UNIVERSITY OF GOTHENBURG

From Debt to Delivery: Investigating the Relationship Between Debt Relief and Maternal Health in Sub-Saharan Africa

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Abstract:

Despite global improvements in maternal health, Sub-Saharan Africa remains a critical concern, accounting for over two-thirds of the world's annual maternal deaths. Meanwhile, large external debt stocks, which have long burdened the region, require debt-servicing that is effectively crowding out government health expenditure. For instance, between 2019 and 2021, nearly half of all Sub-Saharan African countries spent more on servicing debt than on healthcare. At the turn of the millennium, the international community implemented two debt relief initiatives – the Highly Indebted Poor Countries (HIPC) initiative, followed by the Multilateral Debt Relief Initiative (MDRI) – to alleviate these countries' debt burdens and enhance development. Using a sample of 47 Sub-Saharan African countries between 2000 and 2019, this paper empirically investigates the relationship between debt relief under these initiatives and maternal mortality and morbidity. The paper further examines the relationship between debt relief under the initiatives and government health expenditure. Utilizing the variation in initiative participation across time and countries, and employing various econometric specifications, the results indicate that joining the HIPC initiative is associated with statistically significant reductions in the maternal mortality ratio and the lifetime risk of maternal death, as well as a statistically significant increase in government health expenditure as a share of GDP. No conclusive relationships between the MDRI or the amount of debt relief and these outcomes are however found. Furthermore, no conclusive relationships between either the HIPC initiative, the MDRI or the amount of debt relief and maternal morbidity can be established. Considering the increasing debt levels and changing debt structures of Sub-Saharan Africa, along with their potential health development implications, further research on debt relief as a development assistance tool is necessary.

Key words: Debt relief, HIPC, MDRI, maternal health, government health expenditure, Sub-Saharan Africa

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List of Abbreviations

CA – Current Account

DAC – Development Assistance Committee

DSSI – Debt Service Suspension Initiative

GDS – Geometry of Debt Sustainability

HIPC – Highly Indebted Poor Country

IDA – The World Bank's International Development Agency

IMF – The International Monetary Fund

LIC – Low-Income Country

MDRI – Multilateral Debt Relief Initiative

MMR – Maternal Mortality Ratio

NICA – Non-Interest Current Account

ODA – Official Development Assistance

PRSP – Poverty Reduction Strategy Paper

SDG – Sustainable Development Goal

SSA – Sub-Saharan Africa

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"*No civilised country should try to collect the debts of people that are dying of hunger and disease and poverty.*"

– Jeffrey Sachs, quoted by Andrew England
in the Financial Times, July 6, 2004

1 Introduction

Maternal health refers to women's health during pregnancy, childbirth and the postnatal period. Roughly every two minutes, a woman dies due to complications in one of these stages (WHO, 2023). This means that in the span it takes to read this section, at least one family's joy of welcoming a new life is overshadowed by tragedy. Although the global maternal mortality ratio (MMR) dropped by nearly 34% between 2000 and 2020, marking some progress toward the Sustainable Development Goal (SDG) 3.1, the disparity between high-income countries and the developing world is profound (WHO, 2023; UN, n.d.). In 2015, the number of annual global maternal deaths reached an estimate of 303,000, with the developing regions contributing to nearly 99% of this figure, and Sub-Saharan Africa (henceforth SSA) alone accounting for approximately 66% (WHO, UNICEF, UNFPA, World Bank & UNPD, 2015). By 2020, the estimated number of global maternal deaths had decreased slightly to 287,000, along with a marginally less skewed distribution toward the developing regions, accounting for around 95% (WHO, 2023). Notably, SSA increased their relative share, contributing to nearly 70% of worldwide deaths following pregnancy-related complications, highlighting the region's disproportionate burden and lack of development in the global context (ibid.). To further emphasize this discrepancy – in 2020 a 15-year-old girl living in SSA had a 1 in 40 chance of dying from maternal causes during her lifetime, compared to a 1 in 16,000 chance for her counterpart in Australia and New Zeeland (WHO, UNICEF, UNFPA, World Bank & UNDESA/Population Division, 2023).

Preventing maternal deaths is however feasible. In part, it requires developing functioning healthcare systems which, in turn, is largely dependent on health sector financing (Asante et al., 2020). SSA countries are in pressing needs of well-functioning health financing systems, most of which are characterized by high out-of-pocket payments, domestic government health expenditure well below the global average, and heavy dependence on external funding such as foreign aid (ibid.). The stark reality presented in the paragraph above poses apparent development challenges for policymakers in SSA – challenges that are made difficult to overcome due to the unsustainable debt burdens and limited fiscal capacities that have long characterized the region, effectively preventing adequate health sector financing. During the last decade, the situation has deteriorated. Stagnating aid and capital flows following the global financial crisis in 2008, commodity price shocks fueling inflation, currency depreciations, and the impact of the COVID-19 crisis have all led to widened deficits, increased debt burdens and debt service obligations, in turn reducing fiscal space and worsening the region's overall macroeconomic environment (Canuto et al., 2023). Looking ahead, concerns of a new African debt crisis are intensifying. In roughly three-quarters of SSA countries, debt levels are on an unsustainable path, and servicing this debt risks crowding out human development expenditure (Comelli et al., 2023*a*). More specifically – between 2019 and 2021, nearly half of the region's countries spent more on debt-servicing than they did on healthcare (UNCTAD, n.d.). This suggests that explicit debt targets and debt sustainability are central components of the countries' fiscal and subsequent health development strategies (Comelli et al., 2023*a*).

At the turn of the millennium, the International Monetary Fund (IMF) and the World Bank set out to relieve some of the world's poorest and most indebted countries' external debt burdens and fiscal constraints. This was achieved through the Highly Indebted Poor Countries (henceforth HIPC) initiative, which was enhanced a few years later by the Multilateral Debt Relief Initiative (henceforth MDRI). The initiatives contained bilateral and multilateral debt relief and were designed to lower debt-servicing costs as a means of increasing fiscal space, thereby freeing up resources for needed development-focused expenditure (IMF, 2023). The HIPC initiative and the MDRI were successful in lowering the debt-service costs for HIPCs, and several studies have contributed to the literature with findings and insights on the developmental implications of these reduced servicing costs. An in-depth review of these findings is presented in section 4. This paper seeks to further contribute to the research body by empirically investigating the relationship between the debt relief initiatives and maternal health and government health expenditure in SSA.

1.1 Research framework

1.1.1 Aim, research objectives and contributions

Given the presumption that health expenditure serves as a key mechanism through which debt relief and increased fiscal space may influence health outcomes, a large portion of the literature evaluates the impact of debt relief on health expenditure. As Oryema et al. (2017) point out, surprisingly few studies examine the impact of debt relief on the health outcomes themselves – which are arguably of more immediate concern than the underlying mechanisms. To the best of our knowledge, no previous studies have examined whether debt relief under the HIPC initiative and the MDRI may impact maternal health outcomes in SSA. The relevance of addressing this research gap lies in the region's disproportionately high maternal mortality, along with the fact that its external debt burdens are once again on the rise, potentially hindering future provision of adequate maternal healthcare. Additionally, the persistent gender inequality in SSA, as highlighted by Hakura (2017), suggests that women are likely to disproportionately suffer from unsustainable fiscal practices and debt-servicing that effectively reduce health expenditure and exacerbate poverty (International Confederation of Midwives, 2023). Given the widely accepted view that maternal health is an indicator for social development, the relevance of this study is thus further emphasized, adding an institutional depth beyond mere health outcomes (Wilmoth et al., 2012). However, no explicit evaluation of the direct relationship between receiving debt relief and either formal or informal institutions is undertaken as it falls outside the scope of this paper. Hence, this paper seeks to contribute to the understanding of using debt relief as a means of promoting development in general and maternal health in particular, as well as fill a noticeable gap in the existing literature.

More specifically, the paper's primary objective is to investigate the relationship between debt relief under the HIPC initiative and the MDRI, and maternal mortality and morbidity in SSA. To achieve this, we utilize two indicators for maternal mortality and two indicators for maternal morbidity. Additionally, as a secondary objective and in line with previous research, the paper includes an up-to-date assessment of how the debt relief initiatives have influenced government health expenditure in SSA. This objective incorporates and isolates the effect of the MDRI stage, which, to our knowledge, has not been explicitly researched in this context. On that account, we pose the following questions*: Has participation in the HIPC initiative and the MDRI been effective in improving maternal health outcomes in SSA? Have the debt relief initiatives improved government health expenditure in SSA?* To answer these questions, we undertake an empirical approach by using econometric analyses on a panel data set consisting of 47 SSA countries between 2000 and 2019. The methodology and data are discussed in-depth in section 5 and 6, respectively.

1.1.2 Structure

The rest of the paper is structured as follows: section 2 provides a brief history of debt accumulation and its poverty and health implications in SSA, along with a background to the debt relief initiatives. In section 3, a theoretical framework on debt sustainability and human development is introduced. Section 4 presents an overview of previous research on the effects of debt relief along with a brief comparison to the effects of foreign aid, arguably a more commonly utilized development assistance tool. In section 5, the methodological approach is discussed, where the econometric specifications and methodological limitations are accounted for. Section 6 provides an overview of the data, descriptive statistics and variables used in the analyses. Some data limitations are also mentioned. In section 7, the results from the analyses are presented, which are then further discussed in section 8. Section 9 concludes the paper by placing the findings within their current social context, and by offering some suggestions for future research on the subject.

2 Background

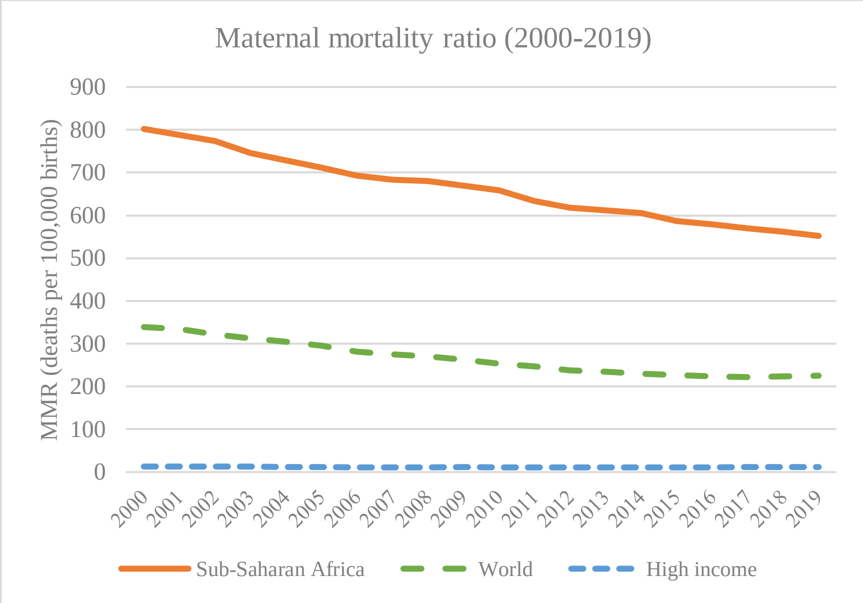
2.1 A brief history on African debt accumulation

During the decades that followed the oil shocks in the 1970's, many SSA countries experienced rising external debt burdens and severe debt distress. As the first round of oil-price increases took place in the beginning of the 1970's, the price of export-heavy commodities such as coffee, cocoa, sugar and uranium followed, thereby improving the terms of trade for these nations with a heavy expansion of government expenditure as a result (Greene & Khan, 1991). Tax revenues were however lagging, causing many countries to turn to foreign borrowing to compensate for the shortfall in funding of ongoing spending projects, and as commodity prices eventually fell, reliance on foreign borrowing intensified instead of reducing expenditure (ibid.). Excessive borrowing in international markets, shifting terms of trade, along with rising interest rates in the 1980's due to inflationary pressures, thus led to 21 SSA countries having a weighted average debt-to-export ratio of 471% in 1985 (Cline, 1988). Debt-to-export ratios of that magnitude imply virtually no ability for countries to service any of their debt, since the amount of foreign currency earned from exports is greatly insufficient for making interest payments, let alone principal payments. This in turn led to increased default risks and considerable economic concern within the region – while the world economy grew at approximately 2% per year up until 2002, SSA experienced negative growth until the mid-1990's, translating into an increase of roughly 220 million impoverished people between 1975 and 2000 (Picker, 2004).

2.2 Debt, poverty and health

Following the outline above, debt crises can exacerbate poverty and hinder development in vulnerable regions, where poverty is firmly linked to the disruption of human health. Poor people are disproportionately exposed to health risks due to several factors, including constrained access to healthcare service and insurance, clean water, and adequate sanitation; food insecurity; a lack of education; and generally fewer opportunities to make beneficial lifestyle-related choices (WHO Africa, n.d.*a*). The relationship between poverty and health also moves in the opposite direction – poor health can deepen poverty by e.g. reducing household savings, lowering learning ability and productivity, and diminishing the overall quality of life (ibid.). This bidirectional relationship can create a vicious downward spiral and potentially lead to poverty traps. Additionally, gender social norms, gender pay gaps, sexual-based violence toward women, and other forms of gender inequity and inequality greatly contribute to unequal health benefits and healthcare provision between women and men in the region (WHO Africa, n.d.*b*). Being an impoverished woman in SSA therefore adds hardship to an already distressing reality. This disparity becomes apparent as health risks and outcomes, and subsequent healthcare needs, widely differ between women and men, with the healthcare needs often being greater for women in part due to maternal and perinatal conditions (WHO Africa, n.d.*b*.). Maternal mortality thus not only serves as key health indicator – it is also widely accepted as socioeconomic indicator, as mentioned in the Introduction (Wilmoth et al., 2012). Sajedinejad et al. (2015) elaborate on this by stating that the maternal mortality ratio displays a society's sociocultural and political development, beyond merely reflecting the national healthcare system and socioeconomic development. As displayed in ***figure 2.1*** – although maternal mortality ratio trends have been improving over the last twenty years – the gap between SSA and the rest of the world is concerning and deserving of much attention.

Figure 2.1 Maternal mortality ratio trends (2000 – 2019)

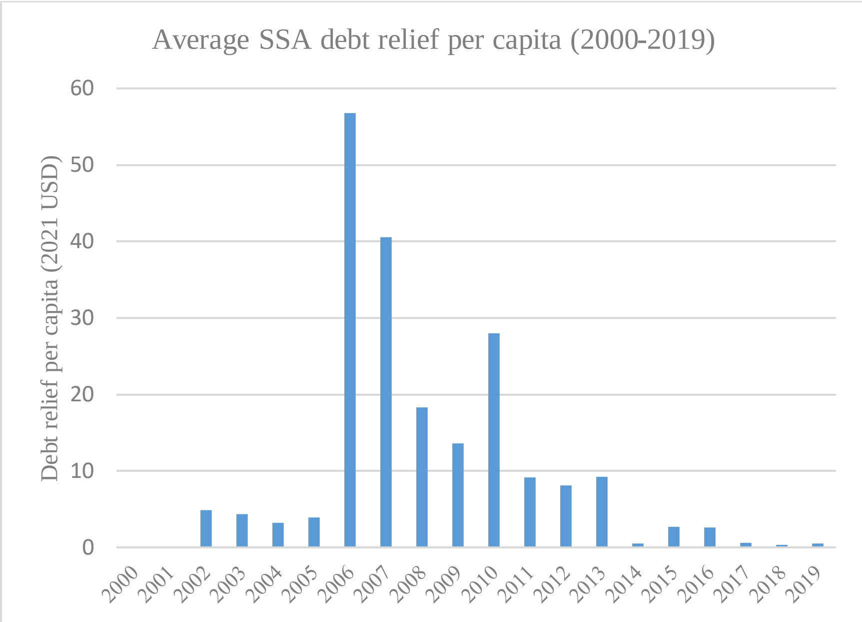


Source: Authors' graph based on data from the World Bank's World Development Indicator database (World Bank, 2024*a*)

2.3 The debt relief initiatives

The HIPC initiative was originally introduced in 1996 by the IMF, World Bank and other multilateral and bilateral creditors, and presented a beacon of hope for the burdened region. As part of an extensive effort to address the need for development in the poorest countries, the initiative was designed around relieving debt as a means of creating fiscal space for development spending, and to provide a path toward continuous poverty-alleviating reforms and debt sustainability (IMF, 2023). Eligibility for the initiative was further made contingent on meeting strict criteria. To date, these criteria include developing a Poverty Reduction Strategy Paper (PRSP) in which the government fully commits to poverty reduction; demonstrating a track record of implementing necessary social reforms and sound macroeconomic policies; facing a debt burden too severe to be alleviated through traditional debt relief measures; and being eligible to borrow from the World Bank's International Development Agency (IDA) (ibid.). Once eligible, the country reaches the decision point at which it may begin to receive interim debt relief, contingent upon preparing a *full* PRSP and continuing to implement policy measures necessary to reach completion point (IMF, 2000). Once the PRSP has been adopted and implemented for at least one year; a track record of achievement can be presented; and key reforms agreed upon at decision point have been successfully implemented, the country reaches the completion point at which full debt relief is granted (IMF, 2023). ***Figure 2.2*** displays the average amount of disbursed debt relief per capita in real terms during the period of the initiatives.

Figure 2.2 Debt relief to SSA countries under the HIPC initiative and MDRI, 2000-2019 (constant 2021 USD)



Source: Authors' graph based on aggregate debt relief data from OECD's Creditor Reporting System (CRS) (OECD, 2024) and population data from the World Bank's Population Estimates and Projections database (World Bank, 2024b)

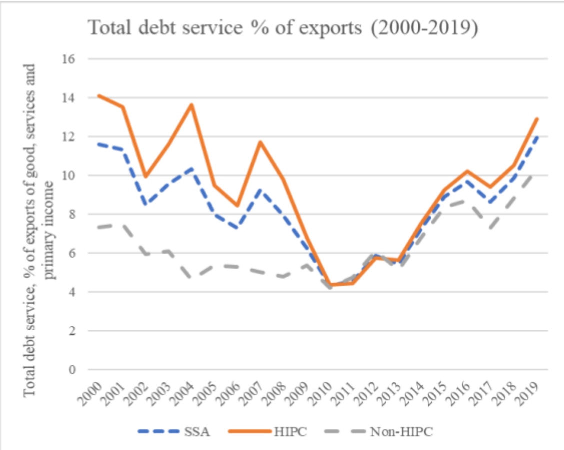
It should furthermore be noted that the *enhanced* HIPC initiative was introduced in 1999, following concerns that the original initiative's eligibility criteria were too strict, such as having requirements of exceptionally high debt-to-export ratios and providing insufficient interim debt relief (IMF, 1999). Going forward, references to the HIPC initiative and decision point pertain to the enhanced initiative, which is consistent with the existing literature.

In 2005, the HIPC initiative was reinforced by the MDRI which was implemented to advance progress toward the SDGs. This allowed for countries past completion point to receive full multilateral relief on qualified debt by the IMF, World Bank and the African Development Fund (ADF) (IMF, 2023). ***Figures 2.3*** and ***2.4*** illustrate the evolution of the debt service-to-export ratio and external debt stock-to-GNI ratio, respectively, in SSA during the years of the initiatives. It is evident that the initiatives successfully reduced external debt stocks and subsequent debt service payments for the HIPCs during the first decade. A noticeable trend shift then occurs around 2010-2011.

Out of the 39 countries qualified, eligible and potentially eligible for the HIPC initiative, 33 are located in SSA, which makes the region particularly relevant for analysis in this context

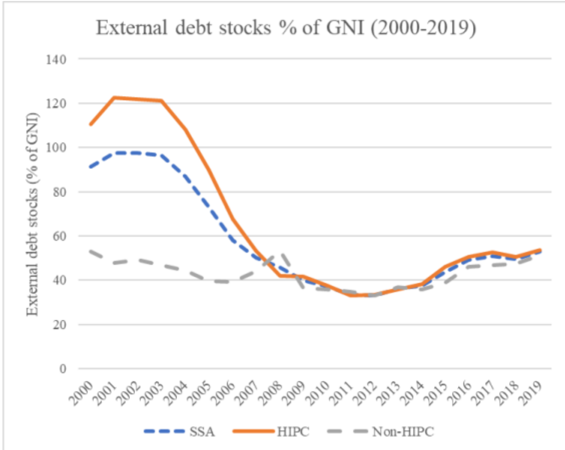
(IMF, 2023). Decision, completion and MDRI delivery points for eligible SSA countries are listed in **table A.1** of Appendix A.

Figure 2.3 Debt service payment-to-export ratios in SSA between 2000-2019



Source: Authors' graph based on data from the World Bank's World Development Indicators database (World Bank, 2024*a*)

Figure 2.4 External debt stock-to-GNI ratios in SSA between 2000-2019



Source: Authors' graph based on data from the World Bank's World Development Indicator database (World Bank, 2024*a*)

2.3.1 Delayed fiscal effects of debt relief

It is often the case that debt relief does not instantly show up in the beneficiary countries' fiscal accounts and subsequent national budgets (Gupta et al., 2002). Much debt relief, such as that provided by the IMF, accrues to central bank accounts, which requires governments to set up special accounts within their central banks to track the savings coming from these initiatives so they can be transferred to the fiscal accounts and thus utilized in the national budget (ibid.). Therefore, we assume, in the empirical analysis, that any effect debt relief may have on the national budget – and consequently on government health spending and maternal health outcomes – is subject to a temporal lag. This is outlined in detail in section 5.

3 Theoretical Framework

3.1 The economics of debt sustainability and human development

To understand the fundamental reasons for debt relief and its potential role, one needs to understand why an unsustainable debt burden can be devastating to a developing country. This section provides a theoretical framework to address these issues.

Essentially, a country's debt stock is manageable if service payments can be made without jeopardizing human development objectives (Vaggi & Frigerio, 2021). Countries with large and unsustainable external debt stocks often need to prioritize debt-servicing over human development spending which, as outlined in the Introduction, has been the case for many SSA countries. To display the mechanics of this framework as well as the potential role of debt relief, we begin by utilizing a general model on debt sustainability, as described by Gottfries (2013). We then expand this model to a slightly simplified approach of the Geometry of Debt Sustainability (GDS) model, developed by Vaggi & Prizzon (2014) and further applied to economic and human development objectives by Vaggi & Frigerio (2021).

3.1.1 A general approach

Gottfries (2013) primarily addresses the long-term dynamics of the debt ratio, which tells us if and at which level the debt ratio in a country will eventually stabilize. The real change in the debt stock between year t and $t + 1$ will depend on the size of the country's primary deficit and real interest payments in year t, which is described as follows:

$$\Delta D_{t+1} = (G_t - T_t) + iD_t \tag{3.1}$$

Here, ΔD_{t+1} denotes the change in the debt stock from year t to year $t + 1$; D denotes the public debt stock; G denotes government expenditure; T denotes government tax revenues; and i denotes the real interest rate. Although Gottfries (2013) refers to the real interest rate as r, we will express it as i to ensure comparability and facilitate a smooth transition to the GDS model, in which Vaggi & Frigerio (2021) denote it by i. Furthermore, $\dot{D}$ and $\dot{d}$ will henceforth denote absolute changes in the debt stock and debt ratio, respectively, over some time period and not growth rates at any given moment. This is consistent with the notation of Vaggi & Frigerio (2021).

By scaling each term to GDP, denoted by $Y,$ we can incorporate the real growth rate of the economy as a further determinant of the debt stock change, which gives us equation (3) (see derivation under **point 1** of Appendix C):

$$\dot{d} = \frac{G-T}{Y} + (i-g)d \tag{3.2}$$

Here, d denotes the debt-to-GDP ratio, with $\dot{d}$ being the change in debt ratio over time, and g denotes the real GDP growth rate. The dynamics are easily visible; a primary deficit caused by either excessive government spending or low tax revenues will add to the debt ratio, as will interest payments if the real cost of debt is greater than the real growth rate, meaning $i > g$. A high initial debt ratio will also correspond to a large change in the ratio, all else equal. Furthermore, the debt ratio is stabilized when it is no longer increasing, i.e. when $\dot{d} = 0.$ In many developed countries, the real interest rate and the real growth rate are both generally in the vicinity of 2-3%, meaning that $i \approx g$, which implies that these countries will have a stable debt-to-GDP ratio as long as there is primary balance, $G = T$ (Gottfries, 2013). However, in fiscal and debt crises which have been plaguing many SSA countries, interest rates often rise because of worrying creditors, in turn causing government expenditure to fall as an attempt to reduce the deficit, further leading to reduced aggregate demand and a slowing growth rate (ibid.). This causes a downward spiral for countries already in distress and makes for a situation very difficult to escape from by traditional means.

3.1.2 The GDS model

The GDS model, as displayed by Vaggi & Frigerio (2021), largely follows the same basic approach as it includes the real growth rate, real interest rate and the debt ratio. However, since the public debt stock of a country consists of a domestic portion and an external portion, with the external portion consistently dominating in many SSA countries, the focus in this model shifts from the primary balance to the current account (CA) balance (Vaggi & Frigerio, 2021). The reason for this is that service payments must be made in the same currency in which the debt was accrued, i.e. in foreign currency, which is obtained either from continued borrowing or more sustainably from a CA surplus (ibid.). This distinction is also how the two models differ – Vaggi & Frigerio (2021) specifically apply the GDS model to a set of SSA countries. In line with the approach taken by the authors, we take the following steps, beginning with a definition of the CA:

$$CA = (X - M) + NPI + NSI \tag{3.3}$$

In equation (3.3), $(X - M)$ denotes the value of net exports; NPI denotes net primary income which includes external debt interest payments; and NSI denotes net secondary income. Thus, the CA measures a country's income over some period. To better represent a country's ability to generate foreign currency that can be used for debt-servicing in the long-run, the interest payment obligations are excluded from the CA, yielding the Non-Interest Current Account ($NICA$), which is defined as follows:

$$NICA = CA - iD = C \tag{3.4}$$

Equation (3.4) shows that a larger external debt stock D makes the outstanding interest payments component iD larger, which reduces the $NICA$, all else equal. As the external debt stock D increases, the real interest rate i usually follows in the same direction, further reducing the $NICA$, since i partly reflects creditor risk. Throughout the African continent, high debt ratios are generally reflected in high borrowing rates (UNCTAD, n.d.).

By utilizing the $NICA$, the real interest rate, the external debt growth rate and the real GDP growth rate, along with following the assumptions and mathematical derivations under point 2 of Appendix C, the result eventually becomes:

$$\dot{d} = -c + (i - g)d \tag{3.5}$$

In equation (3.5), $\dot{d}$ is the change in external debt-to-GDP ratio; c is the $NICA$-to-GDP ratio; i is the real interest rate; g is the real GDP growth rate; and d is the external debt-to-GDP ratio.

This is essentially the same equation as (3.2), only the primary deficit-to-GDP ratio is replaced by the $NICA$-to-GDP ratio, and the total public debt stock is replaced by the external debt stock. The dynamics remain consistent; the negative sign in front of c shows that the larger the $NICA$, and consequently the larger the $NICA$-to-GDP ratio for a given GDP, the better the prospect of avoiding large increases in the debt ratio for given values of i, g and d. A $NICA$ surplus is therefore desirable. This is because the $NICA$ captures the capacity to generate foreign currency and thus to service debt sustainably, as outlined above. Furthermore, it shows that the debt ratio is stabilized or decreasing when $\dot{d} \leq 0$, yielding:

$$c \geq (i - g)d \tag{3.6}$$

Based on inequality (3.6), two scenarios are outlined – one focusing solely on *economic sustainability*, where the debt ratio either stabilizes or decreases, and another adding an objective of *human development sustainability*, which is done by utilizing government health expenditure.

In the first scenario, where economic sustainability is considered alone, we note by observing inequality (3.6) that as the real cost of debt i grows larger than the real economy growth rate g, the $NICA$-to-GDP ratio c needs to increase for a given debt ratio d for the equation to hold. This means that an initial $NICA$ surplus needs to become larger or conversely, an initial $NICA$ deficit needs to become smaller. According to the GDS framework, this will happen through an increase in the country's net export income or a reduction in its debt stock D. Therefore, if economic sustainability is to be achieved, either net exports or debt-servicing need to increase. Note that these implications are the same if the debt ratio d increases for a given interest-growth differential $(i - g)$. Should it be the case, on the other hand, that $i < g$ (meaning the real growth rate exceeds the real cost of debt), the dynamics reverse, most importantly implying that even a high debt ratio may remain sustainable. This is theoretically possible under somewhat favorable conditions; at least according to the Solow model, which predicts that poorer countries with initially small capital stocks and thus a high marginal return on capital, will converge toward richer countries through capital investment and higher growth rates. However – a high debt burden often adversely impacts foreign capital investment and subsequent economy growth due to the so-called debt overhang effect, which essentially means that foreign investors and creditors expect to not be fully repaid by a country with an unsustainably large debt stock (Krugman, 1988). As has been discussed; the result is often that interest rates rise due to creditor concerns. A debt overhang may therefore reduce the prospect of achieving a high growth rate during a debt crisis, and greatly increase the risk of falling into a debt trap.

What brings relevance to the theory outlined so far, is the second scenario where we add a human development objective represented by an amount of government health expenditure, G_H. Vaggi & Frigerio (2021) assume that an increase in government health expenditure leads to a reduction in the CA balance, e.g. through increased imports of medical equipment, medicines and increased foreign borrowing, which adds to the debt ratio for a given GDP.

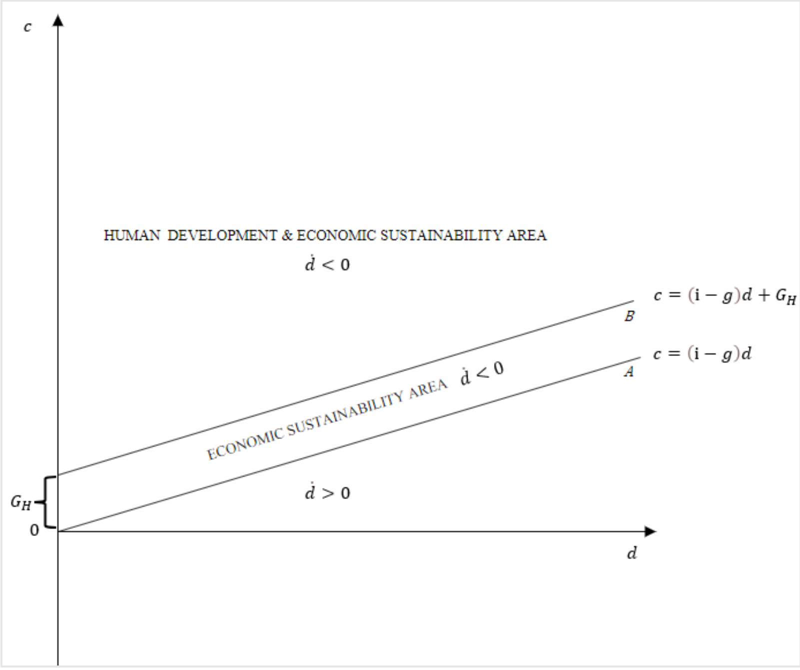
Consequently, for both economic *and* human development sustainability to be maintained, the following equation, which is simply an extension of inequality (3.6), must hold:

$$c \geq (i - g)d + G_H \tag{3.7}$$

The dynamics previously discussed apply here as well – if the right-hand side of inequality (3.7) becomes more positive (or less negative), the debt ratio will increase all else equal, which will require either increased net export income or increased debt-servicing for economic and human development sustainability to be maintained. As shown in inequality (3.7), the trade-off between debt-servicing and human development expenditure becomes evident. If the debt ratio d increases, or if the interest-growth differential $(i - g)$ grows larger (potentially as a direct result of an increased debt ratio d), government resources will need to be allocated toward debt-servicing in order to try to maintain economic sustainability and avoid an uncontrollably growing debt ratio, rather than be directed toward the health sector which would further add to the debt burden and make the situation even worse. In turn, this austerity in government spending reduces aggregate demand in the economy, potentially leading to stagnation or even a decline in the growth rate, which would exacerbate the situation by further increasing $(i - g)$.

These two scenarios are displayed graphically in **figure 3.1**. For a country to have a stabilized or decreasing debt ratio, it needs to be situated on or above *boundary line A*. If it wants to attain economic sustainability as well as human development sustainability, it needs to be on or above *boundary line B*. The positioning on or above *line B* clearly becomes more challenging as the introduction of a human development objective, denoted by G_H, *shifts* the boundary line upward, thereby reducing the human sustainability area, all else equal. Moreover, as the real cost of debt i increases relative to the real growth rate g, the line will *rotate* upwards, effectively reducing the sustainability areas, all else equal. It is also evident that a high debt ratio can be sustained if the $NICA$-to-GDP is sufficiently high, meaning a country can maintain a position far out on the horizontal axis, provided it is also high up on the vertical axis.

Figure 3.1 Graphical representation of the GDS model



Source: Authors' simplified and adapted figure based on the graphical representation by Vaggi & Frigerio (2021)

The GDS model is inherently dynamic, featuring many interconnected components. As has been shown, a heavy debt burden can theoretically be mitigated by a sufficiently high real growth rate. However, as outlined in section 2.1, high debt burdens in SSA have historically correlated with poor macroeconomic performance. Therefore, summarizing the discussion thus far, poor macroeconomic conditions and limited fiscal capacities following unsustainable indebtedness is likely to entrap poor countries in a debt spiral, thereby greatly impeding human development.

Lastly, Vaggi & Prizzon (2014) make it clear how debt relief functions in the GDS model. Although debt relief is intended to increase the probability of achieving both economic and human development sustainability, the authors highlight a paradoxical effect where debt relief might actually distance a country from reaching these objectives. This situation may arise because, although the debt ratio d decreases, the freed-up fiscal space often allows for further debt accumulation (ibid.). This could serve as an explanation as to why the debt burdens of many SSA countries have started rising in later years. The occurrence is however puzzling at first glance, since debt relief under the HIPC and MDRI frameworks is contingent on adopting sustainable fiscal approaches, as discussed in section 2.3. Comelli et al. (2023*b*) offer some insight by referring to the occurrence as a structural problem for many SSA countries, in which fiscal policies focus solely on short-term goals, thereby resulting in breaches of agreed-upon fiscal rules with continuously increasing debt levels as a result. A logical conclusion, therefore, is that debt relief may be more effective in the long-term if it is granted under favorable initial conditions such as a strong institutional environment and macroeconomic stability. However, countries that satisfy these conditions are arguably the ones least likely to qualify for debt relief.

Nonetheless, Vaggi & Prizzon (2014) argue that debt relief remains justified and necessary because it at least offers highly indebted LICs a chance to improve their prospects of achieving both economic and human development sustainability. This is because debt relief can, at least temporarily, reduce the crowding-out effect of debt servicing on development spending.

3.2 Hypotheses

The historical context and theoretical framework presented above directs the focus to the core subject of this paper: alleviating the debt burdens of SSA countries as a means of improving health outcomes, specifically maternal health. Although the authors of the GDS model suggest that the effects of debt relief can be somewhat ambiguous, it is reasonable to hypothesize that alleviating debt should likely create some fiscal space, at least in the short-term. This should allow for countries to direct necessary resources toward health development. Presuming that government health expenditure is a key mechanism for improving health outcomes, we expect maternal health to improve following debt relief. Hence, the following hypotheses are formed:

(1) Participation in the debt relief initiatives is effective in terms of improving maternal health outcomes.
(2) Participation in the debt relief initiatives increases government expenditure devoted to the health sector.

4 Review of Previous Research

Donors and creditors have a variety of development assistance tools to choose from, such as grants, concessional and non-concessional loans, guarantees and debt relief, which are generally referred to as official development assistance (ODA) (OECD, n.d.*a*). Although debt relief does not constitute a capital aid flow per se, it has been agreed upon by the Development Assistance Committee (DAC) countries to be reported as ODA (OECD, n.d.*b*). To avoid confusion, we will refer to non-debt relief ODA as foreign aid in this section.

The research body on development assistance is exhaustive, containing a variety of contrasting findings and a long-standing debate on its general effectiveness. This section presents relevant research on the development impacts of debt and debt relief, and then briefly contrasts these findings to those of foreign aid to provide a clearer perspective on the role of debt relief.

4.1 Debt relief as a development assistance tool

4.1.1 Indebtedness and development

Addressing the fundamental reason for debt relief, which is untenable indebtedness, Aladejare (2023) empirically shows a negative relationship between unsustainable external debt management and long-term longevity in West African countries between 1981 and 2020, concluding that insolvent and unsustainable external debt worsens life expectancy at birth by increasing poverty. In a similar study by Lora & Olivera (2007), the focus is shifted to social expenditure outcomes, and the authors find robust results of higher debt ratios leading to reduced social expenditure in 50 countries worldwide and in Latin America over the period 1985-2003. Interestingly, the authors point out that this effect mostly stems from the size of the debt stock itself and not from debt-service payments, suggesting that debt crowds out social expenditure not through high debt burdens, but through diminished room for further indebtedness. It is however reasonable to expect a strong positive correlation between high debt burdens and constraints on accruing more debt.

4.1.2 Debt relief and development

In the context of alleviating debt, Dessy & Vencatachellum (2007) estimate that bilateral debt relief delivered to the African continent between 1989 and 2003 had a positive impact on the share of government resources allocated toward the public health and education sectors. They do however find that this effect is contingent on the institutional environment; more specifically, it applies to countries with improved institutions. Contrasting findings on the effectiveness of debt relief on public social expenditure are found in the literature as well. Looking at 62 LICs over the period 1989-2003, Chauvin & Kraay (2005) empirically examine whether debt relief has freed up resources for development spending, and find little to no evidence of any effect on the level and composition of public expenditure in beneficiary countries. Other adversaries state that debt relief by itself will not improve a country's macroeconomic situation; instead, improvements in economic institutions, potentially more effectively achieved through direct foreign aid, are necessary (Arslanalp & Henry, 2006). It is also argued by Easterly (2002) that highly indebted countries respond to receiving debt relief by accruing more debt or by depleting their assets. This argument is consistent with the reasoning of Vaggi & Prizzon (2014), who attribute the effect of countries moving *away* from attaining sustainability as they get debt relief to having less constraints on accruing more debt.

Focusing specifically on the impact of debt relief under the HIPC initiative, Djimeu (2018) shows a positive relationship between debt relief under the HIPC initiative and public investment in SSA from the start of the initiative up until 2014. Specifically, the author finds that the post-decision point and post-completion point periods are both associated with significant increases in public investment. No such effect is however found on economic growth and private investment. Moreover, Temah (2009) presents significant and robust results that government health expenditure in SSA starts to increase as soon as a country reaches HIPC decision point, indicating that the reforms undertaken as a prerequisite for becoming eligible, such as developing and starting to implement the PRSP, may be of significance.

The literature on actual health impacts of the HIPC initiative and MDRI is relatively limited. However, Welander (2016) contributes by utilizing microdata on infant mortality across 56 low- and middle-income countries of which 31 are HIPCs. Welander finds that after an indebted country enters the initiative, the probability of an infant dying goes down about half a percentage point, meaning about 3,000 fewer infant deaths in an average HIPC. No infant health effects are however found from graduating the program and receiving full debt relief.

Schmid (2009) undertakes a near identical analysis by also analyzing microdata on infant mortality across low-income HIPCs and non-HIPCs, and provides robust evidence that the infant mortality rate is reduced for post-decision HIPCs. Furthermore, no significant effect of the actual amount of debt relief on infant mortality is found, and Schmid (2009) concludes that the effectiveness of debt relief likely depends on whether the relief improves the economic and political institutions in charge of public service delivery within the country.

The beneficial impact of the HIPC initiative on infant mortality, as demonstrated by Welander (2016) and Schmid (2009), also seem to carry over to under-five mortality in SSA, where it is found that participation in the HIPC initiative is associated with a significant decrease in the under-five mortality rate (Oryema et al., 2017). The same study finds no impact of the amount of debt relief, which is in line with the findings of Schmid (2009), once again suggesting that development progress may be more strongly associated with the mere participation in the initiative and the reforms that follow, rather than the actual amount of debt relief. We are not aware of any studies that contest the findings regarding the health effects of debt relief under the HIPC initiative.

4.1.3 Debt relief vs. foreign aid

Foreign aid, although not the focus of this paper, is another, arguably more common, ODA tool that may or may not complement debt relief. Analyzing the substitutability and complementarity of foreign aid and debt relief in SSA, Powell & Bird (2010) address the complexity that characterizes the relationship between these development assistance tools. The authors clarify that the connection is not uniform; the relationship can be positive, as countries with higher debt stocks often encounter greater economic and developmental challenges and thus receive more aid; or it could be negative if aid donors perceive rising debt stocks as a sign of poor macroeconomic management, and consequently reduce aid. Powell & Bird (2010) do however empirically demonstrate that donor and creditor countries seem to be using debt relief and foreign aid to SSA recipients as complementary assistance tools, though the specifics of allocation are ambiguous. Regarding the role of foreign aid directed specifically at beneficiaries' health sectors, it appears largely consistent with that of debt relief in terms of health outcomes. For instance, Bendavid & Bhattacharya (2014) show that in a total of 140 aid-recipient countries between 1974 and 2010, increases in health aid were associated with significant reductions in the under-five mortality rate, as well as significant increases in life expectancy. Similarly, Banchani & Swiss (2019) use a sample of 130 low- and middle-income countries between 1996-2015 to analyze the impacts of both total foreign aid and aid directed specifically to the reproductive health sector on maternal health. The authors find that the directed aid is associated with significant reductions in maternal mortality.

Overall, the findings presented in this section suggests that debt relief as a development assistance tool is similar in effect to foreign aid, and both seem to play valuable roles in improving health in developing regions.

5 Methodology

The methodology in this study, including the econometric model specifications, assumptions and choice of control variables, follows to some extent a combined approach based on those taken by Banchani & Swiss (2019) and Oryema et al. (2017). Both studies utilize similar methods and control variables that are relevant for the purposes of this paper, and by adopting and combining parts of the basic frameworks of these studies, we ensure some degree of comparability to existing research. Additionally, this study adopts Temah's (2009) approach of using dummy variables to indicate debt relief initiative participation, specifically identifying which stage of the initiative is reached, which is also done in a slightly simplified fashion by Oryema et al. (2017). The advantages of following this specification lie in the ease of isolating and interpretating the potential impact of each specific stage, as well as making it possible to utilize the variation in initiative participation across time and countries (Temah, 2009; Oryema et al., 2021). This is discussed in-detail in section 6.

Specifically, one of the main underlying assumptions of this paper is that there is a temporal lag in which the chain of effects of debt relief might occur. This assumption is supported by four main arguments. First, as per the discussion on the delayed fiscal effects of debt relief in section 2.4.1 following Gupta et al. (2002), it is plausible to assume that there is a delay between the point of being granted debt relief and it being converted into fiscal capacity ready to be utilized in the national budget and subsequent development spending. Second, it follows much of the literature on development assistance. Two examples are Banchani & Swiss (2019) who specifically examine one-to-five-year lagged effects of foreign aid on maternal mortality, and Self & Grabowski (2003), who use lagged explanatory variables to examine the effects of public health expenditure on overall health, stating that conventional wisdom implies that there is some temporal lag between socioeconomic improvements and health outcomes. The third reason for using lagged explanatory variables in the main analysis is to address potential endogeneity issues. Such issues can arise from reverse causality if maternal health outcomes partly reflect a country's macroeconomic conditions, which in turn influences the likelihood of receiving debt relief. Additionally, some omitted variable bias may be resolved if there are unobserved factors within the error term for given country in a specific year that correlates with the 'receipt' of debt relief in the same year. This approach is utilized by Oryema et al. (2017) and Temah (2009) among others, who instrument potentially endogenous explanatory variables by their lagged values in instrumental variable models such as the system Generalized Method of Moments (GMM). This paper also employs the system GMM model for comparison purposes; it is thus elaborated upon below. Lastly, it needs to be considered that debt relief may be granted toward the end of a given year. If a country becomes eligible in, say, November or December, it is unreasonable to assume there to be any effects in that same year.

5.1 Model specifications

Following the arguments above for lagging the debt relief explanatory variables, we specifically employ a three-year temporal lag. This duration is chosen not arbitrarily but to adequately capture two distinct types of delays: the potential delayed fiscal effects of debt relief, and the time required for maternal health outcomes to improve on an aggregate level. While effects might persist beyond three years, no further extension of lags are employed due to a limited time frame. Moreover, when assessing the relationship between the debt relief initiatives and government health expenditure, the temporal lag is restricted to one year since this should be sufficient to account for the potential delay in fiscal effects only. For robustness and to examine whether there may be effects of a more contemporaneous nature, the analyses on both maternal health and health expenditure outcomes are repeated with two-year-lags and no lag, respectively.

Hence, the baseline regressions are as follows:

$$health_{it} = \alpha + \beta \boldsymbol{relief}_{it-3} + \gamma \boldsymbol{X}_{it} + \varepsilon_{it} \tag{5.1}$$

$$expenditure_{it} = \alpha + \beta \boldsymbol{relief}_{it-1} + \gamma \boldsymbol{X}_{it} + \varepsilon_{it} \tag{5.2}$$

In equation (5.1), $health_{it}$ is one of four maternal health outcome variables for country i in year t; $\boldsymbol{relief}_{it-3}$ is a vector of four key explanatory variables indicating HIPC initiative and MDRI participation as well as the real amount of debt relief per capita for country i in year $t-3$; $\boldsymbol{X}_{it}$ is a control vector for country i in year t; and ε_{it} is the error term for country i in year t. The terms in equation (5.2) are analogous, with two differences: the outcome variable, $expenditure_{it}$, now represents government health expenditure as a share of GDP for country i in year t, and the key explanatory variables within $\boldsymbol{relief}_{it-1}$ are lagged by one year instead of three. All variables are outlined in detail in section 6.

5.1.1 Random effects

Following Temah (2009), the baseline model is not estimated using pooled ordinary least squares (POLS). Rather, it is estimated using a random effects (RE) model. The motivation for using RE over POLS is that POLS accounts only for the between-country variation by completely subsuming any unobserved time-invariant country-specific effects, denoted by c_i, in the error term ε_{it}. If c_i is then correlated with the explanatory variables as well as the outcome variables, which is plausible, it leads to endogeneity issues and biased estimates. However, a consistent RE model requires that c_i be uncorrelated with all explanatory variables, which we assume not to be the case (Wooldridge, 2018). We make this assumption because country-fixed effects such as historical events, natural resources, cultural factors and rigid political attitudes and institutions may influence both maternal healthcare provision and participation in the debt relief initiatives. If our assumption is correct, it could potentially cause some inconsistency. However, the RE transformation only *partially* subsumes c_i in ε_{it} (Wooldridge, 2018). This means that RE likely has *less* bias than POLS under the given assumptions (ibid.). Hence, we get a weighted average of the *between* estimator (POLS) and the *within* estimator (FE), which is generally more efficient than POLS when dealing with panel data in a context such as this (ibid.).

Moreover, the decision to use RE is supported by a Breusch-Pagan test, where rejection of the null hypothesis $H_0\colon \sigma_c^2 = 0$ (i.e., rejection of the null that there is zero variability in the country-fixed effects term), indicates appropriateness of the RE model over POLS (Wooldridge, 2018). Conversely, not rejecting essentially means that the unobserved country-specific term c_i is negligible – in that case, all weight is given to the between estimator, making RE estimates equivalent to POLS estimates (ibid.). The null hypothesis is rejected for each regressed outcome variable in this study, thereby supporting the use of RE over POLS.

5.1.2 Fixed effects transformation

Since endogeneity issues likely persist, we further specify our model using fixed effects estimation (FE), following Banchani & Swiss (2019). The FE model is beneficial in this context since it considers the within-country variation *only*, meaning that the model controls for all unobserved and time-invariant country-specific characteristics by eliminating them through fixed effects transformation. The FE estimator allows for correlation between c_i and the explanatory variables, as opposed to the RE estimator, and any explanatory variable that is constant over time for country i, such as c_i, therefore gets eliminated by the transformation, and some endogeneity may be resolved as a result (Wooldridge, 2018). Hence, FE is widely perceived as a more convincing strategy than RE in the context of policy analysis using panel data (ibid.). The benefit of applying this additional FE model specification is confirmed by running Hausman tests for all regressions, which test the null hypothesis that RE and FE estimators do not substantially differ, meaning the choice between them is inconsequential. The null hypothesis is rejected for all outcome variables except for one, implying that FE estimation is largely appropriate (Wooldridge, 2018).

Generally, the Hausman test is commonly used to determine whether the RE or the FE estimator is more appropriate for a given panel data analysis (Wooldridge, 2018). By including both models in this paper, we allow for a comparison under the models' differing assumptions about the correlation between the unobserved country-fixed characteristics and the explanatory variables. Additionally, this approach allows for a robustness check.

5.1.3 System GMM

Consistent with previous studies on the effects of debt relief, an additional specification is employed – the system Generalized Method of Moments (GMM) (Oryema et al., 2017; Temah, 2009; Welander, 2016). This specification is made primarily to allow for some comparison to previous research. The system GMM is tailored for panel data analysis and is generally applicable in analyses where: 1) the setting is dynamic, meaning that current values of the outcome variables are influenced by their lagged values, 2) there are fixed unit-specific effects, 3) some explanatory variables are assumed to be endogenous, 4) error term disturbances are uncorrelated across cross-sectional units, 5) the data set contains many cross-sectional units N relative to the number of time periods T (Roodman, 2009). Given these conditions and the characteristics of our data, including the system GMM as an additional specification is of relevance.

Essentially, the system GMM estimator creates a system of two equations – one where first-differencing is done to remove any country-fixed effects and one corresponding level equation containing the original and untransformed variables. Lagged *differences* of the endogenous variables are then used as instruments in the *level* equation, and lagged *levels* of the endogenous variables are used as instruments in the *differenced* equation, where these instruments are used explicitly for resolving potential endogeneity (Windmeijer, 1998). Roodman (2009) does however highlight that a shortcoming of the system GMM is its specification complexity, and that it can easily produce unreasonable estimates. Given this complexity, the system GMM estimates presented in this paper may be unreliable, and they should be interpreted with this in mind.

5.2 Autocorrelation, multicollinearity and a time-trend

Autocorrelation in panel data, meaning correlated error terms over time, yields inconsistent standard errors and estimates (Drukker, 2003). The inherent issue with autocorrelation being present is that Stata – the statistical software used for this analysis – treats all observations within a country as being statistically independent, which is not plausible. Drukker (2003) recommends the Wooldridge test for detecting first-order autocorrelation due to its applicability and easy implementation. Consequently, Wooldridge tests are conducted for all regressions, where the null hypothesis of there being no first-order autocorrelation is tested. The test rejects for all outcome variables, indicating presence of autocorrelation. This is addressed by clustering the standard errors at the country-level for each regression, making them robust to within-country autocorrelation, while assuming cross-country independence.

Ensuring reliable estimates further requires addressing potential multicollinearity among the explanatory variables. Multicollinearity occurs when the explanatory variables are highly correlated, potentially resulting in unreliable estimates. A commonly used measure to test for multicollinearity is the Variance Inflation Factor (VIF), which tests the degree of multicollinearity of each explanatory variable with the others (O'brien, 2007). The general threshold is a VIF exceeding 10, which indicates serious multicollinearity (ibid.). Accordingly, a VIF test is conducted, resulting in values ranging from 1.04 to 6.76 with a mean VIF of 3.65. This implies some degree of multicollinearity, possibly causing some inconsistency in the results. However, following the rule of 10, multicollinearity should not pose a serious problem.

Following Oryema et al. (2017), the models are further specified with year dummy variables to control for time-specific effects, which could be, for instance, improvements in healthcare technology.

5.3 Methodological limitations

While the estimation methods in this study are employed specifically to enhance efficiency and remove potential bias, it is likely that the key explanatory variables remain endogenous to some degree. The baseline specification uses RE rather than POLS, simply because we do not expect POLS to appropriately address issues with endogeneity, whereas it is expected that the RE estimator may be more consistent in this regard. However, even with the use of relevant control variables, endogeneity issues are still expected to persist in the RE model due to any potential confounding factors that remain in the composite error term, i.e., the error term ε_{it} plus the part of c_i that is still subsumed in it. Moreover, the FE estimation effectively removes all unobserved constant country-specific effects, yet any unobserved time-varying country-specific factors remaining in the error term may still cause omitted variable bias and endogeneity issues. Ideally, the system GMM should resolve much of this. However, due to the model's sensitivity to specification errors and overall complexity, there is a risk that the estimates are inconsistent. Selecting instruments for this model that satisfy both the instrument exogeneity and relevance assumptions is challenging, especially given the constrained time frame for writing this paper. Hence, while the employed model specifications are likely to have resolved some endogeneity, and statistically significant relationships may suggest true effects, these findings should not be interpreted as causal.

A further limitation is the loss of observations during the initial years, which is a consequence of the lags. Although it has been argued that temporal lags are necessary for several reasons, they may result in missing some potential effects of the preparation and eventual implementation of the PRSP in the pre-eligibility period, i.e. before reaching decision point. As presented in section 4.1, previous research has suggested that any eventual reforms and strategies undertaken in the pre-eligibility period as a means of reaching eligibility and decision point, may independently impact health outcomes (Temah, 2009). Losing out on these potential effects for some countries may be problematic in terms of achieving consistent results. However, as has been discussed, the assumption is that increased fiscal space and subsequent increased health expenditure following debt relief is the primary mechanism through which maternal health outcomes may be improved; if so, the benefits of temporal lags arguably outweigh the drawbacks mentioned.

6 Data

6.1 Data sources and sample

A panel data set consisting of 47 SSA countries over the period 2000-2019 is compiled using data from three reliable sources: the World Bank databases, the OECD Creditor Reporting System (CRS) database, and the IMF's HIPC Initiative and MDRI Statistical Update. The data set includes five outcome variables, sourced from the World Bank's *World Development Indicator* database (World Bank, 2024*a*). The four key explanatory variables are constructed using information from the IMF's HIPC and MDRI Initiative Statistical Update (2019), disbursed debt relief data from the OECD CRS (2024), and population figures from the World Bank's *Population Estimates and Projections* database (2024*b*). Additionally, the control variables are collected from three specific World Bank databases: *World Development Indicators*; *Worldwide Governance Indicators;* and *Health, Nutrition and Population Statistics* (2024*a*; 2024*c*; 2024*d*).

The sample includes all countries designated as part of SSA, according to the World Bank's classification (World Bank, n.d.). Although this classification excludes Djibouti, which is handled administratively as being part of the Middle East and North Africa, it is included in this study due to its geographical location in SSA, as well as to increase the number of data points (ibid.). Descriptive statistics for all variables are found in **table 6.1** below, while **table A.1** of Appendix A lists all countries included in the sample. Note however that Somalia and South Sudan, which are included in this list, are excluded from the sample due to lacking adequate data.

Table 6.1 Descriptive statistics

	(1) Obs.	(2) Mean	(3) Std. Dev.	(4) Min	(5) Max
Outcome variables					
Maternal mortality ratio (per 100k live births)	940	495.964	285.470	3	1682
Lifetime risk of maternal death (%)	940	2.646	1.839	0.009	10.314
Low-birthweight babies (% of births)	700	15.431	3.640	8.936	25.518
Prevalence of anemia among preg. women (%)	940	46.250	10.303	22.800	61.600
Gov. health expenditure (% of GDP)	930	1.608	1.128	0.060	6.050
Key explanatory variables					
HIPC decision point	940	0.138	0.345	0	1
HIPC completion point	940	0.434	0.496	0	1
MDRI delivery point	940	0.387	0.487	0	1
Real debt relief per cap (2021 $, thousands)	940	0.008	0.041	0	0.858
Control variables					
Urban population (% of pop.)	940	40.359	17.015	8.250	89.740
Access to basic sanitation services (% of pop.)	933	32.967	21.758	2.794	100
Access to basic water services (% of pop.)	935	62.262	16.502	18.682	99.962
GDP per cap (PPP 2017 int $)	906	8.014	0.901	6.432	10.483
Government effectiveness	892	4.666	1.658	1.561	10
Political stability	893	5.534	2.174	0	10
Control of corruption	893	3.565	2.145	0	10
External health expenditure (% of current health expenditure)	927	20.640	16.538	0	74.820
Adolescent fertility rate, births per 1000 women aged 15-19	940	109.264	40.100	22.629	205.385
Crude birth rate (per 1000 people)	940	36.304	7.751	10.100	52.659

Source: Data from OECD Creditor Reporting System (2024), IMF's HIPC initiative and MDRI Statistical Update (2019) and World Bank's databases (2024*a*; 2024*b*; 2024*c*; 2024*d*)

6.2 Variables

6.2.1 Outcome variables

The main outcome investigated in this paper is maternal health which is arguably a somewhat broad concept. Therefore, maternal health is differentiated into maternal mortality and maternal morbidity. Two outcome variables are used to evaluate maternal mortality: *maternal mortality ratio* (*MMR*) and *lifetime risk of maternal death,* whereas maternal morbidity is proxied by the outcome variables *low birthweight babies as a share of total births* and *prevalence of anemia among pregnant women*. In the evaluation of the paper's second objective – the relationship between debt relief under the inititatives and government health expenditure – the outcome variable *government health expenditure relative to GDP* is utilized.

- *Maternal mortality*

The *MMR* estimates the number of women who die from pregnancy-related causes during pregnancy or within 42 days of a concluded pregnancy per 100,000 live births (World Bank, 2024*a*). Since *MMR* data are derived from regression analysis using variables such as fertility rates, birth attendant presence and PPP GDP, they are subject to potential measurement error and unreliable estimates (ibid.). To address this, the variable *lifetime risk of maternal death*, which is of a similar nature as *MMR*, is added as an outcome variable to serve as a robustness check. *Lifetime risk of maternal death* is defined as the probability of a 15-year-old female eventually dying from maternal causes, given constant fertility and mortality rates (World Bank, 2024*a*). Although this variable is similarly based on estimates and may share the same potential unreliability as the *MMR*, including it provides for a more robust analysis. A similar approach is undertaken by Banchani & Swiss (2019), though they utilize the slightly different indicator *maternal mortality rate*, and further validate their results by using that same indicator from an alternative source. Although a sound strategy, we argue that using two different, but largely related, indicators may provide for a slightly more nuanced and thorough assessment. Furthermore, the decision to use the *maternal mortality ratio* rather than the *maternal mortality rate* is argued by the former's direct association to the SDG target 3.1 of reducing the global maternal mortality ratio to less than 70 per 100,000 live births (UN, n.d.). This allows for a more relevant evaluation of maternal health progress toward the SDGs.

- *Maternal morbidity*

Low birthweight of babies is used as a proxy and refers to newborns weighing less than 2,500 grams at birth, a condition often associated with maternal disease and malnutrition (World Bank, 2024*b*). Furthermore, low birthweight prevalence has been shown to be associated with inadequate prenatal care (Nobile et al., 2007). The outcome variable *low birthweight of babies as a share of total births* thus serves as a relevant proxy variable for maternal morbidity. Given that these data are estimates and may carry some degree of unreliability, an additional indicator for maternal morbidity is included to provide for a more comprehensive and reliable analysis. This indicator is *prevalence of anemia among pregnant women*, defined by pregnant women whose hemoglobin levels are below a specified threshold. This condition impairs the oxygen-carrying capacity, and is commonly caused by nutrient deficiencies, infections, inflammations and gynecological conditions (WHO, n.d.).

- *Government health expenditure*

Government health expenditure relative to GDP is utilized as the outcome variable to evaluate the priority given to domestically funded healthcare with regards to the whole economy, which may in turn affect maternal health. Using a relative measure rather than an absolute amount is in line with Temah (2009), and is more meaningful since it does not take into account the actual economic capacity of a country which may influence how much public funds are allocated to the health sector. The estimates, prepared by the WHO under the System of Health Accounts 2011 framework, track all healthcare spending in each country for a specified time period, resulting in consistent and reliable data (World Bank, 2024*a*). Given this, no further indicators are added for robustness.

6.2.2 Key explanatory variables

As key explanatory variables, four variables are created, including three dummy variables for *HIPC decision point*, *HIPC completion point* and *MDRI delivery point*, alongside one continuous variable approximating *real debt relief per capita*. Following the methodology used by Temah (2009) and Oryema et al. (2017), the *HIPC decision* dummy is assigned the value 1 for eligible countries from the year they reach decision point up until the year completion point is reached, but not including that year to prevent overlap with the completion stage. The value 0 is assigned otherwise. The *HIPC completion* dummy takes the value 1 from the year countries reach completion point and onwards, and 0 otherwise. Similarly, the *MDRI delivery point* dummy takes the value 1 starting from the year countries begin receiving MDRI debt relief and onwards, and 0 otherwise. This construction is beneficial as it allows for isolating the effect of each debt relief stage on the outcome variables. Additionally, it utilizes the variation of the timing of initiative participation across SSA countries, as explained by Oryema et al. (2017). Furthermore, this analysis extends that of Temah's (2009) by incorporating the *MDRI delivery point* dummy, thereby specifically isolating this stage.

Real debt relief per capita is calculated as an approximate measure of the annual per capita debt relief in real terms provided during the initiatives. This variable is constructed using data from the OECD CRS database (2024), which includes aggregate disbursed real debt relief from major multilateral creditors, such as the World Bank, IMF, African Development Bank and EU institutions. According to the IMF (2019), these creditors are among the primary multilateral participants and account for a little under 70% of the total multilateral debt relief provided during the initiatives. Debt relief from other multilateral creditors, most of which have missing or incomplete data in the OECD CRS database, are therefore excluded.

For bilateral debt relief under the initiatives, accurate data isolation for annual relief in real terms is challenging. This relief primarily comes from the Paris Club countries, an informal group of 22 major creditor nations (IMF, 2019; Paris Club, n.d.). 19 of these countries are also members of the DAC, which in turn consists of 32 countries (OECD, n.d.*c*). Therefore, bilateral relief is approximated using the debt relief provided by the DAC countries during the years of the initiatives. To transform it into per capita terms, population estimates from the World Bank's *Population Estimates and Projections* database are used (World Bank, 2024*b*). The annual total of real debt relief, consisting of both multilateral and bilateral sources for each country, is then divided by its estimated population for each corresponding year.

6.2.3 Control variables

The control variables included in this analysis are selected based on their potential confounding effects on the relationship between key explanatory variables and outcome variables, many of which are drawn from those used in previous research (Banchani & Swiss, 2019; Oryema et al., 2017; Temah, 2009). These include *GDP per capita* (which is logged), *share of population living in urban areas*, *government health expenditure relative to GDP*, *adolescent fertility rate* and two Worldwide Governance Indicators – *government effectiveness* and *control of corruption*. We control for these variables to account for the broader economic, demographic and governance factors that are likely to influence maternal health outcomes. It is important to note that *government health expenditure relative to GDP* is added as a control here, specifically following Oryema et al. (2017), while it is serves as the outcome variable when evaluating the relationship between debt relief and government health expenditure – in which case it is not controlled for. Although a key assumption is that the potential impact of debt relief on maternal health primarily occurs through increased health expenditure with the involvement of a probable temporal lag, the non-lagged *government health expenditure relative to GDP* variable is added to the maternal health outcome regressions to control for the potential impact of an increase in government health expenditure that might originate from factors *other* than debt relief.

The variables *access to basic water services* and *access to basic sanitation services* are also controlled for, following Pickbourn & Ndikumana (2016) in their analysis of the impact of health sector aid on the maternal mortality rate. Arguably, access to clean water and adequate sanitation is vital for maintaining sufficient health. Moreover, this analysis controls for an additional governance indicator – *political stability*, which also captures absence of violence

(World Bank, 2024*c*). This choice is motivated by findings that armed conflict in SSA increases the risk of maternal deaths (Kotsadam & Østby, 2019). Furthermore, the scales for all Worldwide Governance Indicators, which originally range from negative to positive values, are recoded to span from 0 to 10 for clarity. The analysis makes two additional extensions by controlling for the *crude birth rate* with the argument that high birth rates may overburden healthcare systems, which in turn may affect health outcomes, as well as *external health expenditure*, which constitute all financial inflows to the national health system from outside the country, mainly foreign health aid transfers (World Bank, 2024*a*).

Since all control variables are included primarily to eliminate potential confounding effects, they are not addressed in further detail. However, some particularly relevant ones are briefly discussed in section 7 and 8.

6.3 Data limitations

The data and variables used in this analysis are subject to several constraints, which may impact the results of this study. Firstly, the data for all continuous variables are macro-level estimates, which can sometimes be unreliable or incorrect. This issue is particularly common for health-related data in African countries, as noted by Musa et al. (2023). Secondly, many relevant and interesting variables used in previous studies, both as outcome variables and control variables, are excluded due to missing data. For instance, Banchani & Swiss (2019) control for the prevalence of skilled birth attendants and contraceptive use – arguably important for eliminating confounding effects – and replace missing data with the most recent year's non-missing data. This approach is not adopted in this analysis due to concerns about the general reliability of such data; omitting the variables may however produce biased results, which needs to be considered. Lastly, isolating annual total debt relief given to each country exclusively under the HIPC initiative and MDRI is difficult, and previous studies do not make it explicitly clear how this is undertaken. This presents two key issues. The first issue, as discussed, is that the constructed variable *real debt relief per capita* is an approximation, and although likely yielding reasonably correct estimates, the figures are not exact which could lead to results that differ from those that would have been obtained with more precise data. The second issue is that *real debt relief per capita* also includes smaller amounts of debt relief received by non-HIPCs, i.e., countries that are not part of the HIPC initiative and MDRI.

Despite this, the overall trend that HIPCs receive substantially more debt relief per capita remains consistent. Additionally, instances of missing debt relief data for some countries in certain years are replaced with zero values, which could potentially skew the results. However, given that it is creditor organizations and countries who report the data and not recipients, it is not unreasonable to assume that missing data may actually correspond to no or minimal provided debt relief.

Despite these potential issues, the variables used in the analysis remain relevant, and there is generally little missing data. Also, the use of two separate variables to respectively indicate both maternal mortality and morbidity should, as mentioned, provide some robustness against these limitations.

7 Results

In the regression tables **7.1-7.5** presented below, columns (1) and (2) display the results using the RE specification, with column (2) specifically incorporating year dummies to control for a time-trend. Columns (3) and (4) show the results from the FE specification, with column (4) similarly controlling for a time-trend by adding year dummies. Column (5) presents the results from the system GMM specification.

7.1 Maternal mortality ratio

The regression results for *maternal mortality ratio* (*MMR*) are detailed in **table 7.1**. Utilizing RE and FE estimators without year dummies, columns (1) and (3) display negative and statistically significant coefficients for the *HIPC decision point* at the 1% significance level. When controlling for a time-trend, the coefficients remain negative and significant but at the 5% level across both specifications. Similarly, coefficients for the *HIPC completion point* are negative and significant at the 1% level without year dummies and at the 10% level with year dummies. These results suggest that there is a decrease in the *MMR* upon reaching these points.

Although the effect of reaching completion point on the *MMR* appears to be marginally stronger than that of reaching decision point when not controlling for a time-trend, the coefficients are overall quite similar in magnitude across both the RE and FE specifications. The system GMM specification shows positive coefficients for both decision point and completion point, although statistically insignificant. For the *MDRI delivery point*, coefficients vary and are insignificant across both the RE and FE specifications. The system GMM specification does however show a negative and statistically significant coefficient at the 10% level. Still, results for this stage are mostly inconclusive. The coefficients for *real debt relief per capita* are insignificant across all specifications.

Most control variables displaying statistically significant coefficients have the expected signs, most notably *log GDP per capita* which indicates that income negatively correlates with maternal mortality. However, the results for government health expenditure relative to GDP are particularly noteworthy. These coefficients are positive and robust across all specifications except for the system GMM, suggesting that higher economic prioritization of the health sector is associated with an increase in the MMR, which directly contrasts the key assumption that increased health expenditure should lead to improved health outcomes. This result, along with a more general discussion regarding some control variables, is further outlined in section 8.

Table 7.1 Outcome variable: Maternal mortality ratio

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE	(5)[a] GMM
HIPC decision point $_{t-3}$	-58.300***	-39.410**	-59.153***	-38.387**	85.276
	(19.506)	(17.756)	(19.108)	(17.200)	(103.850)
HIPC completion point $_{t-3}$	-68.022***	-40.929*	-67.161***	-40.301*	98.300
	(24.330)	(24.125)	(24.278)	(23.277)	(101.831)
MDRI delivery point $_{t-3}$	-1.391	-27.764	0.849	-29.254	-45.874*
	(15.943)	(24.037)	(16.187)	(24.657)	(25.998)
Real debt relief per cap $_{t-3}$	58.388	68.037	52.571	84.608	-16.277
	(54.124)	(62.775)	(52.227)	(57.332)	(67.539)
Urban population	1.329	5.112**	1.769	11.719***	-8.990
	(3.029)	(2.546)	(5.022)	(4.278)	(7.034)
Access to basic sanitation services	0.703	1.326	1.159	2.434	-6.155
	(2.203)	(2.112)	(2.749)	(2.442)	(5.291)
Access to basic water services	-5.338*	-4.865*	-5.892*	-6.270**	11.509
	(3.051)	(2.735)	(3.471)	(2.719)	(9.471)
Log GDP per cap (PPP)	-125.976***	-116.276***	-143.371***	-70.765	133.823
	(33.976)	(40.006)	(44.289)	(60.949)	(148.313)
Government effectiveness	2.023	-10.511	2.790	-9.788	-42.492
	(13.673)	(12.696)	(14.737)	(12.963)	(43.816)
Political stability	-4.708	-7.488	-3.563	-5.221	5.997
	(8.173)	(7.282)	(8.478)	(7.532)	(15.430)
Control of corruption	10.779	8.232	12.204	9.395	82.998
	(10.006)	(9.148)	(10.733)	(9.427)	(52.191)
Government health expenditure	32.324*	42.396**	33.860**	48.706***	9.786
	(17.300)	(16.718)	(16.715)	(15.078)	(39.963)
External health expenditure	-0.702	0.393	-0.413	0.804	0.973
	(1.073)	(0.981)	(1.164)	(1.030)	(1.111)
Adolescent fertility rate	0.544	0.096	0.539	-0.232	2.635
	(1.093)	(1.011)	(1.363)	(1.290)	(3.541)
Crude birth rate	13.952**	4.955	14.502*	1.510	1.104
	(6.723)	(6.329)	(7.670)	(7.257)	(13.849)
Lagged dependent variable					0.753***
					(0.268)
Constant	1168.667***	1428.704***	1266.897**	1033.414**	-1645.282
	(357.047)	(372.661)	(473.268)	(509.641)	(1364.023)
Observations	843	843	843	843	664
R^2	0.50	0.56	0.49	0.55	–
Year dummies	No	Yes	No	Yes	No
Country FE	No	No	Yes	Yes	No

Notes: Clustered standard errors are given in parentheses.
[a]Lags of key explanatory variables are included as instruments in the system GMM up to the fourth lag, similarly to the approach of Oryema et al. (2017). Thus, the index *t*-3 should be disregarded for column (5).
*** p<.01, ** p<.05, * p<.1

7.2 Lifetime risk of maternal death

Displayed in **table 7.2** are the regression results for *lifetime risk of maternal death* as the outcome variable. The findings are largely similar to those in **table 7.1** – the HIPC decision and completion point coefficients are negative and statistically significant at the 1% level across the RE and FE specifications excluding year dummies. When a time-trend is controlled for, the coefficients remain significant with the same sign but at the 5% and 10% level for the RE and FE specification, respectively. This consistency across specifications aligns with the observed results for the *MMR*, suggesting that reaching decision point and completion point are associated with a statistically significant decrease in maternal mortality. Furthermore, the coefficients for *MDRI delivery point* are negative and statistically significant at the 10% level for the RE and FE specifications including year dummies. However, the coefficients for *real debt relief per capita* are insignificant across all specifications, and the system GMM specification displays insignificant coefficients for all key explanatory variables. It is again noted that government health expenditure relative to GDP has positive and statistically significant coefficients across the RE and FE specifications with year dummies. This is discussed in section 8, as mentioned.

Table 7.2 Outcome variable: Lifetime risk of maternal death (%)

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE	(5)[a] GMM
HIPC decision point $_{t-3}$	-0.338***	-0.240**	-0.355***	-0.246**	-0.335
	(0.103)	(0.094)	(0.101)	(0.095)	(0.907)
HIPC completion point $_{t-3}$	-0.406***	-0.255*	-0.407***	-0.255*	-0.281
	(0.142)	(0.140)	(0.140)	(0.136)	(0.892)
MDRI delivery point $_{t-3}$	-0.019	-0.214*	-0.007	-0.221*	-0.196
	(0.094)	(0.125)	(0.093)	(0.127)	(0.239)
Real debt relief per cap $_{t-3}$	0.204	0.375	0.154	0.437	-0.085
	(0.306)	(0.361)	(0.291)	(0.326)	(0.566)
Urban population	0.015	0.033**	0.023	0.070***	-0.068
	(0.015)	(0.014)	(0.025)	(0.026)	(0.056)
Access to basic sanitation services	0.013	0.014	0.013	0.018	-0.028
	(0.013)	(0.012)	(0.016)	(0.014)	(0.039)
Access to basic water services	-0.036**	-0.034**	-0.041**	-0.042***	0.087
	(0.015)	(0.014)	(0.018)	(0.015)	(0.079)
Log GDP per cap (PPP)	-0.752***	-0.650***	-0.790***	-0.383	-0.265
	(0.205)	(0.225)	(0.241)	(0.312)	(1.108)
Government effectiveness	0.074	0.020	0.075	0.021	-0.123
	(0.064)	(0.060)	(0.071)	(0.061)	(0.354)
Political stability	-0.031	-0.045	-0.023	-0.032	0.102
	(0.050)	(0.044)	(0.051)	(0.045)	(0.111)
Control of corruption	0.039	0.026	0.043	0.028	0.381
	(0.052)	(0.046)	(0.057)	(0.048)	(0.445)
Government health expenditure	0.139	0.189**	0.150	0.221***	-0.169
	(0.091)	(0.085)	(0.090)	(0.075)	(0.309)
External health expenditure	-0.005	0.001	-0.003	0.004	0.001
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Adolescent fertility rate	0.011*	0.008	0.012*	0.008	0.020
	(0.006)	(0.005)	(0.007)	(0.006)	(0.025)
Crude birth rate	0.108***	0.072**	0.109***	0.054	-0.049
	(0.031)	(0.033)	(0.035)	(0.039)	(0.107)
Lagged dependent variable					0.909**
					(0.420)
Constant	4.582**	5.264***	4.594*	2.876	-0.717
	(1.877)	(2.013)	(2.323)	(2.545)	(9.502)
Observations	843	843	843	843	664
R^2	0.64	0.68	0.64	0.67	–
Year dummies	No	Yes	No	Yes	No
Country FE	No	No	Yes	Yes	No

Notes: Clustered standard errors are given in parentheses.
[a]Lags of key explanatory variables are included as instruments in the system GMM up to the fourth lag, similarly to the approach of Oryema et al. (2017). Thus, the index *t*-3 should be disregarded for column (5).
*** p<.01, ** p<.05, * p<.1

7.3 Low birthweight babies

Table 7.3 displays the regression results with *low birthweight babies* as the outcome variable, serving as a proxy for maternal morbidity. In the RE and FE specifications without year dummies, the coefficients are negative with similar magnitudes and statistically significant at the 5% level. However, once adding year dummies, these results become statistically insignificant, indicating that that a time-trend may be confounding the previously significant relationships. Across all specifications, the coefficients for *HIPC completion point*, *MDRI* *delivery point* and *real debt relief per capita* remain statistically insignificant, suggesting that these factors do not significantly impact the prevalence of low birthweight babies.

Table 7.3 Outcome variable: Low birthweight babies (% of births)

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE	(5)[a] GMM
HIPC decision point $_{t-3}$	-0.153**	-0.109	-0.153**	-0.112	-0.031
	(0.072)	(0.070)	(0.073)	(0.070)	(0.103)
HIPC completion point $_{t-3}$	-0.071	-0.035	-0.070	-0.039	-0.052
	(0.102)	(0.107)	(0.102)	(0.107)	(0.110)
MDRI delivery point $_{t-3}$	-0.133	-0.159	-0.125	-0.153	0.004
	(0.082)	(0.101)	(0.082)	(0.102)	(0.023)
Real debt relief per cap $_{t-3}$	-0.120	-0.010	-0.123	-0.012	0.015
	(0.196)	(0.161)	(0.197)	(0.157)	(0.049)
Urban population	-0.007	0.034	-0.007	0.035	-0.002
	(0.027)	(0.046)	(0.029)	(0.053)	(0.008)
Access to basic sanitation services	-0.005	-0.003	-0.004	-0.002	0.002
	(0.018)	(0.018)	(0.019)	(0.019)	(0.004)
Access to basic water services	-0.023	-0.028	-0.025	-0.029	0.004
	(0.019)	(0.020)	(0.019)	(0.021)	(0.012)
Log GDP per cap (PPP)	-1.300***	-1.059***	-1.390***	-1.109**	-0.048
	(0.351)	(0.393)	(0.380)	(0.426)	(0.141)
Government effectiveness	0.085	0.073	0.089	0.078	-0.014
	(0.064)	(0.060)	(0.068)	(0.063)	(0.022)
Political stability	0.012	-0.000	0.011	-0.000	0.005
	(0.037)	(0.041)	(0.037)	(0.041)	(0.016)
Control of corruption	0.126**	0.117**	0.125**	0.116*	0.009
	(0.058)	(0.059)	(0.060)	(0.060)	(0.026)
Government health expenditure	0.073	0.119	0.078	0.121	-0.025
	(0.127)	(0.120)	(0.127)	(0.120)	(0.027)
External health expenditure	-0.004	-0.000	-0.004	-0.000	-0.001
	(0.004)	(0.005)	(0.004)	(0.005)	(0.001)
Adolescent fertility rate	0.028***	0.027***	0.029***	0.028***	0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.002)
Crude birth rate	-0.048	-0.089*	-0.048	-0.088*	0.000
	(0.031)	(0.047)	(0.031)	(0.050)	(0.010)
Lagged dependent variable					0.986***
					(0.029)
Constant	25.671***	24.244***	26.411***	24.599***	0.251
	(2.566)	(3.017)	(2.811)	(3.350)	(1.089)
Observations	632	632	632	632	507
R^2	0.63	0.65	0.62	0.64	–
Year dummies	No	Yes	No	Yes	No
Country FE	No	No	Yes	Yes	No

Notes: Clustered standard errors are given in parentheses.
[a]Lags of key explanatory variables are included as instruments in the system GMM up to the fourth lag, similarly to the approach of Oryema et al. (2017). Thus, the index *t*-3 should be disregarded for column (5).
*** p<.01, ** p<.05, * p<.1

7.4 Prevalence of anemia among pregnant women

Table 7.4 outlines the results for the *prevalence of anemia among pregnant women* as the outcome variable. Across most specifications, the coefficients for the decision, completion and MDRI stages are statistically insignificant. In the RE specification controlling for a time-trend, the coefficient is positive and marginally significant at the 10% level. These inconclusive results suggest that there seems to be no significant relationship between reaching the HIPC and MDRI debt relief stages, and anemia prevalence among pregnant women. For *real debt relief per capita*, the coefficients display the anticipated negative sign and are statistically significant at the 1% level in both the RE and FE specifications without year dummies. These effects do however become insignificant when including year dummies, indicating that a time-trend may be confounding the significant results. The system GMM specification displays insignificant results for all key explanatory variables.

Table 7.4 Outcome variable: Prevalence of anemia among pregnant women (%)

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE	(5)[a] GMM
HIPC decision point $_{t-3}$	0.049	0.271	0.054	0.263	0.249
	(0.217)	(0.194)	(0.218)	(0.199)	(0.851)
HIPC completion point $_{t-3}$	0.091	0.344*	0.079	0.308	0.218
	(0.269)	(0.207)	(0.268)	(0.212)	(0.817)
MDRI delivery point $_{t-3}$	-0.053	0.023	-0.047	0.020	-0.102
	(0.199)	(0.211)	(0.191)	(0.213)	(0.095)
Real debt relief per cap $_{t-3}$	-1.595***	-0.308	-1.483***	-0.215	0.208
	(0.534)	(0.417)	(0.515)	(0.425)	(0.467)
Urban population	-0.140**	-0.003	-0.185***	-0.029	-0.021
	(0.055)	(0.057)	(0.060)	(0.066)	(0.060)
Access to basic sanitation services	-0.033	-0.002	-0.021	0.009	-0.021
	(0.040)	(0.042)	(0.042)	(0.046)	(0.020)
Access to basic water services	0.018	0.011	0.020	0.009	0.004
	(0.038)	(0.033)	(0.040)	(0.035)	(0.066)
Log GDP per cap (PPP)	-2.502**	-1.492*	-2.686**	-1.472*	0.257
	(1.045)	(0.789)	(1.067)	(0.803)	(0.662)
Government effectiveness	-0.053	-0.195	-0.069	-0.194	-0.092
	(0.234)	(0.198)	(0.242)	(0.203)	(0.225)
Political stability	-0.002	-0.022	-0.015	-0.027	0.091
	(0.107)	(0.094)	(0.105)	(0.092)	(0.098)
Control of corruption	0.185	0.152	0.194	0.159	0.107
	(0.121)	(0.112)	(0.125)	(0.115)	(0.267)
Government health expenditure	-0.142	0.023	-0.101	0.061	0.154
	(0.139)	(0.121)	(0.142)	(0.122)	(0.111)
External health expenditure	-0.023*	-0.004	-0.022*	-0.003	0.001
	(0.013)	(0.010)	(0.012)	(0.010)	(0.006)
Adolescent fertility rate	0.044**	0.032	0.039*	0.027	0.007
	(0.021)	(0.020)	(0.021)	(0.020)	(0.017)
Crude birth rate	0.137	0.006	0.128	-0.004	-0.104*
	(0.119)	(0.112)	(0.117)	(0.111)	(0.055)
Lagged dependent variable					1.028***
					(0.053)
Constant	62.568***	56.316***	66.245***	57.975***	-0.208
	(8.987)	(8.484)	(9.281)	(8.494)	(6.047)
Observations	843	843	843	843	664
R^2	0.72	0.79	0.72	0.78	–
Year dummies	No	Yes	No	Yes	No
Country FE	No	No	Yes	Yes	No

Notes: Clustered standard errors are given in parentheses.
[a]Lags of key explanatory variables are included as instruments in the system GMM up to the fourth lag, similarly to the approach of Oryema et al. (2017). Thus, the index *t*-3 should be disregarded for column (5).
*** p<.01, ** p<.05, * p<.1

7.5 Government health expenditure relative to GDP

Table 7.5 outlines the regression results with *government health expenditure relative to GDP* as the outcome variable. The coefficients for *HIPC decision point* display the expected positive signs and are robust across all specifications, showing statistical significance at both the 5% and 1% level, except for the system GMM specification. This suggests that becoming eliglible for the HIPC initiative by reaching decision point is associated with an increase in the government health expenditure-to-GDP ratio. For *HIPC completion point* and *MDRI delivery point*, the results are more ambiguous. Although the coefficients for *HIPC completion point* are positive and statistically significant at the 5% and 1% level for the RE and FE specifications respectively when not controlling for a time-trend, adding year dummies makes the coefficients insignificant or only marginally significant. For *MDRI delivery point*, the only statistically significant coefficient is found in the FE specification without year dummies, displaying a negative sign. It is however only marginally significant at the 10% level. The system GMM specification yet again displays insignificant results for all key explanatory variables.

Table 7.5 Outcome variable: Government health expenditure (% of GDP)

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE	(5)[a] GMM
HIPC decision point $_{t-1}$	0.334**	0.262**	0.383***	0.291**	17.428
	(0.134)	(0.126)	(0.139)	(0.122)	(38.241)
HIPC completion point $_{t-1}$	0.262**	0.153	0.343***	0.208*	15.265
	(0.117)	(0.118)	(0.123)	(0.121)	(33.475)
MDRI delivery point $_{t-1}$	-0.148	-0.136	-0.157*	-0.099	-1.865
	(0.091)	(0.141)	(0.083)	(0.129)	(3.971)
Real debt relief per cap $_{t-1}$	0.000	0.000	0.000	0.000	0.593
	(0.000)	(0.000)	(0.000)	(0.000)	(1.209)
Urban population	-0.013	-0.020*	-0.005	-0.034	-0.244
	(0.010)	(0.010)	(0.022)	(0.025)	(0.478)
Access to basic sanitation services	0.027**	0.024**	0.031**	0.025	-0.453
	(0.011)	(0.010)	(0.015)	(0.015)	(1.076)
Access to basic water services	0.008	0.006	0.004	0.005	-0.583
	(0.011)	(0.010)	(0.013)	(0.013)	(1.372)
Log GDP per cap (PPP)	-0.078	-0.054	0.170	-0.023	27.720
	(0.190)	(0.185)	(0.304)	(0.299)	(59.539)
Government effectiveness	0.085	0.123	0.101	0.137	-3.071
	(0.085)	(0.087)	(0.080)	(0.084)	(6.254)
Political stability	0.015	0.025	0.008	0.013	0.451
	(0.024)	(0.025)	(0.025)	(0.025)	(1.569)
Control of corruption	0.016	0.026	-0.045	-0.033	2.288
	(0.055)	(0.053)	(0.056)	(0.048)	(4.528)
External health expenditure	-0.018***	-0.020***	-0.021***	-0.022***	0.184
	(0.005)	(0.005)	(0.006)	(0.006)	(0.429)
Adolescent fertility rate	0.010***	0.011***	0.013***	0.015***	-0.177
	(0.004)	(0.004)	(0.004)	(0.005)	(0.580)
Crude birth rate	-0.023	0.003	-0.013	0.029	-0.470
	(0.024)	(0.030)	(0.031)	(0.039)	(0.724)
Lagged dependent variable					-2.398
					(4.978)
Constant	0.789	-0.382	-1.945	-1.429	-127.735
	(1.860)	(2.011)	(3.167)	(3.194)	(266.913)
Observations	844	844	844	844	803
R^2	0.19	0.22	0.19	0.21	–
Year dummies	No	Yes	No	Yes	No
Country FE	No	No	Yes	Yes	No

Notes: Clustered standard errors are given in parentheses.
[a]Lags of the key explanatory variables are included as instruments in the system GMM, ranging from 1-2 years. Thus, the index *t-1* should be disregarded for column (5).
*** p<.01, ** p<.05, * p<.1

7.6 Contemporaneous effects

To allow for an evaluation in a more contemporaneous setting, the analyses are repeated using two-year lags for all maternal health outcome variables, and no lag for the government health expenditure outcome variable, as outlined in section 5.1. The corresponding regression outputs are provided in **tables B.1-B.5** of Appendix B. The system GMM specification remains unchanged and is therefore not included.

Overall, the results become more ambiguous. For the *maternal mortality ratio* and *lifetime risk of maternal death* outcome variables, the coefficients for *HIPC decision point* and *HIPC completion point* lose statistical significance when controlling for time-trends in the RE and FE specifications, though they remain significant at the 5% or 1% level without year dummies. For *low birthweight babies*, the results remain largely inconclusive, except that the coefficients for *MDRI delivery point* turn statistically significant at the 5% level with negative signs across all specifications – a notable change from the three-year lags where the same coefficients were statistically significant. Despite this, the overall inconsistency observed for this explanatory variable, along with the lack of theoretical grounds to anticipate a significant reduction in the prevalence of low birthweight babies two years post MDRI but not three, suggests that these results may reflect some potential issues with the specific model specification.

For *anemia prevalence among pregnant women*, the results are mostly unchanged, except that the coefficients for *real debt relief per capita* shift to statistically significant at the 5% level, down from the 1% level seen with three-year lags. Note however that this result still only applies to the RE and FE specifications without year dummies. This once again suggests some potential time-specific effect confounding the significant results.

Lastly, results for the *government health expenditure* outcome variable also become more ambiguous without a one-year temporal lag. Specifically, the coefficients for *decision point* and *completion point* in the RE and FE specifications controlling for a time-trend now become statistically insignificant.

8 Discussion

From what has been outlined in the previous section, the most conclusive results regarding this paper's primary objective relate to the mortality dimension of maternal health. Specifically, becoming eligible for the HIPC initiative – marked by reaching the decision point and potentially starting to receive interim debt relief – is associated with statistically significant reductions in both the maternal mortality ratio and the lifetime risk of maternal death across all specifications except for the system GMM. As discussed in section 1 & 2, the maternal mortality ratio may also serve as a proxy for a society's social and institutional development. Thus, it could be presumed that becoming eligible for the HIPC initiative might improve maternal mortality through these channels as well. However, since no other institutional outcome variables have been evaluated, a definitive conclusion in this regard cannot be drawn. Similarly, reaching completion point and thus receiving full debt relief also appears to be significantly associated with improvements in maternal mortality. However, these relationships weaken when controlling for time-specific effects which could be advancements in health technology or infrastructure.

Notably, when employing the system GMM specification, the coefficients for all key explanatory variables remain almost exclusively insignificant. While this might reflect the fact that there is no relationship between the debt relief initiatives and either of the outcome variables, it could also be a result of how the model is specified. Considering that other authors, such as Oryema et al. (2017) and Temah (2009), have found significant and robust results using the system GMM, it is likely the latter. Moreover, the relationship between receiving multilateral debt relief under the MDRI and both maternal mortality indicators is largely uncertain. Although some specifications – including the RE and FE with time-trend controls and the system GMM – show statistically significant relationships at the 10% level, it cannot be made conclusive that the MDRI influences maternal mortality. Similarly, no significant relationships are found between the amount of debt relief and either the maternal mortality ratio or the lifetime risk of maternal death.

These results mostly align with the findings of Oryema et al. (2017), who show that reaching the decision point significantly reduces the under-five mortality in SSA, whereas the amount of debt relief has no such effect. Schmid (2009) arrives at a similar conclusion and attributes health improvements to the mere participation rather than the actual amount of debt relief received. This challenges, to some degree, the assumption that increased fiscal space leading to increased government health expenditure is the primary mechanism behind improvements in maternal health. Rather, it points to the mandatory improvements in formal institutions and development of poverty reduction strategies and reforms, which are necessary for becoming eligible for debt relief. At the same time, one could argue that for e.g. health institutions to improve, substantial resource allocation to the health sector is instrumental, which is clearly constrained by debt-servicing and lacking financial resources. A plausible explanation could be that beneficiary countries are incentivized to continuously improve their formal institutions and develop poverty reduction strategies with whatever resources they may have, anticipating that the reward will be interim debt relief and subsequent full debt relief. This scenario would then create a dynamic where there is a 'build-up' of institutional improvements and a 'release' through received interim debt relief that quickly translates into health improvements, no matter the amount of the relief. In economic terms, this would suggest that the marginal effect of debt relief would be very large just before debt relief is received, making even small amounts of debt relief translate into large improvements in maternal mortality. If this explanation is valid, then beginning to actually *receive* debt relief is clearly of importance as it directly facilitates health improvements, even though the groundwork may be laid by institutional improvements and development reforms.

In examining maternal morbidity, proxied by the prevalence of low birthweight babies and anemia among pregnant women, the findings are tentative. Statistically significant relationships are observed only in specific cases: for low birthweight babies, a significant relationship with the HIPC decision point is found in the RE and FE specifications that do not control for a time-trend. Similarly, for anemia prevalence, a significant relationship with the amount of debt relief is found under the same model specifications, which contrasts the results found for the mortality indicators. When controlling for time, all coefficients become statistically insignificant. Overall, there seems to exist a beneficial relationship between debt relief and maternal mortality, but not maternal morbidity. This discrepancy could have multiple explanations. It may for instance reflect the generally low demand for preventative healthcare products and services in developing countries, which is often the case even when such products and services are heavily subsidized by the government (De Janvry & Sadoulet, 2021; Dupas & Miguel, 2017). This would suggest that health policies and strategies may be more focused on reducing the number of maternal deaths through direct intervention, rather than on improving overall maternal health through preventative measures. The results may also reflect the underlying gender inequities that persist in SSA, as noted by Hakura (2017), which would mean that preventative healthcare measures may disproportionately favor men. While not discussed further in this paper, an empirical analysis comparing preventative healthcare directed toward men and women in SSA could provide for an interesting objective for future research, since there appears to be some gaps in existing research on this matter.

For the paper's secondary objective – investigating the relationship between participation in the debt relief initiatives and government health expenditure – the most notable result is the positive and statistically significant relationship between reaching decision point and government health expenditure relative to GDP across all specifications, except for the system GMM. This result is largely in line with Temah's (2009) observations, and suggests that eligibility for HIPC debt relief creates enough fiscal space for there to be a significant rise in the proportion of government health expenditure relative to GDP. While some statistically significant relationships are also noted at the completion point, these tend to disappear or weaken when controlling for a time-trend. Moreover, no conclusive relationships are found with the MDRI delivery point or the amount of debt relief, as was the case for the health-related outcome variables. In addition to the discussion outlined above as to why *more* relief beyond the interim debt relief seems to have no impact, the tentative effect of the MDRI and the amount of debt relief may also be explained by the dynamics discussed by Vaggi & Frigerio (2021). When additional debt relief is received by beneficiary countries, such as that provided under the MDRI, they may be more inclined to deviate from sustainable debt practices and thus distance themselves from attaining human development sustainability, simply because a smaller debt burden means less constraints for acquiring new debt.

The control variables largely display insignificant coefficients across all outcome variables. Those that do display significant coefficients mostly have the expected signs, where the most robust result is that of *log GDP per capita* for all health-related outcomes, which displays negative and statistically significant coefficients for most specifications. This relationship between the level of national income and health is expected and consistent with conventional wisdom (Case, 2002; Ecob & Smith, 1999). Another interesting result is that the variable *external health expenditure* shows negative and statistically significant coefficients at the 1% level across four out of five specifications when government health expenditure is the outcome variable. This would suggest that external health expenditure, e.g. health aid, crowds out domestic health expenditure, which is also supported by previous research (Ahmed & Alorbi, 2018). An unexpected finding, as mentioned in the previous section, is the positive and significant relationship between government health expenditure relative to GDP and both the maternal mortality ratio and, to a lesser extent, the lifetime risk of maternal death. This suggests that a higher ratio of health expenditure to GDP is associated with an increase in maternal mortality, which is counterintuitive. A possible explanation could be the mechanics of the ratio itself, namely that a lower GDP could lead to a higher ratio if health expenditure remains constant at some minimum level. Consequently, this means that the ratio increases as GDP decreases, implying that poorer countries might show higher ratios due to their relatively lower GDP. This aligns with the fact that lower national income is associated with higher maternal mortality, thereby potentially explaining this counterintuitive result.

It has also been noted that throughout the analyses, the RE and FE specifications have consistently produced coefficients and standard errors of similar magnitudes and statistical significance. One key assumption differentiating the RE from the FE model is about the correlation of the unobserved time-invariant country-specific characteristics c_i with the explanatory variables, where the RE model assumes that c_i is uncorrelated with the explanatory variables and the FE model allows such correlation. Therefore, the similar results across the two models might suggest that c_i does not correlate with the explanatory variables as much as we assumed. The similarity moreover suggests that the estimates are somewhat robust and consistent, regardless of which of the two models is used. However, it is important to recognize that the results found and presented in this paper might depend on the chosen model specifications, utilized control variables and underlying assumptions, which could introduce bias. Additionally, potential endogeneity issues due to omitted variables, measurement errors or reverse causality may also affect the consistency of the results. Therefore, the significant relationships presented are not, and should not be, interpreted as causal.

To summarize, the findings in this paper are mostly in line with previous research on both health outcomes and health expenditure, but uniquely contributes to the understanding of how debt relief initiatives may impact maternal health in SSA. We believe that this understanding is of high importance and relevance. Despite global progress toward the SDGs in improving the health and lives of mothers, the gap between SSA and high-income countries remains substantial and is still far from closing. Improving the health, ensuring survival and enhancing the overall well-being of mothers and mothers-to-be is a key issue – not only because it is a fundamental human right, but also because it may generate positive externalities for households and communities at large (De Janvry & Sadoulet, 2021). It is evident that SSA struggles to achieve these improvements on their own. Although the general effectiveness of development assistance is debated, the theory outlined in this paper suggests that unsustainable foreign borrowing is a major obstacle to human development, which is an issue that clearly demands attention from the international community. Even though the debt relief initiatives seemed to initially place debt-burdened countries on a beneficial trajectory, the recent upward trend in SSA debt levels begs the question if providing excessive debt relief without properly ensuring functional institutions and sustainable fiscal governance in the long-run may potentially reverse development progress. This issue is touched upon in section 3.1.2, where it is explained that debt relief may bring a country away from, rather than toward, reaching economic and human development sustainability over time. If so, development strategies and initiatives formed by the international community may need to shift focus toward primarily ensuring solid and long-term institutional improvements, in which case development assistance measures such as debt relief may become *more* effective than what has been displayed in this paper and other research.

9 Conclusion

This paper set out to empirically investigate the relationship between debt relief under the HIPC initiative and the MDRI, and maternal health outcomes and government health expenditure in SSA. Using data from the World Bank, OECD and the IMF, several econometric specifications have been utilized to analyze these relationships. Across four out of five specifications, the results suggest that becoming eligible for the HIPC initiative, marked by reaching decision point, is associated with statistically significant reductions in the maternal mortality ratio and the lifetime risk of dying from maternal causes. Becoming eligible for the HIPC initiative is also associated with a statistically significant increase in the proportion of government health expenditure to GDP. This result suggests that the increased fiscal space following debt relief may be partially allocated to the health sector, likely contributing to improvements in maternal mortality outcomes. It is also possible that any improvements in both formal and informal institutional frameworks – necessary to become eligible for debt relief – play a role. However, it was beyond the scope of this paper to empirically examine the direct relationship between the debt relief initiatives and the institutional environment. It is worth mentioning once again that these findings should not be interpreted causally and should be considered with some caution, as they are not robust to the system GMM specification.

While reaching completion point also seems to improve maternal mortality outcomes, this relationship appears weaker than that of the initial decision point. Conversely, no conclusive relationships are observed between receiving multilateral debt relief under the MDRI or the amount of debt relief, and either of the paper's two objectives. Moreover, the analysis shows a persistent discrepancy between the potential effect of debt relief on maternal mortality and maternal morbidity, where no conclusive relationships can be established between any of the debt relief explanatory variables and the morbidity outcome variables. Therefore – addressing the research questions and hypotheses proposed in this paper – it appears that participation in the debt relief initiatives has likely been effective in improving the mortality dimension of maternal health as well as government health expenditure in SSA countries. However, the findings predominantly point to these relationships being associated with the initial stages of the HIPC initiative, and not the MDRI or the amount of debt relief – much in line with previous research. The overall relationship between debt relief under the initiatives and maternal morbidity is inconclusive. On that account, our two hypotheses outlined in section 3.2 are partially confirmed.

On an endnote, it is worth noting that debt-related initiatives may be evolving in a new direction. In 2020, the World Bank, IMF and the G20 countries introduced the Debt Service Suspension Initiative (DSSI) in response to the impact of the COVID-19 pandemic on the world's poorest countries, which aimed to provide some fiscal breathing room by suspending all debt service payments (World Bank, 2022). Such an approach might offer a more sustainable long-term solution since it maintains constraints on debt accumulation by not alleviating debt per se, but by addressing the debt service payments directly. If not, it at least introduces a different method for managing debt crises in burdened regions going forward. While the development outcomes of the DSSI are yet to be fully evaluated, the ongoing shift in the debt levels and debt structures of SSA countries – particularly towards creditors like China and private actors with shorter maturity periods and higher refinancing risks – raises concerns about the emergence of a new African debt crisis (Canuto et al. 2023; UNCTAD, n.d). Consequently, traditional initiatives such as the HIPC, MDRI and maybe even the new DSSI, may not be enough for promoting development. The increasingly complex and dynamic debt landscape in SSA, along with its possible development implications, therefore necessitates further research on the efficacy of debt relief as a development assistance tool for the region.

Despite the empirical limitations highlighted throughout this thesis, we argue that the results meaningfully contribute to the understanding of using debt relief as a tool to enhance development in general, and maternal health in particular. Expanding this research area is, as mentioned, important and may provide international and local policymakers with necessary knowledge to develop more sustainable fiscal practices and to more effectively manage debt crises. Such improvements are in turn likely to help advance the critical objective of ensuring the health and survival of young women and mothers in the region.

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Appendix A

Table A.1 HIPC initiative and MDRI status of SSA countries (2019)

Country	Decision point	Completion point	MDRI Delivery point
Benin	2000	2003	2006
Burkina Faso	2000	2002	2006
Burundi	2005	2009	2009
Cameroon	2000	2006	2006
Central African Republic	2007	2009	2009
Chad	2001	2015	2015
Comoros	2010	2012	2012
Congo, Dem. Rep.	2003	2010	2010
Congo, Rep.	2006	2010	2010
Côte d'Ivoire	2009	2012	2012
Ethiopia	2001	2004	2006
Gambia	2000	2007	2007
Ghana	2002	2004	2006
Guinea	2000	2012	2012
Guinea-Bissau	2000	2010	2011
Liberia	2008	2010	2010
Madagascar	2000	2004	2006
Malawi	2000	2006	2006
Mali	2000	2003	2006
Mauritania	2000	2002	2006
Mozambique	2000	2001	2006
Niger	2000	2004	2006
Rwanda	2000	2005	2006
Sao Tome and Principe	2000	2007	2007
Senegal	2000	2004	2006
Sierra Leone	2002	2006	2006
Tanzania	2000	2001	2006
Togo	2008	2010	2010
Uganda	2000	2000	2006
Zambia	2000	2005	2006
Angola	NON-HIPC	–	–
Botswana	NON-HIPC	–	–
Cabo Verde	NON-HIPC	–	–
Djibouti	NON-HIPC	–	–
Equatorial Guinea	NON-HIPC	–	–
Eritrea[a]	NON-HIPC	–	–
Eswatini	NON-HIPC	–	–
Gabon	NON-HIPC	–	–
Kenya	NON-HIPC	–	–
Lesotho	NON-HIPC	–	–
Mauritius	NON-HIPC	–	–
Namibia	NON-HIPC	–	–
Nigeria	NON-HIPC	–	–
Seychelles	NON-HIPC	–	–
Somalia[a,b]	NON-HIPC	–	–
South Africa	NON-HIPC	–	–
South Sudan[b]	NON-HIPC	–	–
Sudan[a]	NON-HIPC	–	–
Zimbabwe	NON-HIPC	–	–

Source: IMF's HIPC initiative and MDRI Statistical Update (2019)

[a]Eritrea, Somalia and Sudan have since 2019 reached decision point or have become potentially eligible for assistance under the HIPC initiative (IMF, 2023)

[b] Somalia and South Sudan are excluded from the analysis due to missing data.

Appendix B

Table B.1 Outcome variable: Maternal mortality ratio

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE
HIPC decision point$_{t-2}$	-46.604**	-26.959	-47.551**	-25.738
	(22.694)	(20.018)	(22.182)	(18.518)
HIPC completion point $_{t-2}$	-74.529***	-37.570	-74.241**	-35.018
	(28.176)	(28.167)	(28.367)	(27.687)
MDRI delivery point $_{t-2}$	2.225	-22.773	5.320	-24.014
	(18.171)	(25.147)	(18.677)	(26.043)
Real debt relief per cap $_{t-2}$	10.500	8.064	3.027	25.445
	(40.727)	(49.023)	(41.020)	(49.319)
Controls	Yes	Yes	Yes	Yes
Observations	844	844	844	844
R^2	0.50	0.55	0.49	0.54
Year dummies	No	Yes	No	Yes
Country FE	No	No	Yes	Yes

Notes: Clustered standard errors are given in parentheses.
*** p<.01, ** p<.05, * p<.1

Table B.2 Outcome variable: Lifetime risk of maternal death (%)

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE
HIPC decision point$_{t-2}$	-0.250**	-0.156	-0.271**	-0.166
	(0.117)	(0.108)	(0.114)	(0.106)
HIPC completion point $_{t-2}$	-0.425***	-0.245	-0.433***	-0.240
	(0.157)	(0.163)	(0.157)	(0.164)
MDRI delivery point $_{t-2}$	0.002	-0.168	0.017	-0.173
	(0.107)	(0.134)	(0.107)	(0.139)
Real debt relief per cap $_{t-2}$	-0.016	0.101	-0.067	0.170
	(0.217)	(0.256)	(0.215)	(0.245)
Controls	Yes	Yes	Yes	Yes
Observations	844	844	844	844
R^2	0.64	0.67	0.63	0.66
Year dummies	No	Yes	No	Yes
Country FE	No	No	Yes	Yes

Notes: Clustered standard errors are given in parentheses.
*** p<.01, ** p<.05, * p<.1

Table B.3 Outcome variable: Low-birthweight babies (% of births)

VARIABLES	(1) RE	(2) RE	(3) FE	(4) FE
HIPC decision point$_{t-2}$	-0.166*	-0.099	-0.167*	-0.105
	(0.087)	(0.077)	(0.088)	(0.076)
HIPC completion point $_{t-2}$	-0.075	-0.014	-0.076	-0.022
	(0.100)	(0.109)	(0.101)	(0.110)
MDRI delivery point $_{t-2}$	-0.191**	-0.220**	-0.178**	-0.210**
	(0.078)	(0.100)	(0.079)	(0.103)
Real debt relief per cap $_{t-2}$	-0.195	-0.147	-0.207	-0.155
	(0.150)	(0.115)	(0.149)	(0.116)
Controls	Yes	Yes	Yes	Yes
Observations	633	633	633	633
R^2	0.64	0.66	0.63	0.64
Year dummies	No	Yes	No	Yes
Country FE	No	No	Yes	Yes

Notes: Clustered standard errors are given in parentheses.
*** p<.01, ** p<.05, * p<.1

Table B.4 Outcome variable: Prevalence of anemia among pregnant women (%)

	(1)	(2)	(3)	(4)
VARIABLES	RE	RE	FE	FE
HIPC decision point$_{t-2}$	-0.026	0.313	-0.016	0.304
	(0.268)	(0.243)	(0.265)	(0.247)
HIPC completion point $_{t-2}$	-0.022	0.366	-0.031	0.331
	(0.264)	(0.232)	(0.261)	(0.239)
MDRI delivery point $_{t-2}$	-0.218	0.038	-0.198	0.032
	(0.180)	(0.239)	(0.176)	(0.241)
Real debt relief per cap $_{t-2}$	-1.316**	-0.359	-1.243**	-0.284
	(0.568)	(0.415)	(0.550)	(0.417)
Controls	Yes	Yes	Yes	Yes
Observations	844	844	844	844
R^2	0.73	0.79	0.72	0.78
Year dummies	No	Yes	No	Yes
Country FE	No	No	Yes	Yes

Notes: Clustered standard errors are given in parentheses.
*** p<.01, ** p<.05, * p<.1

Table B.5 Outcome variable: Government health expenditure (% of GDP)

	(1)	(2)	(3)	(4)
VARIABLES	RE	RE	FE	FE
HIPC decision point	0.366**	0.238	0.444**	0.285
	(0.176)	(0.176)	(0.188)	(0.175)
HIPC completion point	0.280**	0.006	0.407***	0.085
	(0.134)	(0.161)	(0.149)	(0.169)
MDRI delivery point	-0.095	-0.052	-0.093	-0.013
	(0.091)	(0.153)	(0.091)	(0.146)
Real debt relief per cap	-0.535*	-0.366	-0.630*	-0.545
	(0.309)	(0.307)	(0.338)	(0.339)
Controls	Yes	Yes	Yes	Yes
Observations	845	845	845	845
R^2	0.19	0.22	0.19	0.22
Year dummies	No	Yes	No	Yes
Country FE	No	No	Yes	Yes

Notes: Clustered standard errors are given in parentheses.
*** p<.01, ** p<.05, * p<.1

Appendix C

1. The government debt-to-GDP ratio is expressed as $d_t = \frac{D_t}{Y_t}$. By taking the natural logarithm of each side, we get: $\ln d_t = \ln D_t - \ln Y_t$. We can get approximate growth rates by taking the derivative of the logarithms w.r.t time:

$\frac{d \ln d_t}{dt} = \frac{d \ln D_t}{dt} - \frac{d \ln Y_t}{dt}$ thus approximates $\frac{\dot{d}_{t+1}}{d_t} = \frac{\dot{D}_{t+1}}{D_t} - \frac{\dot{Y}_{t+1}}{Y_t}$.

Note that, as in the paper, dotted variables do not denote growth rates but actual changes over time.

Since $\frac{\dot{Y}_{t+1}}{Y_t} = g$, we substitute it, as well as multiply both sides with d_t, and since $d_t = \frac{D_t}{Y_t}$, we get:

$$\dot{d} = \frac{\dot{D}}{D}\frac{D}{Y} - g\frac{D}{Y} = \frac{\dot{D}}{Y} - gd.$$

In line with Gottfries (2013), the time index is dropped for simplicity.

We then use $\dot{D} = G - T + iD$ for substitution, yielding:

$$\dot{d} = \frac{G-T+iD}{Y} - gd = \frac{G-T}{Y} + \frac{iD}{Y} - gd = \frac{G-T}{Y} + id - gd = \frac{G-T}{Y} + (i-g)d$$

Thus, $\dot{d} = \frac{G-T}{Y} + (i-g)d$.

2. An assumption made by Vaggi & Frigerio (2021) is that the capital account, which records the net change of assets and liabilities over some period, consists solely of debt-related flows. In this case, it is the change in the external debt stock $\dot{D}$. The CA is offset by the capital account, meaning that a CA deficit is financed with an equally sized capital account surplus (and vice versa). Thus, the equilibrium of the Balance of Payments (BoP) is found where the CA and the capital account sum to zero, which in this case is expressed by the authors as:

$$-C + iD - \dot{D} = 0 \qquad \text{(C.1)}$$

By scaling each variable to GDP, Y, and multiplying the left-hand side of equation (C.1) by $\frac{D}{D}$, which is possible since $\frac{D}{D} = 1$, we get: $-\frac{C}{Y}\frac{D}{D} + i\frac{D}{Y}\frac{D}{D} - \frac{\dot{D}}{Y}\frac{D}{D} = -\frac{C}{Y} + i\frac{D}{Y} - \frac{D}{Y}\frac{\dot{D}}{D} = 0$ which can be expressed as:

$$\frac{C}{Y} = i\frac{D}{Y} - \frac{D}{Y}\frac{\dot{D}}{D} \qquad \text{(C.2)}$$

If $\frac{C}{Y} = c$, $\frac{D}{Y} = d$, and $\frac{\dot{D}}{D} = \theta$, equation (C.2) can be expressed as:

$$c = (i - \theta)d \qquad \text{(C.3)}$$

where c is the $NICA$-to-GDP ratio, d is the external debt-to-GDP ratio and θ is the growth rate of the external debt stock. As has been shown in the model by Gottfries (2013), the real GDP growth rate impacts the change in the debt ratio over time, meaning the change in the debt-to-GDP ratio over time $\frac{\dot{d}}{d}$ can be expressed as:

$$\frac{\dot{d}}{d} = \frac{\dot{D}}{D} - \frac{\dot{Y}}{Y} = \theta - g \qquad \text{(C.4)}$$

Still in line with the approach of Vaggi & Frigerio (2021), θ from equation (C.3) can be expressed as:

$$\theta = i - \frac{c}{d}$$

and when substituted into equation (C.4), we get:

$$\frac{\dot{d}}{d} = i - \frac{c}{d} - g \qquad \text{(C.5)}$$

which, when both sides are multiplied by d, translates into:

$$\dot{d} = -c + (i - g)d \qquad \text{(C.6)}$$