To aid or not to aid?
An evaluation of the relationship between health aid and health outcomes in developing countries

Master Thesis

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Summary

For many years, foreign aid has been a controversial tool for helping developing countries achieve economic growth and overall welfare. Nevertheless, the early 2000s saw a rise in development assistance dedicated to the health sector. Currently the concept of sustainable development highlights the importance of a healthy population to achieve overall development within and among countries. Does this imply that aid dedicated specifically to the health sector is more effective in producing positive results in recipient countries? Using a dataset that contains Official Development Assistance channelled towards 84 countries between 2008 and 2018, this thesis studies the effect of health aid on health outcomes. To test aid effectiveness, regression models are estimated using infant mortality and life expectancy as proxies for health outcomes. The analyses show only weak effects of health aid on health outcomes in recipient countries. Moreover, this study tests whether domestic healthcare expenditure can give further insights into the complex relationship between aid and development in the health sector by testing for mediation effects. Results yield no direct or indirect mediation effect. Nonetheless, findings show that domestic healthcare expenditure positively affects life expenditure rates in recipient countries. Overall, results suggest that health aid is not a panacea for improving health conditions, and that it is important for developing countries to invest domestic resources in their healthcare system, rather than relying on financial flows from outside the country. Countries should focus on effective policymaking that fosters domestic resources in the long term in order to build robust healthcare systems. Additionally, the influence of both urbanisation and domestic private health expenditure on health outcomes should be investigated further to identify the key drivers of population health.

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Table of Contents

List of tables, figures, and appendices

Tables

Figures

Appendix

1. Introduction

The importance of improved health outcomes and stable health systems has been increasingly recognised since the turn of the century. A healthy population can contribute greatly to economic and sustainable growth in all countries. To achieve this, new development initiatives that focus on reducing global inequalities in a variety of areas, including health, have been established. Two prominent examples are the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs). The MDGs were adopted by the United Nations (UN) in 2000 with the aim to promote development. A total of eight development goals were set to be achieved by 2015. Three of them focused on health: to reduce infant mortality, to improve maternal health, and to combat diseases such as malaria or AIDS (Boerma et al., 2015). A new development agenda was adopted in 2015, the 2030 Agenda for Sustainable Development. 17 development goals, the Sustainable Development Goals (SDGs), now focus on environmental, social, and economic aspects and build on the MDGs. The SDGs point out the interconnectedness of health and economic growth. Health is one of the driving forces for achieving other, non-health related SDGs. Without health improvements, the other goals cannot be achieved (Boerma et al., 2015).

These initiatives are a good starting point to reduce global inequalities by aiming to eradicate poverty, end hunger, improve maternal health, and so on. However, development cannot be achieved without large investments. Countries without the necessary monetary resources draw on assistance from other countries in the form of development assistance. Foreign aid has been a tool for growth in developing countries for quite some time already. The MDGs have led to an even greater resource mobilisation in the new century and increasing amounts of development assistance were channelled towards poor countries (Boerma et al., 2015). The aim was not only to provide greater quantities of development assistance, but also to improve the effectiveness of aid. This has led to a remarkable increase in the share of aid dedicated to the health sector since 2000 (Herfkens & Bains, n.d.).

Despite such resource mobilisations, 55% of deaths or 55.4 million people globally died from communicable and noncommunicable diseases in 2019 (so not from injuries). Diseases are the top ten causes of death worldwide, and diabetes is listed among these main causes. The number of deaths caused by diabetes has increased by 70% since 2000 (World Health Organization [WHO], 2020). That is because many poor countries do not have enough financial means and medical supplies, inadequate health facilities, and are lacking skilled medical personnel, despite the domestic resources invested in local healthcare systems (Boerma et al., 2015). Moreover, in 2017, only about one third of the global population had access to essential health services (UN, 2020). So how come, despite the increased aid flows dedicated to the health sector, poor countries are still struggling to build and finance sufficient healthcare systems?

When donors provide aid, it does not automatically translate into welfare in the recipient country. Donors and recipient countries must work together to ensure that funds are used in the best

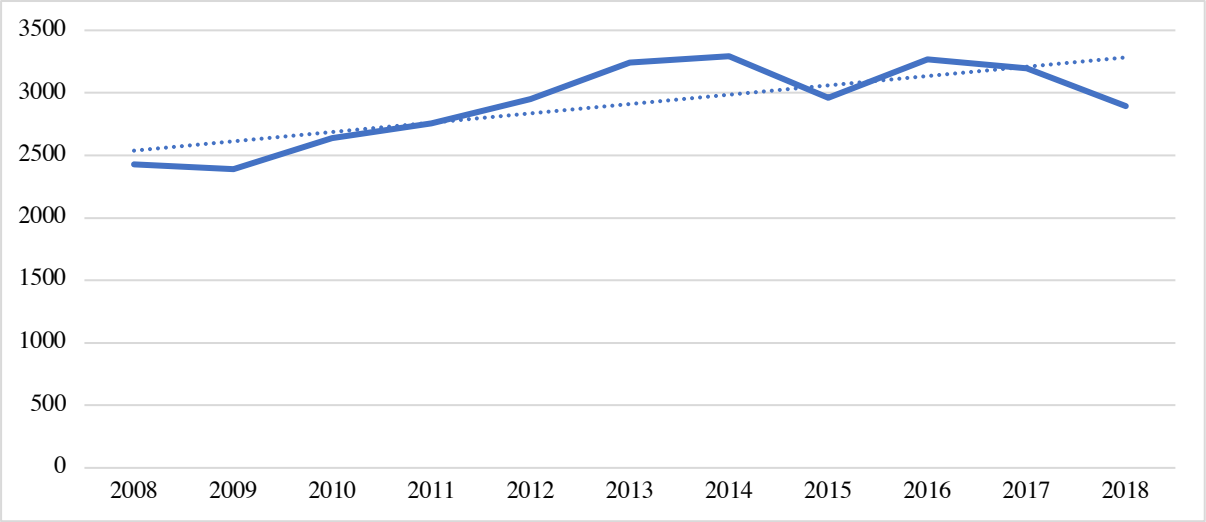
possible way. One prerequisite for a successful use of foreign aid is that it is aligned with and integrated into national budgets. This fosters sustainable local capacity and a sound institutional environment. Moreover, developing countries must be given ownership over this money so that they can eventually take off into self-sustained growth, through well-established local capacities (Herfkens & Bains, n.d.). This suggests that it is important to align foreign aid with domestic government spending for health to create stable health systems that foster population health.

The aim of this thesis is to build on the existing body of knowledge in the debate around aid effectiveness and to understand whether development assistance for health improves population health in recipient countries. Moreover, it investigates whether healthcare expenditure plays a mediating role in this relationship. In other words: is health aid effective and does healthcare expenditure play a significant part in the relationship between aid and development? Numerous scholars have investigated health aid before and after 2000 and have arrived at diverging outcomes. But because previous research has not yet focused on whether national health expenditure mediates the relationship between health aid and (improved) health outcomes in recipient countries, this study analyses the following research question:

What is the effect of health aid on health outcomes in developing countries between 2008 and 2018, and does healthcare expenditure help explain this relationship by mediating it?

Figure 1 is a graphical representation of Official Development Assistance (ODA) flows to 84 countries between 2008 and 2018. These aid flows were dedicated for the health sector. The overall trend is positive, but the growth of health aid has slowed down since the financial crisis in 2008/2009 (compared to a steep growth rate in the early 2000s) (Boerma et al., 2015).

Figure 1. Health aid (in million US dollars) to 84 ODA eligible countries, 2008 to 2018



Note. *Data were extracted from the OECD Creditor Reporting System in May 2021 (https://stats.oecd.org/Index.aspx?DataSetCode=crs1)*

1.1 Relevance

1.1.1 Social relevance

Whether researching the effectiveness of foreign aid is of societal relevance depends on several things. Firstly, do policymakers care about this social phenomenon (Lehnert, Miller & Wonka, 2007)? The amount of development assistance has increased by 66% between 2000 and 2014 (Boerma et al., 2015). This suggests that donors perceive foreign aid to be an important and effective tool in promoting development and growth in recipient countries. The establishment of the MDGs has also triggered increasing amounts of aid flows devoted for health purposes. In fact, as of 2017, about 40% of aid low-income countries received was specifically dedicated for health investments (WHO, 2019). Furthermore, the current COVID-19 pandemic was an awakening that strong health systems are vital in every country because the world is essentially interconnected, and such diseases can cause global crises (Lenhardt, 2020). According to the UN, "no one is safe, until everyone is" (United Nations Department of Economic and Social Affairs, 2020). In other words, countries must work together to achieve a healthier tomorrow. Donor countries play an important role in this development because they can help poor countries achieve the development objectives set out by the MDGs and the SDGs by providing financial aid (Herfkens & Bains, n.d). This confirms the importance of funds dedicated for health purposes from a policy perspective.

Secondly, is someone affected by development assistance and does an effective use yield notable positive results (Lehnert et al., 2007)? Healthcare is an essential component of our society because it has the power to save lives, relieve symptoms, improve health conditions, and even extend life with the right medical practices. Therefore, better health services may positively affect the health of each citizen. Policymakers are also affected by positive or negative results of aid effectiveness, because this way they can better plan, finance, and manage the provision of health services (Kind, 2018).

Thirdly, does this research advance people's understanding of the phenomenon (Lehnert et al., 2007)? There is no consensus among scholars whether foreign aid improves the standard of living in recipient countries. Some argue that development assistance does not contribute to growth in recipient countries at all; others find that sector-specific aid may indeed be effective (Ovaska, 2003; Mishra & Newhouse, 2009). Therefore, this research aims to contribute to the existing debate around aid effectiveness by possibly providing a more conclusive picture. Finally, social relevance is assessed by referring to an evaluative standard, which is used to analyse a social phenomenon. The social phenomenon in this thesis is health aid and its effectiveness is being examined. Different results of the analysis have different implications for health aid effectiveness (Lehnert et al., 2007).

1.1.2 Theoretical relevance

This research also adds to scientific literature in the following ways. First, it gives further insights into the relationship between health aid and health outcomes in recipient countries by a) analysing a new period (2008 to 2018) and by b) studying the role of healthcare expenditure in this relationship. More specifically, it tests whether this variable is a mediator, because health expenditure may be affected by fluctuating levels of development assistance, and it also has an impact on population health.

Secondly, it expands the temporal scope of existing research. Thus far, research has focused on the years before the 2000s, the early 2000s, or the time corresponding to the MDGs. The growth rate of donor funding for healthcare has declined in recent years (compared to the steep growth rate in the early 2000s). As of 2017, high income countries dedicate 0.03% of their GDP for health aid, which is well below the targeted 0.7% for total development aid agreed to globally. Nevertheless, aid remains an important source of funding, with 140 countries of all income groups having received external health support in 2017 (WHO, 2019). That said, it is important to investigate this more recent period that experienced slight changes in the health aid landscape.

Thirdly, this research can contribute to the broader debate around aid effectiveness, beyond health specific aid. The results of this thesis may be applied to other sectors of the economy to understand how the aid received for that particular sector can be used more effectively to yield development and growth. Moreover, assessing whether healthcare expenditure is a mediating variable may help understand whether the relationship between aid and development is mediated by a third variable in other sectors.

1.2 Structure

This research uses a quantitative approach to analyse health aid effectiveness between 2008 and 2018. The remaining paper is structured as follows. The theoretical section reviews and elaborates on the following overarching topics: the connection between economic growth and human development, foreign aid, health aid, healthcare expenditure, and health outcomes. Not only is literature reviewed to understand the position of scholars in the aid effectiveness debate, but also are factors identified that may help explain why no consensus regarding its effectiveness exists. After that, the empirical process is outlined in the research design. The results are presented afterwards, which are critically reflected on in the discussion. Finally, the lessons learnt are reviewed in the conclusion, policy recommendations are made, and limitations of this study that might be relevant for future research are listed.

2. Theoretical section

To understand the concept of health aid and the analysis undertaken in this paper, the following paragraphs do not jump to the debate around health aid effectiveness directly. Rather, a more holistic approach is applied. First, the relationship between economic growth and human development is explained. Next, overall aid effectiveness is discussed. This is followed by a section on health sector specific aid, and the concept of healthcare expenditure and its potential role in explaining health outcomes in recipient countries is outlined. Next, the term health outcomes is introduced and defined. The theoretical section will inform the conceptual framework and the hypothesis development.

2.1 Economic growth and human development

Many developing countries, such as Africa's least developed countries, finance a large part of their investments and operations through foreign aid. Such financial flows, if they exceed a certain threshold, can help those nations become self-sustained in terms of economic growth (Wamboye, Adekola & Sergi, 2013). But what does sustainable growth actually mean and how can we understand economic development in the aid landscape? There are two lines of thought in the literature. The first one addresses the determinants of economic growth from a rather theoretical, economic perspective. The second strand goes further by exploring the ultimate objectives of economic development, which includes human development in the discussion (Boozer, Ranis, Stewart & Suri, 2003). This work expands on the findings of Ranis, Stewart and Ramirez (2000), who claim that there is an interconnectedness between economic growth and human development (defined by health and education of a country's population) and that the latter is important to achieve sustainable growth in a country. The authors call human development a "key ingredient" for development, not just a result of such (Boozer et al., 2003, p. 24). Ranis et al. (2000) compared the performance on human development and economic growth of numerous developing countries between 1960 and 1992. In their research, many African and some Latin American nations are classified as 'vicious', meaning that they experienced both weak economic growth and human development in that period; the opposite of vicious are countries classified as 'virtuous'. Moving from vicious to virtuous straight away is a difficult process because it requires countries to strengthen their human development first (Ranis et al., 2000). This suggests that improvements in economic growth alone are insufficient and that there is a link between economic growth and human development, which can potentially explain aid (in)effectiveness.

2.2 Foreign aid

To get a first impression of the overall aid landscape, the next section explores the literature on overall foreign aid. This aims to give the reader an overview of scholars' findings and to explore aid effectiveness from a broader perspective, before focusing on health aid.

2.2.1 The debate around aid effectiveness

Foreign aid is a well-known tool used by public and private donors to help improve the standard of living in recipient countries. Such donations can come in various ways, including in monetary terms, investments made by companies or through humanitarian assistance such as food aid. The provision of aid, however, does not always result in increased outcomes. Scholars have attempted to find out whether this tool fosters (economic) development in recipient countries for many years already and arrived at different conclusions, which can be divided into two groups: those that find aid to be ineffective, and those that believe in its effectiveness. A more detailed elaboration follows. In 1987, Mosley, Hudson and Horrell were unable to find statistical evidence that links aid to the growth rate of a country's Gross National Product (GNI). Similarly, a paper by Doucouliagos and Paldam (2008) investigating the results of 68 studies on aid effectiveness that covered a period of 40 years did not confirm a statistically significant effect of foreign aid on development. Rajan and Subramanian (2008) found no evidence that the right policies or institutions foster aid, nor that certain types of aid work better than others. In contrast, Durbarry, Gemmell and Greenaway (1998) found that foreign aid promotes growth in developing countries, which however is dependent on stable macroeconomic policies. Hansen and Tarp (2000) reviewed three generations of aid effectiveness studies between the 1960s and 2000. Their results are in favour of aid effectiveness and they conclude that aid increases aggregate savings and investments in recipient countries (Hansen & Tarp, 2000). But do such differing conclusions on aid effectiveness over the past decades mean that aid fails to reach its objective after all? A set of factors were identified that potentially explain why scholars do not always arrive at the same outcomes: the micro-macro paradox, because of country-specific differences, the characteristics of data used, and the interaction of economic and non-economic variables on development (Hansen & Tarp, 2000). The next paragraphs elaborate on these points in more detail.

2.2.1.1 The micro-macro paradox. The micro-macro paradox is a well-known phenomenon in economics that can explain different results of aid effectiveness. This phenomenon suggests that micro and macro data are not the same. More specifically, data may yield positive results of projects that are financed by aid, which is at the micro level. However, at the macro level (the overall economy), no evidence of improvements can be identified (Mosley, 1986). This paradox can be caused by data inaccuracy, bias of project data, and the rate of return formula that only measures the potential successes of the projects and not what happens to the overall economy. The disbursement of aid might change spending patterns of the public sector and the economic behaviour of the private sector. The following example explains this paradox in relatively simple terms: Food aid helps combat starvation in the short term. In the long term, however, it may bring down domestic prices of food, and hence fewer local producers supply food in the future (Mosley, 1986). While Mosley (1986) suggests that this paradox

may explain aid (in)effectiveness, Hansen and Tarp (2000) find that it does not hold, meaning that aid is beneficial both at the micro and the macro level.

2.2.1.2 Country-specific characteristics. Secondly, country-specific differences may affect outcomes. Therefore, the right instruments must be chosen to adapt aid effectiveness to individual country needs (Hansen & Tarp, 2000). Moreover, controlling for other growth determinants when assessing the impact of foreign aid on economic development is important (Durbarry et al., 1998). Effective institutions and factors like the absence of corruption influence how well aid translates into positive results (Barkat, Mrabet & Alsamara, 2016; Mishra & Newhouse, 2009). If this is not the case, the recipient government may not use the financial aid for the purpose intended by donors, also called aid fungibility (Stevens, 2008). This term will be discussed in more detail later (in section 2.5). Moreover, countries do not always allocate and use the resources they have in the most efficient way, nor have the capacity to absorb the development assistance in the best way (Bein, Unlucan, Olowu & Kalifa, 2017; Lu et al., 2010).

2.2.1.3 Data characteristics. As mentioned in the previous paragraph, every country has characteristics that are distinct from any other nation. Such differences may affect the research process. Results can vary when cross-country versus single-country studies are carried out, or when qualitative versus quantitative data are used. Acknowledging the similarities and differences in the data collection process and limitations to data gathering in some situations might advance one's understanding of the relationship between aid and development.

2.2.1.4 Interconnectedness of economic growth and human development. Finally, non-economic variables such as human development have an impact on aid effectiveness (Hansen & Tarp, 2010). The debate around economic growth and human development introduced in the beginning of the theoretical section assumes that there is an interconnectedness between these two variables. In short, when trying to understand the determinants of an economy's growth and development, neither factor can be analysed in isolation (Boozer et al., 2003). Human development is not only an end product of the development process a country goes through, but it is also a key component of advancing economic growth; it is a "key ingredient" for development (Boozer et al., 2003, p. 24). Development assistance directed at the health sector can therefore greatly contribute to sustainable development and achieve not only health improvements, but also sustainable economic growth (Ranis et al., 2000).

The preceding paragraphs suggest that the relationship between foreign aid and development in recipient countries is rather complex than straightforward and that it involves a variety of elements. The fact that scholars assume a link between economic growth and human development suggests that

improvements in the health sector are vital for overall growth. This leads to the next section that discusses sector specific aid and introduces development assistance for health, which is the main focus of this research.

2.3 Health aid

2.3.1 Introduction to health aid

Total foreign aid refers to overall aid flows, whereas sector specific aid is dedicated for a specific sector of the economy, for instance healthcare; in this case, the aim is to improve health conditions in the recipient country (Toseef, Jensen & Tarraf, 2020). Mishra and Newhouse (2009) argue that it is difficult to find statistical evidence for overall aid effectiveness, because there are various channels between aid and economic growth, and hence the relationship between X (aid) and Y (improvements) is too far apart (Mishra & Newhouse, 2009). Moreover, as discussed before (in section 2.2), a variety of factors play into this relationship. Health aid, on the other hand, can be more closely linked with population health (Mishra & Newhouse, 2009). Therefore, statistical evidence of aid effectiveness may be easier to find when it is sector specific. Eger, Öhler and Rudolph (2018) also highlight the importance of need based aid allocation. They suggest that donors should pay attention to sector specific needs in recipient countries to make aid allocation more effective and achieve development targets such as the SDGs (Eger et al., 2018). The sector specific aid allocation by the Development Assistance Committee (DAC) of the Organization for Economic Co-operation and Development (OECD) has adapted over time. The foreign aid provided by the DAC is called Official Development Assistance and is the main focus of this paper. A more in-depth explanation of ODA will follow in the operationalisation (section 3.3.1.1). The share of ODA dedicated for the educational sector, for instance, has dropped over the past decades, whereas health aid (as a share of total ODA) has increased, especially since the 2000s (Scott & Ahmad, 2011). More specifically, it rose from 6.8% in 2000 to 12.9% in 2010 (Bendavid & Bhattacharya, 2014). The MDGs and the AIDS crisis are, among other things, important drivers of this surge as they promoted the importance of health-related topics (Scott & Ahmad, 2011). Hence, thanks to initiatives like the MDGs, global awareness for health has risen since the turn of the century, and donors are increasingly aware of the importance of health improvements for overall growth. This awareness may be reflected in the amounts of aid that go to Africa. More specifically, Sub-Saharan Africa receives the largest share of overall ODA, as well as large amounts of health aid. Between 1990 and 2011, for instance, the amount of health aid channelled towards this region increased by 1,400%, the greatest proportional increase compared to other regions (Gyimah-Brempong, 2015).

The assumed superiority in terms of effectiveness of sector specific aid and the increasing amounts of health aid since the 2000s lead to the next section, which explores the literature around health aid effectiveness and scholars' findings.

2.3.2 Literature review on health aid

Williamson (2008) finds that health sector specific aid has an insignificant effect on human development, just like general aid used for economic development. Stevens (2008) findings are aligned with those of Williamson, as he argues that health aid is ineffective, and that the lack in data makes it hard to assess whether improvements have been made. Moreover, he argues that financial aid given directly to the governments of recipient countries may be embezzled without donors knowing. Issues such as corruption play a major role in aid distribution at the local level (Stevens, 2008). In contrast, an analysis conducted by Mishra and Newhouse (2009) found that health aid positively affects infant mortality rates; the statistically significant decline was associated with more funding. The authors examined 118 countries between 1970 and 2004. Non-health-specific aid did not show a statistically significant effect on mortality rates, which implies that aid must be directed towards a certain sector to be effective. Furthermore, they estimate that by doubling the amount of health aid a country receives, infant mortality rates can be reduced by approximately 2% (Mishra & Newhouse, 2009).

Dietrich (2011) investigated which factors explain aid (in)effectiveness in the public health sector. She argues that corrupt states have incentives to effectively implement health aid, because it can improve their reputation at a relatively low cost compared to other sectors. Recipient countries can please donors by complying to their conditions and improving health outcomes, while exploiting other sectors for private gains. Bangladesh serves as an example: it ranks very high in corruption, yet notable improvements in health outcomes could be observed between 1995 and 2010. In 2006, for instance, about 20% of aid received was targeted at the healthcare sector. Such receptivity affects the relations with donors, which can also positively influence total aid flows (Dietrich, 2011). Dietrich's findings are interesting as they oppose the stance of some scholars that see corruption as an obstacle for health aid effectiveness (Barkat et al., 2016).

Feeny and Ouattara (2013) investigated a similar period (1990 to 2005) and found a positive and statistically significant relationship between health aid and improvements in child health in 109 countries, which they measured through immunisation against measles, diphtheria, pertussis, and tetanus. Besides the positive effect of health aid on children's health, the authors also found that domestic resources (tax revenues, income per capita, mediatization, population density, good governance, and institutional quality) may improve child health (Feeny & Ouattara, 2013). Bendavid and Bhattacharya's (2014) analysis also yields positive results; the countries they examined were able to purchase things like new technologies and vaccines with health aid and both life expectancy and child mortality improved in these countries since 2000. The authors, however, note that additional causal factors may play into the explanation of health improvements (Bendavid & Bhattacharya, 2014). Finally, Toseef et al. (2020) examined 90 countries between 2001 and 2015, a period that corresponds with the MDGs. In addition to immunisation rate against measles, diphtheria, pertussis, and tetanus, they measured population health through infant mortality rate, life expectancy at birth, and annual death

rate. In their analysis, they measured the impact of total foreign aid and health sector aid together. Little evidence was found that development assistance improved population health between 2001 and 2015 in recipient countries.

Existing studies also analysed the effectiveness of health aid in selected countries. A case study from Uganda investigated disease severity and disease burden, showing that health aid reduced both (Odokonyero, Ijjo, Marty, Muhumuza & Moses, 2015). Another paper evaluated health aid in Somalia in the first decade of the 21st century. However, the considerably greater amount of aid targeted at the health sector did not translate into significant health improvements. The authors recommend more strategic action using health contributions, especially with respect to nutrition, reproductive health, and expanded programmes on immunisation (Capobianco & Naidu, 2011).

To summarise, existing literature investigating the effectiveness of health aid can be broadly divided into two categories: studies concluding that development assistance for health fosters population health in recipient countries, and those that do not agree with such results. The next section elaborates on possible reasons why a clear yes / no answer cannot be derived from literature.

2.3.3 The debate around health aid effectiveness

Diverging opinions on health aid effectiveness align with the two opposing views in the debate around overall aid effectiveness. Possible explanations for this were identified in the section on overall foreign aid and will be applied to health aid in the following paragraphs, as they may help gain a better understanding in this debate. Recall that these possible explanations are the micro-macro paradox, country-specific differences, data characteristics, and the influence of third variables (Hansen and Tarp, 2000).

2.3.3.1 The micro-macro paradox. Some scholars believe that observing aid effectiveness at the micro and at the macro level can result in different outcomes. It may therefore be interesting to see whether this paradox can help explain aid effectiveness in the health sector. Improvements may be evident for health indicators like the death rate or life expectancy, but the overall population health (i.e. the broader picture) has not advanced significantly. Mishra and Newhouse (2009), however, argue that this paradox does not fully hold for health aid.

2.3.3.2 Country-specific characteristics. Another factor that can produce contradictory results among scholars is the study of a different set of countries. Some researchers focused on a single region such as East Africa, whereas others excluded certain countries due to data availability (Bein et al., 2017). Hansen & Tarp's (2000) concern regarding country-specific characteristics may therefore be relevant in explaining different results, because results might not always apply to all developing

countries. The case study on Somalia, for instance, suggests that more tailored strategies to make health aid work are needed for this specific country (Capobianco & Naidu, 2011).

2.3.3.3 Data characteristics. Diverging opinions around health aid effectiveness may also be explained by the characteristics of the data included in the studies. First, scholars have not always analysed the same timeframes. Williamson (2008), for instance, investigated the years between 1973 and 2004, whereas Dietrich (2011) focused on the period from 1990 to 2004 and Bein et al. (2017) looked at the effect of health aid in this century (2000-2014). Secondly, the various research papers included different control variables in their analyses. Some focused on political variables, others included economic or health variables to control for including Gross Domestic Product (GDP) (Williamson, 2008), war (Mishra & Newhouse, 2009), political institutions (Dietrich, 2011), urbanisation (Bendavid & Bhattachary, 2014), use of mosquito net, and access to water (Odokonyero, 2015). Age and education were also controlled for by some researchers (Odokonyero, 2015). Finally, health outcomes were not always measured through the same proxy. Williamson (2008) captured a country's overall quality of health by looking at infant mortality, life expectancy, death rate and immunisation against DPT and measles. Bendavid and Bhattachary (2014) used life expectancy and under-5 mortality to measure developments. Bein et al. (2017), on the other hand, used adult life expectancy as well as neonatal, under-5, and infant deaths as proxies.

2.3.3.4 Other factors. Furthermore, the interplay between economic and non-economic factors arguably causes aid (in)effectiveness (Hansen & Tarp, 2000). Healthcare expenditure is an important source of funding for a country's health system but has not yet been mentioned. The next section explores the literature on health expenditure and how it can be placed in the context of aid effectiveness. Many studies have researched the effect of health aid on development but have not clearly demonstrated what aid does to public spending patterns. Exploring this might be important to understand aid effectiveness better. This leads to the next section, which explores healthcare expenditure.

2.4 Healthcare expenditure

Before exploring healthcare expenditure in the context of development assistance, a brief overview of this concept and its role in (developing) countries is given.

2.4.1 Introduction to healthcare expenditure

Both health aid and healthcare spending has increased in recent years. Between 2000 and 2017, expenditure grew more than overall economic growth (3.9% and 3.0% respectively). In low-income countries, health spending rose by 7.8% a year during this period. Monetary support by donors is a significant source of funding for low-income countries; in fact, 27% of health expenses in those

countries are financed through foreign aid (WHO, 2019). Rising healthcare expenditure may be due to increases in countries' incomes, and economic growth generally, which then positively affects health investments (Bedir, 2016). Income is among the principal factors determining state expenditure for healthcare (Martín Martín, Puerto López del Amo González, & Dolores Cano García, 2011). A study investigating determinants of healthcare expenditure in Zimbabwe finds that foreign aid and income (measured as per capita GDP) are, among others, key factors explaining spending patterns (Dhoro, Chidoko, Sakuhuni & Gwaindepi, 2011).

In addition to public expenditure by the government, healthcare systems are financed through things like out-of-pocket payments and private insurance schemes. Out-of-pocket payments are common means in many developing countries (Pauly, Zweifel, Scheffler, Preker & Basset, 2006). In Burkina Faso, the Congo, Cote d'Ivoire, and Senegal, for instance, out-of-pocket payments represent more than 50% of total health spending (Leive & Xu, 2008). Lower per capita spending by government usually requires higher out-of-pocket spending by citizens (Chang et al., 2019). In the SAARC-ASEAN region, private spending also significantly contributes to health improvements, measured through crude death rate (Rahman, Khanam and Rahman, 2018). While this paper focuses on government expenditure for health, the significance of private health spending is important to be kept in mind to understand the results of this study.

Based on these studies, it is clear that healthcare expenditure is significant for a country's development. However, the question remains how healthcare expenditure fits into the aid landscape, and whether foreign aid can explain variations in healthcare expenditure in recipient countries. The next section reviews the literature that recognises a connection between healthcare expenditure and development assistance for health.

2.4.2 Healthcare expenditure in the context of foreign aid

Studies can be broadly divided into two categories: Research that focuses on the impact of health aid on healthcare expenditure, and those that explore the relationship between health aid and health outcomes in recipient countries. These two strands of research suggest that healthcare expenditure is an intermediate variable in the relationship between health aid and human development and that this relationship may be broken down into two paths: one that goes from health aid to healthcare expenditure, and the other one that goes from healthcare expenditure to health outcomes. This is outlined in the following section.

2.4.2.1 Health aid and healthcare expenditure. Barkat et al. (2016) find that more health aid was associated with higher government spending for health between 1995 and 2012 in Sub-Saharan African countries. Mishra and Newhouse (2009) also suggest that health aid leads to increased healthcare expenditure in recipient countries. It is argued that when countries receive more aid targeted

at the health sector, they actually spend it on their healthcare system (Barkat et al., 2016). However, public funds are not always used in the most effective and appropriate way; compared to private funds, they are more sensitive to the influence of confounding variables like corruption (Rahman et al., 2018). In contrast, Lu et al. (2010) warn that foreign aid is a key factor causing government health expenditure to decline because ministries of finance allocate less money to the ministry of health and other health-related ministries after receiving large amounts of health aid. Health aid may instead be used for other things such as increasing financial reserves. Moreover, some countries simply do not have the capacity to fully use health aid, because of managerial, supervisory, or leadership weaknesses. If countries do not steadily increase their domestic healthcare expenditure while receiving large amounts of health aid, they might end up having low public health expenditure in the future. A decrease in domestic health expenditure was particularly evident in the Sub-Saharan African region (Lu et al., 2010).

2.4.2.2 Health expenditure and population health. The second part of the relationship assumes a connection between healthcare expenditure and health outcomes. The following results were found: Raeesi, Harati-Khalilabad, Rezapour, Azari & Javan-Noughabi (2018) measured health outcomes through the proxies infant mortality, under-5 mortality and life expectancy, concluding that higher expenditure positively affects health outcomes in the investigated countries. Bein et al. (2017) researched healthcare expenditure in eight East African countries. They find that higher spending in the health sector is coupled with improvements in population health, measured through life expectancy at birth, and the number of neonatal, infant, and under-5 deaths between 2000 and 2014. However, financial resources for health must be guided by effective policies for optimal use, which is not always the case (Chang et al., 2019).

To summarise, a nation's domestic healthcare expenditure can be an important driver of population health. To test whether it affects the relationship between health aid and health outcomes in recipient countries, domestic healthcare expenditure is assumed to be a mediating variable. This aims at understanding whether foreign aid is aligned with the national budget, whether it crowds out domestic sources of financing, or whether it does not have an effect on a country's health expenditure at all.

2.5 Aid fungibility

Finally, the term aid fungibility is introduced as another potential explanation of aid (in)effectiveness in recipient countries. Aid fungibility means that recipient countries do not use the money they receive according to donors' intentions. Fungibility may explain why large aid flows do not yield the desired outcomes and why assessing the effect of aid is difficult. That is because governments reduce their own domestic expenditure, which makes the direct relationship between aid and outcomes no longer significant, and it is unclear which operations were financed through those aid

flows (Jones, 2005). There is evidence that sectoral aid is fungible on average. An example of sectoral aid fungibility is that instead of using the aid a country receives for the health sector (as intended by donors), the money is used to finance military operations. The problem with aid fungibility is that the alternative use may yield worse results (compared to the intended use) for the country's welfare (Pettersson, 2007). Government expenditure also plays a role in this complex process. An indirect transfer of funds happens when the recipient government lowers its own domestic spending in sector A and uses this money in sector B instead, because it received development assistance targeted at sector A (Jones, 2005). Jones (2005) argues that, generally, more development aid translates into higher government expenditure. However, aid fungibility makes it hard to assess in which sectors this money is actually being used and how it stimulates higher domestic government spending. To conclude, if health aid were fungible, it would make its impact on population health more difficult to assess. It is not easy to trace in which sectors the money was actually used and the amount of funds that were redirected to other sectors (Jansen Hagen, 2006).

2.6 Health outcomes

To determine the effect of health aid on health outcomes, it is useful to first understand the rather abstract concept of health outcomes. In simple terms, being healthy means being free from diseases. However, health is more complex concept than the mere absence of diseases; different components play into determining optimal health (Eberst, 1984). According to the constitution of the WHO, health is not only defined by the absence of diseases, but also as an interplay of physical, mental, and social well-being. An optimal state of this interplay is a fundamental human right. The health of all people is vital for achieving peace, security, and cooperation among countries and individuals. As the world is essentially interconnected, achievements by one country also contribute to population health in another nation, because diseases in one country may pose a threat to other countries. Governments are responsible to ensure the health of their people by providing adequate healthcare, but also through social means (Constitution of the World Health Organization, 1946). Hence, besides the right medical conditions, social determinants shape health outcomes. Such factors are the structural conditions that define how people live, work, and so on. They are just as important to ensure healthy lives as medical causes; in fact, they can account for up to 55% of health outcomes. Income is among the social determinants of health. It discloses health differences among countries; nations with worse socioeconomic standing generally have inferior health systems compared to high income countries (WHO, n.d.). As mentioned earlier, income is one of the main factors determining how much a government spends on its healthcare system (Martín Martín et al., 2011). To conclude, the determinants of health outcomes should be kept in mind to understand the findings of this study and identify ways for improving aid effectiveness.

2.7 Aim of the study and hypothesis development

This study examines the effectiveness of health aid on health outcomes. Given that donors contribute large amounts of money every year, a conclusive answer with regards to effectiveness is desirable. These days, foreign aid is increasingly directed towards specific sectors of the economy, one of which is the health sector. Development initiatives such as the MDGs and the SDGs rose awareness on the importance of population health for overall growth. In poorer countries, development is often (at least partly) financed by foreign aid. Therefore, a relationship between health aid and population health improvements is assumed and leads to the first hypothesis:

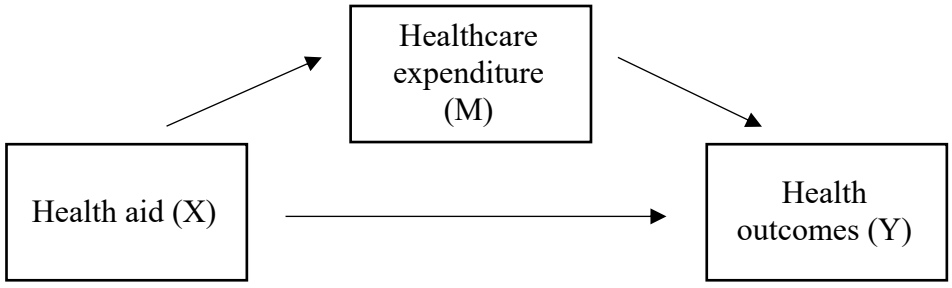
H_1: Health aid leads to improved health outcomes in recipient countries.

The relationship between health aid and health outcomes may, however, be more complex than assumed and might involve additional factors. Based on the theories reviewed and summarised before, this paper hypothesises that healthcare expenditure in recipient countries is a mediating variable in the relationship between health aid and health outcomes. Rather than being directly distributed for projects and programmes, health aid is channelled through the government of recipient countries, which aligns the funds it receives with own monetary sources. Therefore, the following hypothesis is developed:

H_2: Healthcare expenditure mediates the relationship between health aid and health outcomes in recipient countries.

The conceptual framework depicted in Figure 2 represents the hypothesised relationship between health aid (X) and health outcomes (Y), and by taking healthcare expenditure (M) into account.

Figure 2. Conceptual diagram of the simple mediation model



Note. Adapted from *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach,* by A. F. Hayes, 2017, p. 79.

3. Research design

To evaluate the effectiveness of health aid, this paper investigates whether a correlation between health aid and health outcomes can be established, and if healthcare expenditure plays a role in this relationship. To do so, a quantitative analysis is conducted that tests the hypotheses. This section is structured as follows: First, the empirical methods are outlined. Next, a description of the data, and the operationalisation of the variables is made.

3.1 Empirical method

3.1.1 Choice of model

In experimental studies, researchers can use random assignment to treatment groups to account for unobservable characteristics. But because an experimental study was not possible, this paper uses an observational research approach. To make causal inferences and increase the sample size (which enhances statistical inference), a large-N cross-sectional time-series research design is employed. A set of control variables is included, which allows for a better understanding of the relationship between the independent and the dependent variable and to control for unobservable factors. This research is related to the work of several scholars (that were mentioned in the theoretical section) who investigated the effect of health aid on population health in recipient countries. Most studies employed a time-series cross-sectional research approach to validate their hypotheses. Moreover, the majority of papers focused on all developing countries where data were available (i.e. large-N studies) (examples: Williamson (2008); Feeny and Ouattara (2013)). Odokonyero et al. (2015) and Capobianco and Naidu (2011), on the other hand, focused their analysis on a single country, namely Uganda and Somalia. However, they also included quantitative data to test their research question. Overall, a large-N time-series cross-sectional research approach is most suitable in this analysis.

A common method to test the relationship between X and Y is linear regression. Such model comes in various forms, such as multiple linear regression, which includes more than one independent variable. This model is particularly useful when analysing panel data (i.e. time-series cross sectional data). Ordinary Least Squares is a type of linear regression model often used in empirical research. However, this estimation method is not always the optimal choice. When one or more assumptions of linear regression are violated (more on this in section 3.1.4), a so-called Fixed Effects Model can be estimated; this model also accounts for the dynamic nature of the data. The Fixed Effects Model is a commonly used estimator and was employed by various health aid scholars before (example: Williamson, 2008; Feeny and Ouattara, 2013). Therefore, this choice of model is deemed most appropriate and is employed as baseline specification. To conclude, the selection of the baseline model was guided by the nature of the data used in this research as well as previous studies. A mediation analysis builds on these results. The choice of this estimation technique was derived from theory, as domestic government health expenditure is hypothesised to be a mediating variable between health aid

and health outcomes. Moreover, Toseef et al. (2020) suggest testing more complex models to understand the effect of development assistance on population health. Therefore, the aim of the mediation analysis is to expand on the empirical methodology used by scholars and to gain a deeper understanding of the relationship between health aid and population health. In sum, the analysis conducted in this research builds off the existing literature and extends the empirical methodology with the mediation estimates. The next paragraphs further explain the models of this study.

3.1.2 Fixed Effects Model

There are two data requirements to use the Fixed Effects Model: The dependent variable must be measured over at least two time periods for each country, and these measures must be comparable. Moreover, the predictor variables must change over time in value (Allison, 2011). Both prerequisites are met in this study. The Fixed Effects Model allows any kinds of associations between the unobserved and the observed variables. It effectively controls for time-invariant predictor variables, also when they are unmeasured; it removes the time-invariant characteristics of the countries that may bias results, as we are interested in variation over time (Allison, 2011).

Two Fixed Effects Models are estimated: one that uses current values of all explanatory variables and one that uses lagged values of the explanatory variables to account for delayed effects. It may take some time to implement aid into the health system, which delays its effect on health outcomes; the same holds for advancements in the control variables. To address potential violations of linear regression assumptions (more on this in section 3.1.4), the variables are log-transformed. This aims at making the data as 'normal' as possible to gain more accurate results. Log-log transformation means that the outcome variable and at least one explanatory variable are transformed; in this case, all variables are transformed. More formally, the first model is:

$$\mathbf{Y_{it} = \mu + \gamma\, ln\_health\_aid_{it} + \beta_1\, ln\_DGE_{it} + \beta_2\, ln\_GDP_{it} + \beta_3\, ln\_DPE_{it}}$$
$$\mathbf{+ \beta_4\, ln\_Urb_{it} + \beta_5\, ln\_HFI_{it} + \alpha_i + \varepsilon_{it}}$$

Where μ is the intercept, Y_{it} is the health outcome for country *i* in year *t*, ln_health_aid is the foreign aid country *i* receives in year *t*, and γ is the coefficient of the main independent variable. DGE, GDP, DPE, Urb, and HFI are other predictor (control variables), and each β is the coefficient of interest of these variables. The coefficient measures the effect of the explanatory variable on the outcome variable. For instance, when the amount of health aid received increases by 1%, health outcomes change by γ% (or β%). Finally, α and ε are error terms.

The second model follows the baseline fixed effects model above but takes into account lagged responses of the predictor variables. More specifically, it allows for a one-year lagged response of the health aid variable, because aid received in year one may only translate into (improved) health outcomes

a year later. The other explanatory variables are lagged for the same reason; growth/development in year one may not instantly affect population health. More formally:

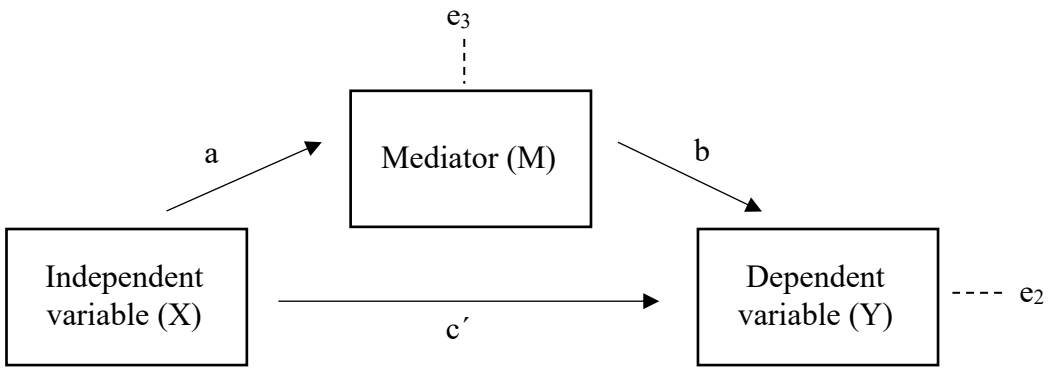
$$\mathbf{Y_{it}} = \mu + \gamma\, ln\_health\_aid_{it-1} + \beta_1\, ln\_DGE_{it-1} + \beta_2\, ln\_GDP_{it-1} + \beta_3\, ln\_DPE_{it-1} + \beta_4\, ln\_Urb_{it-1} + \beta_5\, ln\_HFI_{it-1} + \alpha_i + \varepsilon_{it}$$

3.1.3 Mediation analysis

A mediation analysis follows the Fixed Effects Model to test for direct and/or indirect effects of health aid on outcomes and understand which role healthcare expenditure plays. Scholars suggest that testing more complex models involving additional variables is important, as the relation between aid and population health is likely to be more complicated (Toseef et al., 2020). Mediation analysis tests for a direct effect between X and Y, as well as an indirect effect mediated by M (MacKinnon, Cheong & Pirlott, 2012). Applied to this study, it means the following: The direct effect is the one that can be connected to the project outcomes directly. This means that health aid is distributed directly to interventions that affect health outcomes. The indirect effect, on the other hand, means that aid is channelled through the government and that it affects a country's health spending patterns (which in turn affect population health) before being invested in health-related interventions. Therefore, this study attempts to understand the aid-development relationship 'de nuovo'. Mediation analysis reflects a more nuanced causal model than previous papers; in addition to examining the correlation between health aid and outcomes by including a set of control variables, a mediating variable is added to the analysis. As outlined before and supported by theory, a link between health aid, healthcare expenditure, and health outcomes can be established. Its effect on the relationship between X and Y, however, is unclear; mediation analysis tests this.

The model assumes a causal sequence between the independent variable (X), the mediator variable (M), and the dependent variable (Y) (MacKinnon et al., 2012). This study uses healthcare expenditure as the only mediator variable (M), hence a single mediator model (Figure 3), also called simple mediation model, is applied (Hayes, 2017). Like in the Fixed Effects Model, health aid represents the independent variable, and the dependent variable is health outcomes in recipient countries. Two linear models are required, because there are two consequential variables.

Figure 3. Single mediator model (statistical diagram)



Note. Source: Statistical Mediation Analysis. In *APA handbook of research methods in psychology*, by D. MacKinnon et al., 2012, p. 315.

The simple mediator model is expressed through equations 1 to 3:

$$\mathbf{Y = i_1 + c\,X + e_1} \quad (1)$$

$$\mathbf{Y = i_2 + c'\,X + b\,M + e_2} \quad (2)$$

$$\mathbf{M = i_3 + a\,X + e_3} \quad (3)$$

where the coefficients i_1, i_2, and i_3 are intercepts, e_1, e_2, and e_3 are residuals, and X, M and Y are the independent variable, the mediator, and the dependent variable respectively. The temporal order of the model's variables is X → M → Y. In equation (1), c is the total effect of X on Y. Equations (2) and (3) are displayed in Figure 3 and show how the total effect is separated into a direct effect of X on Y and a mediated effect through M. In equation (2), c' describes the direct effect of X on Y, controlling for M; b denotes the relation between M and Y, controlling for X. In equation (3), coefficient a estimates the effect of X on M (MacKinnon et al., 2012). The product of a and b (ab) is the indirect (= mediated) effect of X on Y through M; if this product is positive, then the indirect effect will be positive. The total effect of X on Y equals the sum of the direct and indirect effects of X, which is: c = c' + ab. The indirect effect is the difference between the total effect and the direct effect of X on Y (Hayes, 2017).

Hayes (2017) challenges the conventional wisdom as he argues that causality between X and Y is not a prerequisite for undertaking mediation analysis. He argues that it can be carried out even if causality cannot be established unequivocally due to limitations in the research design. The argument of causality in this paper is based on the theory and the findings of previous scholars, and according to Hayes, this is a sufficient precondition for mediation analysis (Hayes, 2017).

3.1.4 Assumption testing

Before the analysis is conducted, the following assumptions of linear regression are tested: normality, multicollinearity, linearity, and homoscedasticity. The assumptions are reviewed briefly and are followed by the regression diagnostics.

Normality means that the errors in estimation of Y are normally distributed. Only severe violations of this assumption affect the validity of results, but nonetheless non-normality can reduce the correct rejection of a false null hypothesis. In practice, this assumption is seldom met (Hayes, 2017). Multicollinearity assumes that there is a perfect linear relationship between the independent variables. In linear regression, no perfect multicollinearity is desirable (Field, 2009). Linearity assumes that the relationship between predictor variables and outcome variables is (approximately) linear (Hayes, 2017). Homoscedasticity states that the variance of the error terms is constant. If this assumption does not hold, then the errors in estimation are heteroscedastic. Slight violations are said to be acceptable (Hayes, 2017).

3.1.4.1 Normal distribution. To test whether each variable is normally distributed, the Kolmogorov-Smirnov test and the Shapiro-Wilk test are performed, and the skewness and kurtosis are examined (see Table 1). For both tests, the null hypotheses assuming a normal distribution are rejected. The variables' skewness and kurtosis also indicate non-normal distribution, because: Skewness: Values > 1 indicate that the variable is right skewed, values < -1 mean that the variable is left skewed, and kurtosis: Values > 1 indicate that the variable is leptokurtic, values < -1 indicate that the variable is platykurtic.

Table 1. Summary statistics (variable distribution)

Variable	Skewness	Kurtosis
Health aid	2.146	4.744
Domestic government expenditure	2.315	7.425
Infant mortality	0.908	-0.021
Life expectancy	-0.607	-0.656
Gross domestic product	1.191	1.032
Urbanisation	-0.013	-0.695
Domestic private expenditure	2.039	5.191
Human Freedom Index	-0.498	-0.349

3.1.4.2 Multicollinearity. To detect multicollinearity, the variance inflation factors (VIF) as well as the tolerance values were investigated (see Table 2). VIF values greater than 10 and a tolerance smaller than 0.1 indicate multicollinearity (Alin, 2010; Daoud, 2017). Using both measures, no

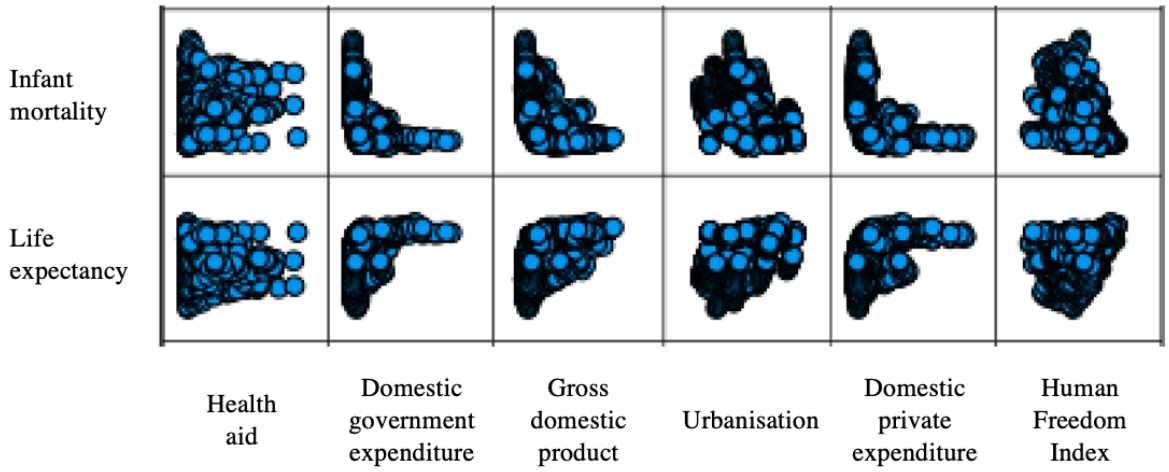
multicollinearity can be identified in this dataset. The mean of the VIF values equals 2.976 which is smaller than the threshold value of 10. Additionally, all tolerance values are greater than 0.1. Severe issues of multicollinearity do not exist and hence this assumption is not violated.

Table 2. Multicollinearity statistics

Independent variable	Collinearity statistics	
	Variance Inflation Factor	Tolerance
Health aid	1.261	0.793
Domestic government expenditure	4.805	0.208
Gross domestic product	5.271	0.190
Urbanisation	2.206	0.453
Domestic private expenditure	3.102	0.322
Human Freedom Index	1.211	0.826

3.1.4.3 Linearity. This assumption was tested by plotting the independent variables on the X-axis, and the dependent variables on the Y-axis. The scatterplots show that the relationships between the explanatory and the outcome variables are non-linear (see Figure 4).

Figure 4. Scatterplots



3.1.4.4 Heteroskedasticity. The Breusch-Pagan-Godfrey test was performed to test for heteroskedasticity. Because $p<0.05$, the null hypothesis that the variances for the errors are equal is rejected and the dataset exhibits heteroskedasticity. Heteroscedasticity can affect the validity of inference; however, slight violations are said to be acceptable. Moreover, heteroskedasticity commonly appears in datasets that have large ranges of values, which is the case in this paper (see Table 4). One remedy for this issue is to redefine variables, for instance by using per capita values and rates rather

than the raw values. This was done as much as possible by using the per capita values and rates of some variables. Nevertheless, the violation of the homoskedasticity assumption is acknowledged and further elaborated on in the limitations section of this paper.

A log-log transformation is performed to remedy the violations of non-normal distribution and non-linearity. This aims at making the data as 'normal' as possible, and hence gaining relatively more valid results. In a log-log transformation, both explanatory and outcome variables are transformed. Before moving on, it is important to keep in mind that violations of the assumptions of linear regression do not necessarily mean that the model is not a good fit for the data (Field, 2009). Therefore, the analysis is performed with this data and assumption violations were corrected as far as possible.

3.2 Data

As mentioned before, this study is of observational nature and uses secondary data. The data were extracted from three different databases. The OECD's Creditor Reporting System was used for health aid measures. Information on the Human Freedom Index was obtained from the Fraser Institute. The World Development Indicators (WDI) databank by the World Bank provided sufficient information for all other variables. More specifically, both the WDI database and the Health Nutrition and Population Statistics database were used. Data banks are updated on a regular basis, which may result in future data changes. Therefore, it is important to note that all data were extracted in April and May 2021.

The sample used in this study consists of all ODA eligible countries for which data were available. ODA eligibility is defined by the OECD, based on a country's GNI. More specifically, countries were eligible for inclusion if they received ODA every year between 2008 and 2018. Some of the ODA eligible countries had to be excluded from this study as they exhibited missing data for at least one of the variables; this practice is called case-wise deletion and is deemed most appropriate in this analysis (Burke, 1998). Therefore, of 153 ODA eligible countries, 69 are excluded due to insufficient data availability, and the sample equals n=84 countries. A list of all countries included in this study can be found in the appendix.

The time units are measured at regular time intervals (every year from 2008 to 2018). The period 2008 to 2018 was selected for several reasons. No data were available for the Human Freedom Index before 2008 and after 2018, and the data were incomplete for other control variables before 2008. The Human Freedom Index was chosen over another institutional index because it is considered the most complete freedom index for a large number of countries (Vásquez & McMahon, 2020). Hence, extending the period beyond 2008 to 2018 would have reduced the sample size even further and led to the inclusion of a less suitable index. Moreover, the remarkable growth of health aid flows has slowed

down since the financial crisis in 2008/2009 (Boerma et al., 2015). It is interesting to see whether this affects results.

As mentioned before, this study uses a combination of cross-sectional and time-series units, also called panel data. The dataset is a short panel as many countries (n) are observed over a relatively short time span (t). Each country is observed over all time periods, which makes the data set a balanced panel. Finally, because the same countries are observed each year, it is a fixed panel (Park, 2011). The data are not averaged over certain time periods (example: five-year periods) as some scholars have done so in their research. Averaging would have reduced the sample size further and was not possible as *t* is a prime number (= eleven).

3.3 Operationalisation

The objective of this thesis is to measure the effect of health aid on different outcome measures by controlling for other factors that may influence results. The different concepts must be turned into measurable observations to use them in the analysis. The following section addresses the operationalisation of the variables and gives the reader an understanding why each factor is included. Table 3 summarises the operationalisation of the variables.

3.3.1 Independent variables

3.3.1.1 Main explanatory variable. Foreign aid is provided by a variety of donors, ranging from private philanthropies like the Gates foundation to governments. Lack of data availability, however, makes it difficult to assess the impact of private donors. Therefore, this paper focuses on Official Development Assistance from the Development Assistance Committee of the OECD. ODA can be characterised by three main things, namely:

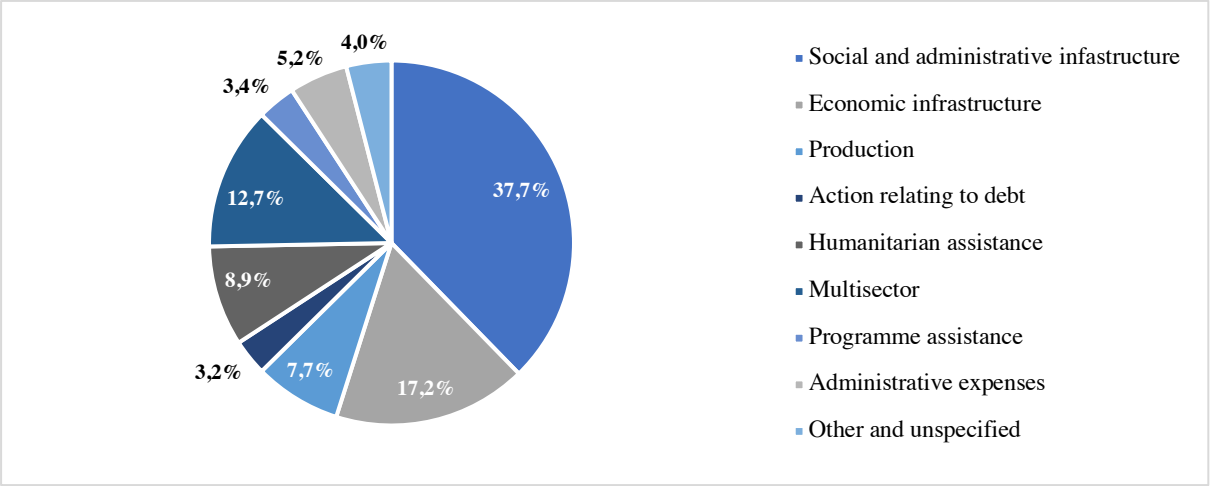
1. It is provided by governments (national or state level) or by their official agencies;
2. Its aim is to improve the welfare and economic development of recipient developing countries;
3. The money is either provided in the form of a grant or a loan with very low interest rates (Keeley, 2012).

DAC member countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States of America (OECD, n.d. a). The OECD monitors the provision of aid flows. DAC members donated about 128 billion US dollars of ODA to eligible countries in 2010. Donors aim to contribute 0.7% of their Gross National Income each year for aid purposes; however, this target is not always met. A large amount of aid flows goes to Sub-Saharan Africa; the region received about 44 billion US dollars in 2010. Other regions include countries in

North-of-Sahara Africa, South and Central Asia, Far East Asia, the Middle East, North and Central America, South America, Oceania, and Europe (Keeley, 2012).

Emergency assistance, distributed in the event of natural disasters like an earthquake or tsunami, is probably the type of aid that most immediately comes to mind when thinking about foreign assistance. However, ODA consists of much more than emergency aid. The money each country receives is dedicated for various sectors (see Figure 5), for instance to enhance the economic infrastructure or for programme assistance; as of 2010, about 37.7% was used for social and administrative infrastructure, which includes health (Keeley, 2012). This study focuses on ODA flows dedicated for the health sector, which is the main independent variable to predict health outcomes in recipient countries. Such flows include aid for the following areas: Health policy and administrative management, medical education/training, medical research, medical services, basic healthcare, basic health infrastructure, basic nutrition, infectious disease control, health education, malaria control, tuberculosis control, health personnel development, non-communicable disease control, tobacco use control, control of harmful use of alcohol and drugs, promotion of mental health and well-being, other prevention and treatment of non-communicable diseases, and research for prevention and control of non-communicable diseases. Money was channelled, among others, through Non-Governmental Organisations, the public sector, private sector institutions, and teaching institutions. The money is declared as gross disbursements and includes all types of aid (budget support, core contributions and pooled programmes and funds, project-type interventions, experts and other technical assistance, scholarships and student costs in donor countries, debt relief, administrative costs not included elsewhere, and other in-donor expenditures). This is the main explanatory variable, and it is referred to as 'health aid' in the remaining sections of the thesis. The unit of analysis is million US dollars (as of 2019) and flows are indicated in constant prices (OECD, 2021).

Figure 5. Sectoral distribution of Official Development Assistance



Note. Data were retrieved from *What is aid?* in *From Aid to Development: The Global Fight against Poverty*, OECD Publishing, Paris, by B. Keeley, 2012, p. 64.

The central focus lays on explaining the influence of health aid on health outcomes, but the models also include other factors (i.e. additional explanatory variables) that might impact results, which are: healthcare expenditure, gross domestic product, the size of the urban population, and an index for institutional quality. These variables are operationalised below.

3.3.1.2 Mediator variable. Healthcare expenditure is not an abstract conceptual idea but must be defined more precise to understand how it is measured, because the World Bank database (World Development Indicators) offers different measurements of a country's healthcare expenditure. Lu et al. (2010) argue that foreign aid for health is a key factor causing a decline in domestic healthcare expenditure in recipient countries. Therefore, to measure healthcare expenditure, the most appropriate measure is 'Domestic general government health expenditure per capita'. It is measured in current US dollar, the periodicity is annual, and the aggregation method is weighted average. The long definition provided by the World Bank is as follow: "Public expenditure on health from domestic sources per capita expressed in current US dollars." (World Bank, n.d.). For the sake of simplicity, this variable is also referred to as DGE (= domestic government expenditure).

3.3.1.3 Control variables. Because this is an observational study, the independent variable cannot be manipulated. Control variables help to understand the relationships between the main variables. They can be controlled for statistically by isolating their effects from the relationship under investigation (Bhandari, 2021). The theoretical section of this research suggests that when studying foreign aid, there are several exogenous factors that can influence the results of a statistical analysis. Klomp and de Haan (2009), for instance, investigated whether regime type and (in)stability influence population health. They find that democracy positively affects individual health, and an instable government has a negative impact on the quality of the healthcare sector (and hence on individual health). These findings suggest that there are alternative explanations for improvements in a country's health status besides foreign aid, which need to be controlled for to exclude alternative explanations of the effectiveness of health aid. Health aid scholars have chosen a wide range of control variables that can be classified as political, economic, demographic or health variables. The selection of control variables used in this study is based on previous research and on data availability. The operationalisation of each control variable follows.

3.3.1.3.1 Economy. The purpose of ODA is to promote welfare and development in developing countries (OECD, n.d. c). ODA recipients are listed according to their GNI per capita. GNI comprises of "(…) gross domestic product plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production." (OECD, n.d. b). Scholars assume a connection between a country's human development and its economic growth (as elaborated on in the theoretical section). It is therefore necessary to include a measure that controls for economic growth. Because most

scholars have used GDP for this purpose, and because it is part of a nation's GNI, GDP is an appropriate measure to control for economic growth. More specifically, GDP per capita is used in this analysis. The data are indicated in current US dollars, with an annual periodicity, and weighted average as aggregation method. The World Bank defines this measure as follows: "GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources." (World Bank, n.d.).

3.3.1.3.2 Socioeconomic factor. Several scholars have included urbanisation as a control variable, which implies that this factor potentially influences health outcomes (Williamson, 2008; Feeny & Ouattara, 2013; Bendavid & Bhattacharya, 2014; Toseef et al., 2020; Odokonyero et al., 2015). The lack of healthcare professionals is especially prevalent in the rural areas of developing countries. Compared to the urban population, people living in rural areas experience poorer health status (Strasser, Kam & Regalado, 2016). A closer distance to health services fosters the positive impact of health aid (Odokonyero et al., 2015). Urbanisation is therefore included in the analysis to control for demographic characteristics. More specifically, this variable measures the urban population as percentage of the total population in each country. A detailed definition of this variable is: "Urban population refers to people living in urban areas as defined by national statistical offices […]" (World Bank, n.d.). The periodicity is annual, and the aggregation method is weighted average. A limitation of this measurement is that countries may classify urban/rural areas differently (World Bank, n.d.). However, because several scholars have included urban percentages in their research, this measurement is deemed appropriate (Williamson, 2008; Toseef et al., 2020). From now on, this variable is referred to as 'urbanisation'.

3.3.1.3.3 Private spending. Health aid aims to provide adequate access to health services for everyone. But as this is not a reality yet, health operations are regularly financed by private healthcare expenditure. Monetary contributions are, among others, made by foreign organisations such as the Gates foundation (Keeley, 2012). In this analysis, however, we focus on private spending from domestic sources. Some scholars argue that private funds are more effective in producing health improvements and have included it in their analysis to test whether it substantially affects health outcomes (Rahman et al., 2018, Williamson, 2008). Therefore, domestic private health expenditure per capita is included as control variable. It is measured in current US dollars, its periodicity is annual, and the aggregation method is weighted average. The long definition of this variable is as follows: "Current private expenditures on health per capita expressed in current US dollars. Domestic private sources include funds from households, corporations, and non-profit organizations. Such expenditures can be either prepaid to voluntary health insurance or paid directly to healthcare providers." (World Bank, n.d.). For

the sake of simplicity, this variable is also referred to as DPE (= domestic private expenditure) in the remainder of this paper.

3.3.1.3.4 Political situation. Effective institutions can influence aid effectiveness. That is because factors such as corruption might incentivise the recipient government not to use the money for its indented purpose (Stevens, 2008). Moreover, some countries do not have the capacity to absorb and use development assistance in the most efficient way (Lu et al., 2010). The Human Freedom Index serves to control for these differences among countries; it measures the absence of coercive constraints. Indicators from the following areas are used to assess the economic and personal freedom of countries: Rule of Law; security and safety; movement; religion; association, assembly and civil society; expression and information; identity and relationships; size of government; legal system and property rights; access to sound money; freedom to trade internationally; and regulation of credit, labour, and business. The index consists of two subindices, the economic and the political index. Both receive equal weight in the result, which is measured on a scale from 0 to 10; 10 is the best score (i.e. most freedom). The Human Freedom Index is included in the analysis because it is considered the most comprehensive index on freedom, and previous scholars (such as Williamson, Toseef et al.) included it in their analysis to control for the quality of institutions (Vásquez & McMahon, 2020). Furthermore, it is argued that the connection between a country's human prosperity and its economic freedom is well established, implying that it may influence the outcome variable (Toseef et al., 2020).

3.3.2 Dependent variables

Health outcomes are an abstract concept and not directly measurable as such. They must be operationalised to turn them into measurable observations. Mortality, morbidity, and perceived health and lifestyle are argued to be key health outcomes, because they capture the multidimensionality and complexity that define health (Roy et al., 2009). Previous research measured human development through various indicators, for instance crude death rate, (infant) mortality rate, life expectancy rate, or immunisation against diseases (Williamson, 2008; Bendavid & Bhattacharya, 2014; Toseef et al., 2020). According to the UN, life expectancy at birth and under-5 mortality rate are both well established and widely used indicators for health development. Both indicators also have limitations in measuring health outcomes because lack of data availability in developing countries or diverse definitions of health parameters among countries may lead to less accurate / comparable measurements (UN, n.d.). However, because both indicators are widely used and well developed, they are used in this study to capture health outcomes (while acknowledging their limitations). A precise definition of both indicators is given below.

3.3.2.1 Infant mortality. This measure is a reliable indicator for human development because it is sensitive to changes in economic circumstances. Additionally, this proxy depends on a great variety of health improvements in recipient countries, which makes it a comprehensive measure (Mishra & Newhouse, 2009). In this study, infant mortality rate is the number of infants that die before they complete their first year of age. This rate is measured per 1,000 live births that happen in the given year. The periodicity is annual, and the aggregation method is weighted average (World Bank, n.d.). For the sake of simplicity, this outcome variable is shortened to 'infant mortality' in the remaining parts of the paper.

3.3.2.2 Life expectancy. Life expectancy rates have improved considerably (on average by nine years) in poor countries between 1999 and 2012, which coincides with the period of increased health aid, and scholars argue that health aid is expected to increase life expectancy (Williamson, 2008; Barkat et al., 2016). Moreover, developing countries are experiencing increasing life expectancy rates in recent years. This indicator is measured in years and predicts a new-born's life expectancy at birth, assuming the current mortality patters remain constant throughout the infant's life. Life expectancy reflects the overall mortality level of a nation and captures all age groups within a given year. The aggregation method is weighted average, and the periodicity is annual (World Bank, n.d.). This variable is referred to as both life expectancy rates and life expectancy (for the sake of simplicity).

The selection of control variables was confirmed by the adjusted R^2, which increased from adjusted $R^2 = 0.964$ to adjusted $R^2 = 0.978$ after the control variables were added to the model (compared to a model that only included health aid as explanatory variable).

Table 3. Operationalisation (summary)

Variable	Measure	Time span	Source
Health aid	ODA for health in constant 2019 US dollars	2008-2018	OECD Creditor Reporting System
Domestic government expenditure	Domestic government expenditures on health per capita in current US dollars	2008-2018	World development indicators
Gross domestic product	GDP per capita in current US dollars	2008-2018	World development indicators
Urbanisation	Urban population as percentage of the total population	2008-2018	World development indicators
Domestic private expenditure	Domestic private expenditures on health per capita in current US dollars	2008-2018	World development indicators
Human Freedom Index	Average of economic and political index, measured on a scale from 0 (least free) to 10 (most free)	2008-2018	Fraser Institute
Infant mortality	Number of infants that die before completing their first year of age (measured per 1,000 live births each year)	2008-2018	World development indicators
Life expectancy	Life expectancy of a new-born at birth, assuming current mortality patterns remain constant	2008-2018	World development indicators

3.4 Reliability and validity of the study

Reliability assesses whether the study's measures are stable, and hence reliable. The measures for each variable are taken from official sources (OECD data bank, World Bank database, and the Fraser Institute), and have been used by researchers before, which makes them reliable. Therefore, if the study were to be repeated, it can be assumed that results would not differ substantially (Bryman & Bell, 2011).

Validity examines the veracity of the results and the conclusion of the study. Measurement validity mainly applies to quantitative studies and assesses whether the measures reflect the concepts they are representing in a meaningful way. A concept measure must be reliable to be valid. In this thesis, the measures of each concept were carefully chosen. Selection was guided by previous research and theory to operationalise each concept in the best possible way. Table 3 summarises the variables used in this research (Bryman & Bell, 2011). Internal validity addresses the issue of causality and questions whether the dependent variable is caused by the independent variable and not by something else. Because this is an observational study, confounding factors cannot be eliminated. However, they are controlled for in the analysis to create a robust research design (Bryman & Bell, 2011). External validity assesses to what extend the study's findings can be generalised beyond the context of this research. To ensure external validity, the study's sample represents 55% of ODA eligible countries between 2008 and 2018, which may allow to generalise results. Moreover, sampling bias was eliminated as much as possible by including nations from every region; the exclusion of countries was solely based on a lack of data availability (Bryman & Bell, 2011).

4. Analysis

In this section, the results of the analyses are reported. The analyses were done using the software SPSS. The section is structured as follows: First, a summary of the descriptive statistics is provided. This is followed by the Fixed Effects analysis. After that, the mediation analysis is reported.

4.1 Descriptive statistics

Table 4 summarises the data used in this study. For each variable, the following statistics are provided: observations, mean, standard deviation, minimum, maximum, and range. 84 countries were observed over a period of eleven years, which results in 924 observations. The descriptive statistics provide a general idea of the data, and some notes follow. The range of each variable is quite large, and the minimum values of the variables health aid, domestic government expenditure, and gross domestic product are rather low. Moreover, both health indicators infant mortality and life expectancy vary considerably with regards to their minimum and maximum values.

Table 4. Summary statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum	Range
Health aid	924	34.65	48.48	0.03	285.81	285.78
Domestic government expenditure	924	113.79	142.50	0.93	1,021.71	1,020.78
Infant mortality	924	33.86	23.23	4.80	114.50	109.70
Life expectancy	924	67.31	7.96	43.38	80.10	36.71
Gross domestic product	924	3,689.15	3,120.62	198.35	15,592.57	15,394.22
Urbanisation	924	49.52	19.48	10.12	91.87	81.75
Domestic private expenditure	924	93.27	96.57	2.18	569.04	566.85
Human Freedom Index	924	6.57	0.74	4.39	8.14	3.75

4.2 Fixed Effects Model

Two baseline models were estimated for each outcome variable. The first model was estimated using current values of all variables. The second model allowed for a lagged response of the explanatory variables on the outcome variable to account for delayed effects that influence health outcomes. The results of each estimated model are specified below. First, the results of the Fixed Effects estimations with infant mortality are reported, which are also summarised in Table 5. The table is structured as follows: Model 1 is the model estimate with current values of all variables, Model 2 is estimated with lagged explanatory variables (one-year lag), and Model 3 is the robustness check, which allows for a two-year lag of the explanatory variables.

4.2.1 Infant mortality

4.2.1.1 Model 1. As mentioned before, the data must be log-log transformed to get more valid results and fix the linearity and normality violations of linear regression. Therefore, a base of 10 is used in the log-transformation. The model fit is $R^2 = 0.985$; adjusted $R^2 = 0.984$, indicating a high model fit. Health aid, domestic government expenditure and gross domestic product are not statistically significant. Urbanisation, domestic private expenditure, and the Human Freedom Index are significant at 1%, although the Human Freedom Index has the unexpected sign on infant mortality. A 1% increase in urbanisation results in a 1.8% decline in infant mortality, and domestic private expenditure lowers infant mortality by 0.2% for every 1% change. To conclude, the main independent variable health aid and the mediator variable domestic government expenditure are not statistically significant.

4.2.1.2 Model 2. Next, the explanatory variables are lagged by one year. It aims to account for delayed effects of aid effectiveness, because aid received in year one may not translate into improved health outcomes in the same year. A greater lag would reduce the sample size too much. This results in $t = 10$.

Results yield a model fit of $R^2 = 0.988$, and adjusted $R^2 = 0.987$. Again, health aid, domestic government expenditure, and gross domestic product are not significant. Urbanisation, domestic private expenditure, and the Human Freedom Index are significant at the 1% level, but again the Human Freedom Index has the 'wrong' sign on infant mortality (meaning that a 1% increase of this variable would increase infant mortality). A 1% growth in urbanisation leads to a 1.8% decrease in the dependent variable, and a 1% increase in domestic private expenditure results in a 0.13% decrease in infant mortality. To conclude, like in the previous model, health aid and domestic government expenditure are not statistically significant.

Table 5. Fixed effects model with the dependent variable infant mortality

Variables	Model 1	Model 2	Model 3
ln_health_aid	0.002	0.006	0.010**
	(0.005)	(0.005)	(0.005)
ln_DGE	-0.013	-0.018	-0.022
	(0.015)	(0.015)	(0.014)
ln_GDP	-0.020	-0.026	-0.048
	(0.029)	(0.029)	(0.028)
ln_Urb	-1.799***	-1.750***	-1.656***
	(0.092)	(0.095)	(0.099)
ln_DPE	-0.153***	-0.131***	-0.103***
	(0.019)	(0.019)	(0.018)
ln_HFI	0.407***	0.479***	0.503***
	(0.110)	(0.107)	(0.103)
Constant	4.500***	4.345***	4.199***
	(0.177)	(0.180)	(0.183)
R-squared	0.985	0.988	0.991
Adjusted R-squared	0.984	0.987	0.989
Number of observations	924	840	756
Number of countries	84	84	84

Notes: Standard errors are in parentheses. Country and year effects are included in the regressions. Column one includes current values; column two includes a one-year lag; column three includes a two-year lag (as robustness check). All regression estimations include the same set of control variables.

* Significant at 10%

** Significant at 5%

*** Significant at 1%

4.2.2 Life expectancy

Next, the models are estimated by replacing infant mortality with life expectancy as dependent variable to evaluate the effect of health aid on another outcome measure. Population health may be measured through a variety of indicators. Life expectancy captures human development in a different way than infant mortality (as it assumes constant living conditions at the time the measurement is made). Hence, the Fixed Effects analysis is run again, and like for infant mortality, two baseline models are estimated (with a log-log transformation). The results of the model estimates with life expectancy as dependent variable are reported below and summarised in Table 6. Model 4 is estimated with current values of all variables, Model 5 allows for a one-year lag of the explanatory variables, and Model 6 is the robustness check, with a two-year lag of the explanatory variables.

4.2.2.1 Model 4. The model fit is $R^2 = 0.981$, and adjusted $R^2 = 0.980$, which is similar to the estimations with infant mortality. Health aid is significant at 10% and has the expected sign on the outcome variable (meaning that health aid positively affects the dependent variable). A 1% increase in health aid results in a 0.002% higher life expectancy. Moreover, domestic government expenditure is significant at 1%, and it increases life expectancy by 0.012% for every 1% change in expenditure. Gross domestic product is significant at 1% but has a negative sign on the outcome variable (meaning that a growth in GDP would lower life expectancy). Urbanisation is also significant at 1% and its effect on life expectancy is higher than the one of health aid or domestic government expenditure; a 1% increase in urbanisation increases the life expectancy rate by 0.521%. Finally, domestic private expenditure and the Human Freedom Index do not significantly affect life expectancy rates. To summarise, the main independent variable health aid and the mediator variable domestic government expenditure are both significant on life expectancy and have a positive effect on it (albeit this effect is small).

4.2.2.2 Model 5. The explanatory variables were lagged by one period to capture the delayed effect of aid and other factors on development. The model fit is $R^2 = 0.985$, and adjusted $R^2 = 0.983$. Health aid is no longer significant (compared to Model 4). Domestic government expenditure remains significant with a coefficient of 0.010. Like in Model 4, gross domestic product is significant but has a negative sign on life expectancy. Urbanisation remains significant at 1%, and domestic private expenditure and the Human Freedom Index do not have a statistically significant effect on the outcome variable. To conclude, health aid is not statistically significant on life expectancy, but domestic government expenditure is.

Table 6. Fixed effects model with the dependent variable life expectancy

Variables	Model 4	Model 5	Model 6
ln_health_aid	0.002*	0.002	0.002**
	(0.001)	(0.001)	(0.001)
ln_DGE	0.011***	0.010***	0.008***
	(0.003)	(0.003)	(0.003)
ln_GDP	-0.017***	-0.011**	-0.005
	(0.006)	(0.005)	(0.005)
ln_Urb	0.522***	0.488***	0.451***
	(0.018)	(0.018)	(0.018)
ln_DPE	0.001	0.000	0.000
	(0.004)	(0.003)	(0.003)
ln_HFI	0.025	0.013	0.003
	(0.021)	(0.020)	(0.019)
Constant	0.945***	0.998***	1.054***
	(0.034)	(0.033)	(0.033)
R-squared	0.981	0.985	0.989
Adjusted R-squared	0.980	0.983	0.987
Number of observations	924	840	756
Number of countries	84	84	84

Notes: Standard errors are in parentheses. Country and year effects are included in the regressions. Column one includes current values; column two includes a one-year lag; column three includes a two-year lag. All regression estimations include the same set of control variables.

* Significant at 10%

** Significant at 5%

*** Significant at 1%

4.2.3 Robustness check

To test whether results are robust, a two-year lag is applied to allow for an even greater delayed effect of the explanatory variables on health outcomes. This results in t = 9. The model is re-estimated for each outcome variable. The results of the robustness checks are summarised in Table 5 for infant mortality (Model 3) and in Table 6 for life expectancy (Model 6).

4.2.3.1 Model 3. The model fit is $R^2 = 0.991$ and adjusted $R^2 = 0.989$. Health aid is significant at 5% but has a positive sign on infant mortality, meaning that an increase in health aid leads to higher infant mortality. Domestic government expenditure is not significant. Urbanisation, domestic private expenditure, and the Human Freedom Index remain significant at 1%, and the signs of the coefficients

of all explanatory variables are the same as in Model 1 and 2. The results of the robustness check support the model estimates of the two baseline models for all variables, except for health aid. The significance of health aid when a two-year lag is applied confirms the assumption by scholars that aid has delayed effects, however the positive sign of its coefficient is worrisome. This will be assessed further in the discussion section.

4.2.3.2 Model 6. The model fit is $R^2 = 0.989$, and adjusted $R^2 = 0.987$. Health aid is significant at 5%, and like before, a 1% increase in health aid results in a 0.002% increase in the life expectancy rate. Domestic government expenditure is significant at 1%. Gross domestic product is no longer significant. Finally, urbanisation is significant at 1% and life expectancy increases by 0.451% for every 1% increase in urbanisation. The robustness check confirms the results of the baseline models for the outcome variable life expectancy, except for gross domestic product, which is no longer significant when a two-year lag is applied. The fact that health aid was significant in the model estimates with current values and a two-year lag, but not when a one-year lag was applied will be discussed more thoroughly in the discussion section.

4.3 Mediation analysis

The following analyses test the hypothesis of whether domestic government expenditure mediates the relationship between health aid and health outcomes in recipient countries. Recall that statistical evidence of an association between X and Y is not a necessary precondition, and that the theoretical argumentation in this paper is sufficient for performing the mediation analysis (Hayes, 2017). The mediation effect of health aid on health outcomes through domestic government expenditure is tested by running different regressions: the effect of X on Y (c'), the effect of X on M (a), the effect of M on Y (b), and the effect of X and M predicting Y. This mediation analysis builds on the baseline model that allows for a one-year lag of the explanatory variables, because it allows for delayed effects of the explanatory variables.

4.3.1 Infant mortality

Table 7 summarises the results of the mediation analysis for the outcome variable infant mortality. Recalling the mediation model, it splits up the effect of X on Y by introducing a mediator. X to M is represented by path a, and M to Y is represented by path b. The direct effect (X to Y) is represented by c'. The analysis yields the following: a = -0.001, b = -0.018, and c' = 0.006. All three paths are not statistically significant, because the confidence intervals include 0. The direct effect c' = 0.006, and the indirect effect, which is the product of a and b (ab) = 0.000. The total effect is the sum of the direct and the indirect effect (c' + ab) = 0.006. The results imply neither partial nor full mediation, as that would require the direct and/or the indirect effect to be statistically significant. To conclude, the

mediation analysis suggests the following: The intervention does not significantly change the mediator, which does not significantly change the outcome. Hence, health aid has no significant effect on population health, and neither does domestic government expenditure for health.

Table 7. Mediation analysis with infant mortality as outcome variable

Variable	B	Confidence Interval
Outcome: DGE		
ln_health_aid	-0.001	[-0.025; 0.023]
ln_GDP	0.929***	[0.806; 1.052]
ln_Urb	1.018***	[0.559; 1.476]
ln_DPE	0.070	[-0.021; 0.161]
ln_HFI	0.642**	[0.120; 1.163]
constant	-3.957***	[-4.791; -3.123]
R-squared	0.983	
Adjusted R-squared	0.981	
Outcome: Infant mortality		
ln_health_aid	0.006	[-0.004; 0.015]
ln_DGE	-0.018	[-0.046; 0.011]
ln_GDP	-0.026	[-0.082; 0.030]
ln_Urb	-1.750***	[-1.936; -1.564]
ln_DPE	-0.131***	[-0.167; -0.094]
ln_HFI	0.479***	[0.269; 0.689]
constant	4.345	[-4.791; -3.123]
R-squared	0.988	
Adjusted R-squared	0.987	
Indirect effect	0.000	
Direct effect	0.006	
Total effect	0.006	

Notes: The model is estimated with the baseline model (one-year lag).

* Significant at 10%

** Significant at 5%

*** Significant at 1%

4.3.2 Life expectancy

The mediation analysis is now performed with the outcome variable life expectancy. The findings are summarised in Table 8. Results are as follows: a = 0.001, b = 0.010, and c' = 0.002. Paths

a and c' are not significant, but path b is (the confidence interval does not include 0). The direct effect of X on Y equals 0.002 and is not significant. The indirect effect (ab) equals 0.000 and is not significant either. The total effect equals 0.002. Because b is significant (M → Y), the results imply the following: there is no effect of X on M, but a significant intervention of M on Y. To summarise, the intervention does not significantly change the mediator, but the mediator has a significant effect on the outcome. However, because both the direct and the indirect effect are nonsignificant, neither partial nor full mediation is present. The results of the mediation analyses are discussed in detail in the discussion section below.

Table 8. Mediation analysis with life expectancy as outcome variable

Variable	B	Confidence Interval
Outcome: DGE		
ln_health_aid	-0.001	[-0.025; 0.023]
ln_GDP	0.929***	[0.806; 1.052]
ln_Urb	1.018***	[0.559; 1.476]
ln_DPE	0.070	[-0.021; 0.161]
ln_HFI	0.642**	[0.120; 1.163]
constant	-3.957***	[-4.791; -3.123]
R-squared	0.983	
Adjusted R-squared	0.981	
Outcome: Life expectancy		
ln_health_aid	0.002	[-0.010; 0.004]
ln_DGE	0.010***	[0.004; 0.015]
ln_GDP	-0.011**	[-0.022; -0.001]
ln_Urb	0.448***	[0.454; 0.523]
ln_DPE	0.000	[-0.006; 0.007]
ln_HFI	0.013	[-0.026; 0.052]
constant	0.998***	[0.933; 1.064]
R-squared	0.985	
Adjusted R-squared	0.983	
Indirect effect	0.000	
Direct effect	0.002	
Total effect	0.002	

Notes: The model is estimated with the baseline model (one-year lag).

* Significant at 10%

** Significant at 5%

*** Significant at 1%

5. Discussion

This thesis studied the effect of health sector specific aid on health outcomes in recipient countries. Human development was measured through infant mortality and life expectancy rates. The following hypotheses were tested:

H_1: Health aid leads to improved health outcomes in recipient countries.

H_2: Healthcare expenditure mediates the relationship between health aid and health outcomes in recipient countries.

H_1 aimed at understanding the effect of health aid in recipient countries, and H_2 whether domestic healthcare expenditure by governments mediates this relationship. The following paragraphs discuss the analyses' results in light of recent findings and theories. The discussion section is structured as follows: First, the results of the Fixed Effects Models are discussed. This is followed by a detailed discussion of the mediation analyses.

5.1 Fixed Effects Model

5.1.1 Infant mortality

To briefly recall the results from the analysis, health aid and domestic government expenditure were not found to be statistically significant on infant mortality. The control variables urbanisation and domestic private expenditure were significant. The same holds for the Human Freedom Index which, however, had an unexpected effect on infant mortality. Moreover, results indicate that the effect of aid may be delayed. Even though health aid and healthcare expenditure are the main explanatory variables of interest, all control variables will be discussed to gain a better understanding of aid effectiveness.

The insignificant effect of health aid on infant mortality is in line with the findings of previous scholars that dispute the effectiveness of health aid (example: Williamson, 2008). It is argued that the amount of foreign aid given to a country must surpass a certain threshold to be effective (Wamboye et al., 2013). This might have not been the case in the two baseline models (current values and one-year lag). The descriptive statistics suggest that the minimum value of disbursed health aid was considerably low. Another explanation could be that not enough time had yet elapsed to observe improvements in population health. The assumption that development assistance needs some time to show its effect is also supported by the robustness check, as health aid becomes significant when a two-year lag is applied. However, in this case, health aid has a worsening effect on infant mortality. A possible explanation for this might be that aid flows are not always used the way they should be. Inefficient use of resources can worsen health conditions in the absence of good health policies and a sound political system.

The insignificant effect of domestic government expenditure for health on improving infant mortality in recipient countries aligns with the assumption that public sources of financing are not always used in the best possible way by governments to foster growth and development (Rahman et al., 2018). Effective policies must be in place to ensure an efficient use of domestic resources (Chang et al., 2019). Moreover, government spending for the health sector might have not been high enough to cause observable improvements. In contrast, domestic private health expenditure had a statistically significant effect on lowering infant mortality. According to the micro-macro paradox, the disbursement of aid affects spending patterns of the public sector, which in turn influences the economic behaviour of the private sector. Out-of-pocket spending for health services is a common payment method in developing countries, and higher private expenditure by citizens is often a result of insufficient government investments in the healthcare system. Hence, a possible explanation why private funds have an impact on health outcomes could be that they were much higher compared to public spending by the government. Domestic sources of funding are, among others, tax revenues and per capita income (Feeny & Ouattara, 2013). It is possible that these sources did not yield sufficient returns to finance health operations between 2008 and 2018. Nevertheless, health expenditure plays a role in improving health outcomes, but where it comes from seems to matter.

The positive impact of urbanisation on infant mortality aligns with the assumption that health is not only defined by the absence of diseases, but that social determinants like where you live, work, and so on shape health as well (WHO, n.d.). An example would be the availability of skilled medical personnel in urban areas that have a positive impact on health status (Strasser et al., 2016). Gross domestic product was not significant. A possible explanation might be that improvements in the overall economic situation of a country do not necessarily benefit the healthcare sector. In addition to economic stability, effective policies and good governance are necessary to ensure that sufficient resources are allocated to ministries of health and not embezzled or inefficiently used instead (Stevens, 2008; Barkat et al., 2016).

Finally, results indicate that the Human Freedom Index worsens infant mortality rates in recipient countries. Recall that the index aims to captures the economic and political situation in a country. Scholars suggest that economic freedom positively influences human development, and that misuse of funds is less common in strong political systems (Toseef et al., 2020; Barkat et al., 2016). Such unexpected results may imply that the economic and political freedom in the selected countries is rather low and that is why the Human Freedom Index does not produce positive results. This is in line with findings from the Freedom House, which argue that political freedom has declined in recent years, and that some of the democratic achievements of the 20th century are fading (Abramowitz, n.d.). Such results may also explain the insignificance of health aid on infant mortality. Bad governance might have prevented development assistance to be effectively used for projects addressing infant mortality during the investigated period.

5.1.2 Life expectancy

The next paragraphs discuss the results of the model estimates with life expectancy before comparing the findings of both health indicators to gain a better understanding. To recap results, health aid had a positive, significant effect on life expectancy (for current values and a two-year lag), as well as domestic government expenditure and urbanisation. These results deviate from the infant mortality models. Health aid is significant, and results imply that more aid extends life expectancy, although the effect is very small. Why health aid is not significant when the explanatory variables are lagged by one period is not clear. A potential explanation could be that the statistically significant effect of health aid on life expectancy is small anyways, and that yearly fluctuations in aid inflows or life expectancy rates might have caused this insignificance.

Higher domestic government expenditure also positively affects life expectancy rates in recipient countries. As mentioned before, this suggests that if countries use their own resources in the right way, they can be effective. Like for infant mortality, urbanisation plays a role in prolonging life expectancy. Again, this can be explained by a better accessibility to medical services and skilled medical personnel in urban areas and confirms that socioeconomic factors are important determinants of health (Strasser et al., 2016; WHO, n.d.). Domestic private expenditure for health and the Human Freedom Index do not seem to be significant determinants of life expectancy rates. The negative effect of gross domestic product on life expectancy rates is worrisome. A possible explanation might be that the economic situation of a country alone cannot improve population health, and that social determinants like the work and living environment are essential to see better life expectancy rates (WHO, n.d.). Why results deviate for the two indicators will be discussed below.

5.1.3 Comparison of results

Firstly, it is argued that aid flows must be large enough (i.e. pass a certain threshold) to be effective and foster development (Wamboye et al., 2013). Infant mortality and life expectancy capture different parts of population health. One possible explanation is that the amount of aid allocated to infant mortality projects did not surpass this threshold, whereas for projects addressing life expectancy it did (i.e. internal allocation of health aid), or that larger investments are required to improve infant mortality rates compared to life expectancy rates. However, whether this is true is hard to re-enact because recipient countries might not report accurately and in the same fashion for which projects the money was used.

Secondly, data characteristics and country-specific features may explain the findings. Even though the outcome variables were chosen carefully (based on theory and previous studies), they are measured in different ways. Whilst life expectancy assumes constant mortality patterns at the time of measurement, infant mortality rates are based on current numbers. Moreover, some countries only have a limited capacity to absorb aid (Lu et al., 2010). Such limited capacity might be more prevalent for one

health indicator than another. Hence, results might be observable more easily for one indicator compared to another.

The concept of aid fungibility is another possible factor explaining why health aid did not significantly improve infant mortality rates. Instead of using this money for projects that can improve maternal and infant health, politicians might have diverted this money to projects in other sectors, such as infrastructure or education. It is possible that life expectancy still benefits from the diversion of funds to a certain extent, whereas infant mortality rates depend much more on the health system. The interconnectedness of economic growth and human development must also be kept in mind when evaluating the findings. Economic growth is not a panacea for everything; it must be combined with the right tools to foster human welfare. Population health must be strengthened as well so that countries can move from a vicious state to virtuous one (Ranis et al., 2000). This is confirmed by the insignificant effect of GDP on infant mortality rates, and by a negative effect of GDP on life expectancy rates. Before moving on to discuss the results of the mediation analysis, two important concepts in the debate around aid effectiveness will be mentioned: lagged aid and reverse causality.

5.1.4 Lagged aid

A delayed effect of (health) aid (and other explanatory variables) on development has been discussed before and accounted for in the analysis by allowing for a one-year and a two-year lag. This concept must be kept in mind when interpreting results. The robustness check (two-year lag) finds that health aid influences outcomes for both indicators and supports the assumption of a delayed effect. However, as mentioned before, the worsening effect of health aid on infant mortality is worrisome and unclear. Again, a possible explanation is that each health indicator reacts differently to health aid and that a reduction in infant mortality rates possibly requires more tailored strategies and higher amounts of aid. A two-year lag shows statistically significant but very small effects on outcomes. Aid may need even more time to be implemented and improve population health.

5.1.5 Reverse causality

The issue of reverse causality might also explain aid (in)effectiveness as it can hinder to assess the impact of foreign aid on development. It is unclear whether donors allocate more aid to countries that exhibit low economic growth, or to countries that have successfully implemented aid projects in the past (Bitzer & Gören, 2018). Wilson (2011) investigated the effect of development assistance for health on mortality rates in 96 countries between 1975 and 2005, concluding that health aid does not decrease mortality rates. Although the objective of aid is to help countries that need financial assistance the most, health aid seems to be given to countries that experience successes in terms of health improvements. According to Wilson (2011, p. 3032), health aid is "[…] following success, rather than causing it". Hence, countries with bad infant mortality rates or low life expectancy rates might not

attract sufficient aid flows. They are stuck in a vicious circle, unable to improve human development to gain economic growth.

Overall, results are rather pessimistic for both health indicators. Even though health aid is significant on life expectancy in two out of three models, the effect is very small. Nevertheless, the significant effects of some control variables on health outcomes are supported by Feeny and Ouattara's (2013) findings, which argue that determinants such as population density or income improve (child) health.

5.2 Mediation analysis

Recall that the mediation analysis builds on the baseline model that allows for a one-year lag of the explanatory variables to account for delayed effects. The main focus lays on understanding the impact of health aid on healthcare expenditure, and whether expenditure mediates the relationship between aid and outcomes. Therefore, the impact of the control variables in the mediation analyses will not be discussed again. For both health indicators, neither full nor partial mediation can be observed because neither the direct nor the indirect effect is statistically significant. In practice, a direct effect of health aid on population health would mean that aid is channelled directly towards projects that tackle infant deaths or prolong life expectancy. The indirect effect of health aid on health outcomes means that an additional variable mediates this relationship, which was hypothesised to be domestic government expenditure for health.

There is a nonsignificant intervention effect of the independent variable on the mediating variable. This means that health aid does not have an effect on the level of domestic government health spending in recipient countries. Such insignificant effect does not confirm the worry of scholars that health aid sometimes crowds out public health measures (Wilson, 2011). Nevertheless, aid fungibility makes this difficult to assess. When a country receives more health aid, they may lower their own expenses for healthcare (Lu et al., 2010). However, such diversion of funds is not necessarily observable, because aid simply replaces the missing domestic resources. The freed domestic resources are then used in other sectors, and the money intended for health purposes is used to finance the healthcare system instead. This is the first path of the relationship between the independent, the mediator, and the dependent variable. The second path measures the effect of government expenditure on health outcomes. Whereas domestic government spending does not significantly change infant mortality, it has a significant effect on life expectancy rates. The diverted domestic funds cannot be used to tackle infant mortality anymore, and the available resources from health aid might not be used for infant mortality projects. Instead, they are used for other health indicators that yield improvements of population health more quickly. This links back to the problem of reverse causality, where aid chases

success, causing developing countries to follow unsustainable practices to attract health aid also in future years.

Overall, the results of the mediation analysis do not suggest that countries integrate health aid in or align it with their national budgets. However, this is important to ensure a successful use of foreign development assistance (Herfkens & Bains, n.d.). It remains unclear how health aid is used in the government apparatus.

6. Conclusion

6.1 Overall conclusion and policy recommendations

The purpose of this study was to test the effect of health aid on health outcomes measured through life expectancy and infant mortality rates, and to understand which role government health expenditure plays in this relationship. Data on 84 ODA eligible countries between 2008 and 2018 were obtained and analysed by running different regression estimates. Results suggest that health aid had weak (no) effects on life expectancy (infant mortality) in recipient countries. Nevertheless, the weak positive results give confidence that combining health aid with the right policies may yield stronger improvements. A one-size-fits-all strategy might not be the right tool for all components of population health and is a possible explanation of deviating results for both health indicators. Hence, investments should be made based on the characteristics of the health indicators.

Furthermore, no evidence was found that domestic government expenditure for health mediates the relationship between health aid and population health. However, findings suggest that domestic health expenditure can have a positive effect on population health. Spending by the government had a significant effect on life expectancy rates, and private expenditure improved infant mortality rates. This suggests that domestic financing, whether it comes from the public or the individual, is an important source of funding. However, out-of-pocket spending by citizens can also result in poverty. Governments should therefore ensure that private and public funds are combined in the best possible way so that citizens have at least basic access to medical services without having to worry about their economic situation. There is also evidence that socioeconomic factors like a sound living and working environment are important, measured through urbanisation. Politicians must recognise the interconnectedness of health and socioeconomic factors to ensure that citizens live in a wholesome environment that benefits both their physical and mental health, and that the urban as well as the rural population has access to medical services. Effective policies that foster socioeconomic determinants can contribute to population health and to sustainable development in the long term, so that countries do not fully depend on foreign monetary assistance.

Furthermore, health aid does not necessarily translate into improved health outcomes in the same year aid flows are received; investments may have delayed effects on development. Therefore, both donors and recipient countries must recognise long-term effects in the policymaking process.

Rather than evaluating the effectiveness of current aid on current health performance, donors should keep this lagged effect in mind. Recipient countries should choose the right tools that can capture this delayed effect. However, this does not guarantee that foreign aid works after all. The issue of aid fungibility must also be kept in mind. Whether sectoral aid is more effective in improving health outcomes is not clear from the results. Donors should assess whether targeting specific sectors of the economy makes more sense or whether this money is diverted to other sectors anyways (aid fungibility). In the latter case, distribution strategies should change so that the health sector actually benefits from foreign assistance.

Finally, reverse causality may be an obstacle to evaluating aid effectiveness and distributing the monetary assistance in the most appropriate way. Donors should not distribute large amounts of aid only to countries that have successfully used this money in the past to improve health outcomes, but also to nations that exhibit poor population health and need foreign assistance. Furthermore, recipient countries should follow sustainable strategies to advance their healthcare system and population health in the long run, rather than pursuing strategies that only yield short-term improvements to attract more aid in the next year.

Overall, domestic policymaking should aim at establishing healthcare systems that are sustainable and effective in the long run and that allow citizens to access at least the necessary basic health services over the course of life. Developing countries should not rely too heavily on development assistance to do its magic without having the right policies in place and lacking own domestic resources. Aid flows can be cut short during chance events like the 2008/2009 financial crisis. In such moments, it is important that the domestic healthcare system can operate by itself. What remains uncertain is whether foreign (health) aid is as powerful in achieving development as aid advocates claim it to be.

6.2 Limitations and suggestions for future research

This study has several limitations and implications for future research, which are discussed below. First, the choice of data is examined. The analysis was limited to the time span 2008 to 2018 because data on the Human Freedom Index were only available for these years, and because other control variables had sufficient data gaps for some countries prior to 2008. Including years before 2008 would have substantially reduced the sample size. Nevertheless, other databases can be explored in future studies to obtain a greater sample size.

Second, not all assumptions of linear regression were met. A log-log transformation was employed to remedy the violations as much as possible. Fixing the homoskedasticity violation, however, was only possible to a limited extent (by using per capita values and rates), which limits the generalisability (external validity) of the results. Furthermore, the internal validity was limited due to omitted variable bias. The scope of this study did not allow to include all confounding factors that might influence the relationship between health aid and health outcomes. Such factors are, among others,

access to water, war, and literacy rate (Mishra & Newhouse, 2009). However, to counter this as much as possible, a theoretically sound argumentation aimed at creating a robust research design to establish a causal relationship between health aid and health outcomes. Future studies may include a greater set of control variables to address this limitation.

Third, lagging the explanatory variables by more than two years was not possible as it would have further reduced the sample size and data were only available for eleven years. Allowing for a greater lag, however, might advance the understanding of health aid effectiveness and may be explored in future studies. Furthermore, both urbanisation and domestic private expenditure for health had a statistically significant effect on health outcomes. Researching these variables more thoroughly in future studies may advance the understanding of their impact on improving population health in recipient countries and their interplay with health aid.

Future studies may implement an instrument for reverse causality. The concept of reverse causality makes it more difficult to evaluate aid effectiveness and was acknowledged in the discussion. However, due to the limited scope of this study, an instrument for reverse causality was not included in the analysis. Finally, future research may expand on the assumption that some factor mediates the relationship between health aid and health outcomes and test which variable this could be to gain additional insights into the health aid research.

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Appendix

Table 9. List of countries

All countries		
Albania	Ethiopia	Mozambique
Algeria	Fiji	Myanmar
Angola	Gabon	Namibia
Argentina	Georgia	Nepal
Armenia	Ghana	Nicaragua
Azerbaijan	Guatemala	Niger
Bangladesh	Guinea-Bissau	Nigeria
Belize	Guyana	North Macedonia
Benin	Haiti	Pakistan
Bolivia	Honduras	Panama
Bosnia and Herzegovina	India	Papua New Guinea
Botswana	Indonesia	Paraguay
Brazil	Iran	Peru
Burkina Faso	Jamaica	Philippines
Burundi	Jordan	Rwanda
Cameroon	Kazakhstan	Senegal
Central African Republic	Kenya	Serbia
Chad	Kyrgyzstan	Sierra Leone
China	Lesotho	South Africa
Colombia	Madagascar	Sri Lanka
Congo	Malawi	Tanzania
Costa Rica	Malaysia	Thailand
Cote d'Ivoire	Mali	Tunisia
Dominican Republic	Mauritania	Turkey
DR Congo	Mexico	Uganda
Ecuador	Moldova	Ukraine
Egypt	Mongolia	Vietnam
El Salvador	Morocco	Zambia