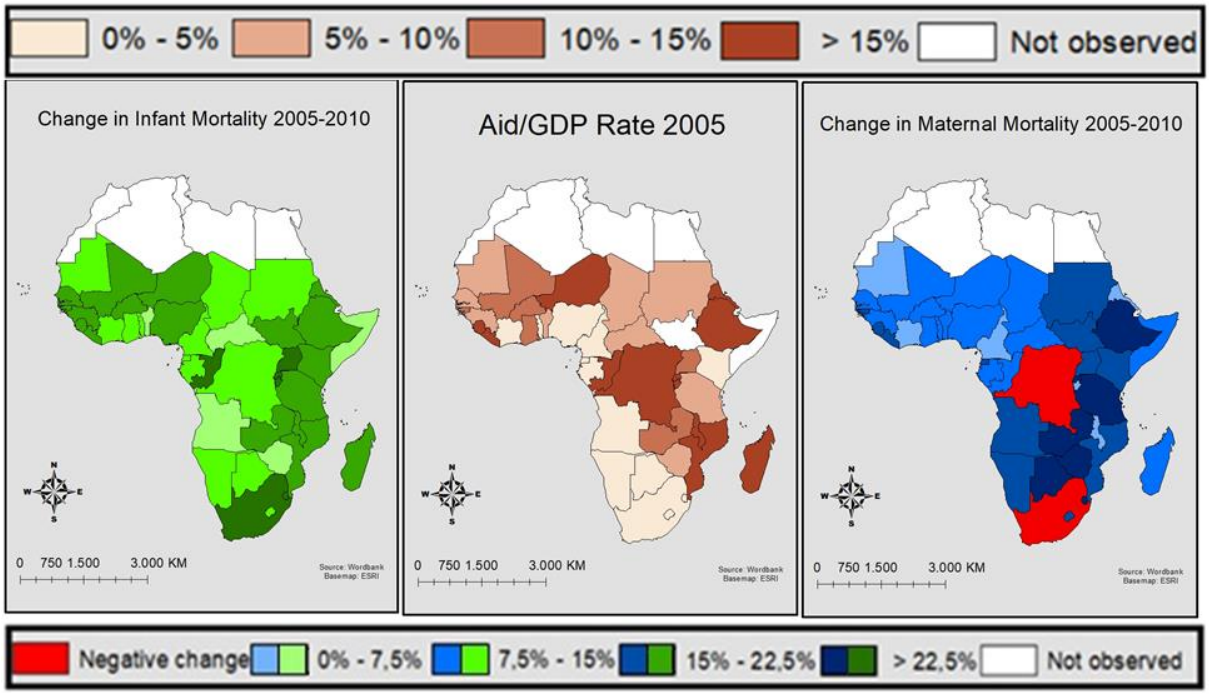

Figure 6: Visual representation of the change in infant mortality in green, the Aid/GDP rate in red and the change in maternal mortality in blue of the years 2005 to 2010.

In 2010 (see Figure 7), African countries received relatively less aid compared to 2005. The west and the east are still receiving the most, but considerably less than in 2005. When looking at change in infant mortality, the west did not decrease as much as the region used to. The east still decreased, but it is shifting more towards the south. Change in maternal mortality happened most in the east and the north. Overall decreases in maternal mortality happened in all African countries, but less intense than the five-year period before.

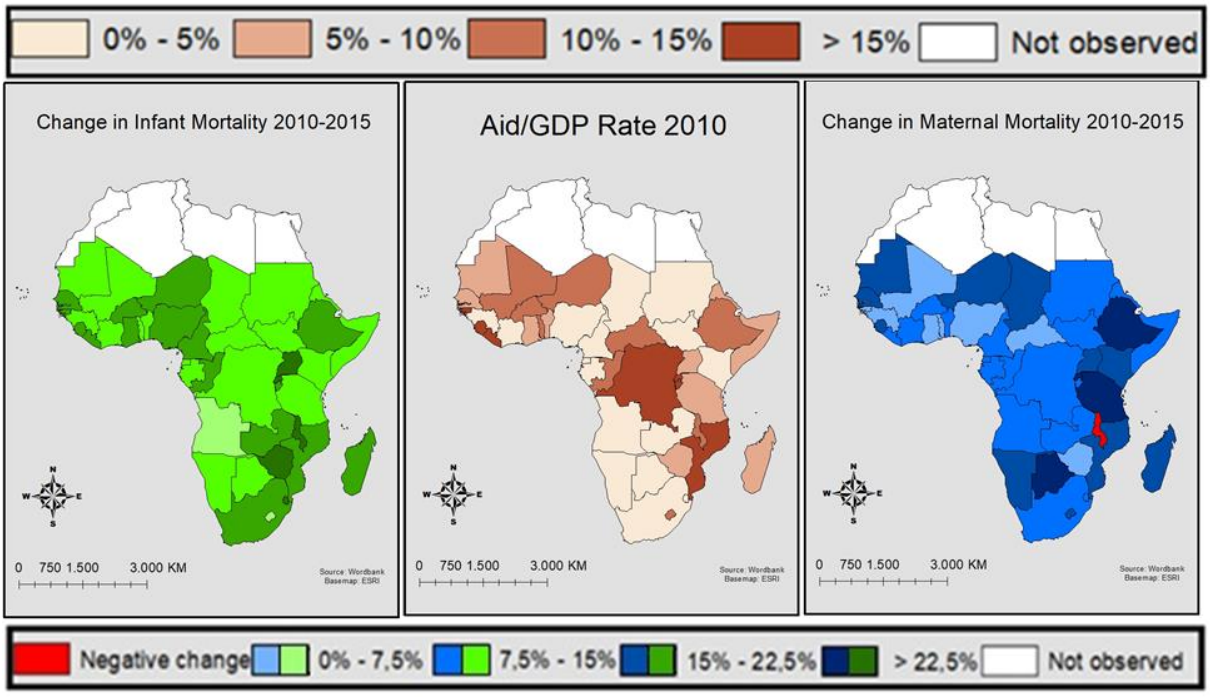

Figure 7: Visual representation of the change in infant mortality in green, the Aid/GDP rate in red and the change in maternal mortality in blue of the years 2010 to 2015.

When looking at an overall prevalence of the Aid/GDP rate and change in both mortality rates, there is indeed a positive effect visible. Countries receiving relatively more development aid experience a larger decrease in infant and maternal mortality. However, there are of course outliers in every period. Again, Africa is a huge continent, resulting in a large diversity between countries. Thus, the degree in which a country experiences mortality rate change differs as well. Moreover, other variables might influence this change as well (Fielding, 2011; Abeselom, 2018). This will be examined in the next section.

4.3 – Mediation Analysis

This section will test whether the level of corruption and the level of freedom have a mediating influence in the relation between the Aid/GDP rate and the change in both mortality rates (for elaborate results, see Appendix 4: SPSS Results, Table 1: Mediation analysis for infant mortality, and Table 2: Mediation analysis for maternal mortality). The direct relation between both variables, which has been examined in section 4.1, is called the direct effect. The influence of both mediators is called the indirect effect. Four models are created; Model 1 only consists of the Aid/GDP rate and is the reference base of the analysis. In Model 2, the level of corruption is added as mediator. In Model 3, the level of corruption is replaced by the level of freedom as mediator. Lastly, in Model 4, both variables are added as mediator. To determine whether these mediators are worth taking into account, this research makes use of the Akaike Information Criterion (Akaike, 1977) and the Bayesian Information Criterion (Schwarz et al., 1978). The AIC and the BIC are closely related to each other and both estimate the relative quality of a statistical model. What the criteria do, is estimating how much information is lost by adding a new variable into a model. This research is looking for a model in which the least information is lost; thus, a model in which the AIC and the BIC are the lowest.

4.3.1 – Model A: Infant Mortality

Model 1, the starting point of our analysis, equals the simple linear regression analysis this research had done in section 6.1.1 and concluded that it was significant (Significance = 0.000). The AIC and the BIC are 234.34 and 234.61 respectively (see Table 5 below). When adding the first mediator, the level of corruption, the AIC and the BIC change tremendously: to 166.76 and 166.77 respectively. This entails that by adding a new variable, the quality of the model increases. The mechanism by which the Aid/GDP rate effects change in infant mortality responds to the level of corruption in a country. This is visible in the strength of the correlation as well, which is moderate (R = 0.432). Model 3 replaces the level of corruption by the level of freedom in a country. Again, Model 1 is taken as starting point. The AIC and the BIC of Model 3 increase in size (AIC = 235.45 BIC 235.87). The quality of the model decreased after adding the level of freedom, so it suggests that it has no mediating effect on the relation between the Aid/GDP rate and the change in infant mortality. In Model 4, in which both freedom and corruption are added, the AIC and BIC are 168.45 and 168.47 respectively. However, this model is less parsimonious than Model 2.

Now that it is established that Model 2 has the highest quality, the direction of the effect of corruption can be determined as well. The level of corruption is measured on a scale from 1 to 100 in which 100 is a high level of corruption. For each point the level of corruption in a country increases, and the Aid/GDP rate is taken to be constant, change in infant mortality decreases with 0,077 percent point (Coefficient: Corruption = -0,077). Thus, when a country has a high level of corruption, infant mortality decreases less. The mediating effect of corruption can also be underlined by the fact that a one percent point increase of the Aid/GDP rate has less impact on the change in infant mortality rate in Model 2 than in Model 1 (from 0,390 to 0,357). As this coefficient decreased with 8,4% after corruption has been added, it can be concluded that the level of corruption in a receiving country has a mediating effect of 8,4% in the relation between the Aid/GDP rate and change in infant mortality. As the coefficient of corruption is negative, the effect of corruption is negative as well. This is in

line with Fielding's theory (2011), that the level of corruption in a country has a negative impact on the efficiency of development aid, and thus, degrades the effect of development aid on improving mortality rates.

Infant Mortality	Model 1	**Model 2**	Model 3	Model 4
Significance: Aid/GDP	0.000	**0.000**	0.000	0.000
Significance: Corruption	X	**0.219**	X	0.752
Significance: Freedom	X	**X**	0.158	0.408
R	0.399	**0.432**	0.414	0.438
Coefficient: AID/GDP	0.390	**0.357**	0.397	0.369
Coefficient: Corruption	X	**-0.077**	X	-0.270
Coefficient: Freedom	X	**X**	0.522	0.445
AIC	234.34	**166.76**	235.45	168.45
BIC	234.61	**166.77**	235.87	168.47

Table 5: Brief summary of the results of the mediation analysis for infant mortality. The model with the highest quality is depicted in bold. For a more elaborate table, see Appendix 4: SPSS Results, Table 2: Mediation analysis for infant mortality.

4.3.2 – Model B: Maternal Mortality

Model 1 is the starting point of the analysis again, equalling the simple linear regression analysis done in section 6.1.2 with a significance of 0.027. The AIC and the BIC are 291.74 and 291.99 respectively (see Table 6 below). After adding corruption as mediator, AIC and BIC decrease tremendously again to 222.36 and 222.34 respectively. Thus, the model increased in quality once more. The mechanism by which the Aid/GDP rate effects change in the maternal mortality rates responds to the level of corruption in a country. The strength of this correlation is weak (R = 0.247). Model 3 uses freedom as mediator instead of corruption. When comparing the AIC and BIC of Model 3 and Model 1, the levels slightly decrease to 290.64 and 291.02. This entails that the mediator freedom has a slightly mediating effect on the relationship between the Aid/GDP rate and the change in maternal mortality, but not as prominent as the level of corruption has in Model 2. In Model 4 again, both variables have been added as mediator. Compared to Model 1, the quality of Model 4 improves to an AIC and a BIC of 222.64 and 222.62 respectively. However, Model 2 appears to be of better quality and, as freedom does not contribute to the model as significantly as corruption, it can be concluded that Model 2 is the model with the highest quality.

Now that the best model has been detected, the direction of the effect of corruption can be determined again as well. Using the same 1 to 100 scale again, each point a country is more corrupt, and the Aid/GDP rate is taken to be constant, the change in maternal mortality decreases with 0.171 percent point (Coefficient: Corruption = -0.171). Thus, change in maternal mortality reacts stronger to a higher level of corruption than change in infant mortality. This mediating effect can be underlined by looking at the coefficients of the Aid/GDP rate. When adding corruption to the model, a one percentage point increase of this rate has less impact on change in maternal mortality. This coefficient decreases with 19.5%

from 0.375 to 0.302. Thus, the level of corruption in a receiving country has a mediating effect of 19.5% on the relation between the Aid/GDP rate and change in maternal mortality. As stated, the coefficient of the level of corruption is negative; entailing that the mediating effect is negative as well. This recurrently is in line with the theory of Fielding (2011).

Maternal Mortality	Model 1	**Model 2**	Model 3	Model 4
Significance: Aid/GDP	0.027	**0.073**	0.002	0.035
Significance: Corruption	X	**0.176**	X	0.724
Significance: Freedom	X	**X**	0.008	0.052
R	0.239	**0.247**	0.326	0.313
Coefficient: AID/GDP	0.375	**0.302**	0.403	0.357
Coefficient: Corruption	X	**-0.171**	X	0.061
Coefficient: Freedom	X	**X**	1.665	2.057
AIC	291.74	**222.36**	290.64	222.64
BIC	291.99	**222.34**	291.02	222.62

Table 6: Brief summary of the results of the mediation analysis. The model with the highest quality is depicted in bold. For maternal mortality; for a more elaborate table, see Appendix 4: SPSS Results, Table 3: Mediation analysis for maternal mortality.

5 – Conclusions

This research focused on whether the relative amount of development aid a country receives has a positive impact on the degree infant mortality and maternal mortality change over time. Both mortality rates can be seen as important indicators for health progress, as both groups are highly vulnerable to communicable diseases: one of the main drivers in the Demographic Transition Model, the Epidemiological Transition Model and the Global Health Transition Theory. Development aid is deemed to have a positive impact on health progress. It can be the means for a country to transfer to a more advanced stage. However, development aid has its downsides as well. Receiving countries become dependent on the donating countries, decreasing their autonomy and sovereignty. This may have as consequence that development aid is given for the wrong reason. Furthermore, development aid decreases in efficiency when the receiving country is corrupt.

By means of simple linear regression analysis, this research has established a significant relation between the relative amount of development aid and changes in both mortality rates in periods of five years. The more relative development aid a country receives, the more both mortality rates decrease over time. This is in line with the findings of Bendavid and Bhattacharya (2014), entailing that the under-five mortality rate decreases as the amount of development aid increases. It is also in accordance with the results of Ziesemer's research (2016), in which he established that development aid has a positive impact on life expectancy and thus, mortality rates. However, the Aid/GDP rate accounts only for a small proportion of the variability for both mortality rates. Thus, other factors are influencing change in both mortality rates as well. The relation is geographically visible as well. In countries in the north-west and in the east of Sub-Saharan Africa, the Aid/GDP rates are high, resulting in a relatively larger decrease in both mortality rates than in other parts of Sub-Saharan Africa.

To test whether the level of corruption and the level of freedom in a receiving country have a mediating influence on the above mentioned relation, this research made use of a mediation analysis. It established that the level of freedom does not have a significant influence, but that the level of corruption in a receiving country does. When adding the level of corruption to the model of infant mortality, the coefficient of the Aid/GDP rate decreased with 8.4%, which entails that the negatively mediating effect of corruption on the relation between the relative amount of aid and the change in infant mortality is 8.4%. For maternal mortality, this effect is even higher: 19.5%. These findings correlate with Fielding's theory (2011), that a high level of corruption has a negative effect on the effectiveness of development aid. Furthermore, these findings also correlate with the first part of this research. Here was established that the variability of the change in both mortality rates that the Aid/GDP rate accounts for is higher for infant mortality than for maternal mortality. This entails that there are more factors influencing change in maternal mortality. The level of corruption in a country appears to be one of these factors.

This research made use of secondary data gathered from well-known and high-established organizations to create a clear picture of the relation between the relative amount of aid a country receives and changes in both infant and maternal mortality rate. However, the consequence of using secondary data is that one is dependent on the availability of the data. Not all observed years are available in all datasets. Furthermore, not all datasets cover all the observed countries for every year, degrading the statistical power of the tests carried out using this data. Recommendations for future research would be to create a broader dataset in which this statistical power is not lost.

6 – References

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7 – Appendices

7.1 – Appendix 1: Countries Observed

Countries observed in this research in alphabetical order: Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Cote d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Republic of the Congo, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

7.2 – Appendix 2: Sources used for the Corruption Perception Index

African Development Bank Country Policy and Institutional Assessment, Bertelsmann Stiftung Sustainable Governance Indicators, Bertelsmann Stiftung Transformation Index, Economist Intelligence Unit Country Risk Service, Freedom House Nations in Transit, Global Insight Business Conditions and Risk Indicators, IMD World Competitiveness Center World Competitiveness Yearbook Executive Opinion Survey, Political and Economic Risk Consultancy Asian Intelligence, The PRS Group International Country Risk Guide, World Bank Country Policy and Institutional Assessment, World Economic Forum Executive Opinion Survey, World Justice Project Rule of Law Index Expert Survey, and Varieties of Democracy (V-Dem)

7.3 – Appendix 3: Criteria of the Freedom in the World Index

Electoral Process, Political Pluralism and Participation Functioning of Government, Freedom of Expression and Belief, Associational and Organizational Rights, Rule of Law, and Personal Autonomy and Individual Rights

7.4 – Appendix 4: SPSS Results

Infant Mortality	Model 1	Model 2	Model 3	Model 4
Overall significance	0.000	0.000	0.000	0.000
Significance: Aid/GDP	0.000	0.000	0.000	0.000
Significance: Corruption	X	0.219	X	0.752
Significance: Freedom	X	X	0.158	0.408
R	0.399	0.432	0.414	0.438
Strength correlation	Weak	Moderate	Moderate	Moderate
R-Square	0.159	0.186	0.171	0.192
Intercept	11.73	15.01	9.44	11.61
B: AID/GDP	0.390	0.357	0.397	0.369
B: Corruption	X	-0.077	X	-0.27
B: Freedom	X	X	0,522	0.445
AIC[1]	234.34	166.76	235.45	168.45
BIC[2]	234.61	166.77	235.87	168.47

1: AIC = n*log(SSE/n) + 2(k+1)
2: BIC = n*log(SSE/n) + (k + 1)*log(n)

Model 1: AID/GDP
Model 2: AID/GDP, Corruption
Model 3: AID/GDP, Freedom
Model 4: AID/GDP, Corruption, Freedom

Table 1: Mediation Analysis for Infant Mortality

Maternal Mortality	Model 1	Model 2	Model 3	Model 4
Overall significance	0,005	0,049	0,001	0,020
Significance: Aid/GDP	0,027	0,073	0,002	0,035
Significance: Corruption	-	0,176	-	0,724
Significance: Freedom	-	-	0,008	0,052
R	0,239	0,247	0,326	0,313
Strength correlation	Weak	Weak	Weak	Weak
R-Square	0,057	0,061	0,106	0,098
Intercept	8,83	13,99	1,42	-1,82
Coefficient: AID/GDP	0,375	0,302	0,403	0,357
Coefficient: Corruption	-	-0,171	-	0,061
Coefficient: Freedom	-	-	1,665	2,057
AIC[1]	291,74	222,36	290,64	222,64
BIC[2]	291,99	222,34	291,02	222,62

1: AIC = n*log(SSE/n) + 2(k+1)
2: BIC = n*log(SSE/n) + (k + 1)*log(n)

Model 1: AID/GDP
Model 2: AID/GDP, Corruption
Model 3: AID/GDP, Freedom
Model 4: AID/GDP, Corruption, Freedom

Table 2: Mediation Analysis for Maternal Mortality