UNIVERSITY OF ST GALLEN

Debt Relief Efficiency

Measuring the efficiency of the *Heavily Indebted Poor Countries* initiative and the *Multilateral Debt Relief Initiative* implemented by both the *International Monetary Fund* and the *World Bank*

Bachelor's Thesis

Bachelor in Economics

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November 20, 2016

Abstract

We provide evidence about the efficiency of debt relief during the *Heavily Indebted Poor Countries* initiative and the *Multilateral Debt Relief Initiative*. We test the hypothesis stating that relieved countries would not have seen their performances rise that much, had they not benefitted from relief. We define debt (relief) and go over the history of debt reliefs and studies on this field, followed by a brief first attempt at a linear (OLS) regression of relief on GDP per capita, *Millenium Development Goals (MDGs)* and democracy scores. Lacking conclusive results, our empirical strategy turns to the use of average treatment effects, an adaptation of a method from Acemoglu et al. By controlling for the GDP dynamics linearly, we draw a counterfactual path for GDP around relief. We find evidence that debt relief might not provide a substantial treatment effect for GDP growth. A qualitative analysis of the evolution of *MDGs* tends to confirm this: debt relief did not deliver either a substantial advantage to the economical or social infrastructure of over-indebted countries. Assuming that these inefficient results are due to a lack of governance and corruption, we propose a solution for a more potent debt relief, by adapting the Swiss *debt brake* mechanism.

Contents

List of Figures

List of Tables

List of Stata Code Listings

Aknowledgements

– Prof. Anthony Strittmatter for the early help provided in order to build the empirical framework.

– Prof. Marin Ferry for sharing the database of a research in which he participated, upon my email request.

Acronyms

AfDB   African Development Bank

DRF   Debt Reduction Facility

FCSC   Federal Constitution of the Swiss Confederation

GDP   Gross Domestic Product

HDI   Human Development Index; the expression *low HDIs* will refer to countries classified with a low Human Development Index

HIPC   Heavily Indebted Poor Country

IBRD   International Bank for Reconstruction and Development

IDA   International Development Association

IGO   Intergovernmental Organization

IMF   International Monetary Fund

LDC   Least Developed Country

MDG   Millennium Development Goal

MDRI   Multilateral Debt Relief Initiative

ODA   Official Development Assistance

OECD   Organization for Economic Co-operation and Development

OLS   Ordinary Least Squares

SPA   Special Program of Assistance

TET   Treatment Effects on the Treated

UDS   United Democracy Scores

UN   United Nations

WB   World Bank

1 Introduction

Recently, high sovereign debt levels and a poor economy in developed countries, such as the United States and certain European countries, drew public attention to the existence of a level of debt over which a country's economy might not be sustainable[1]. Indeed, extreme cases, such as the partial bailout of Iceland in 2008 and the Greek partial debt restructuring in 2012, tended to confirm the eventual existence of a *debt overhang*[2] threshold. This issue is not new for developing countries. In fact, such emergency measures would have been potentially a lot more frequent, if not for regular debt reliefs pursued by the International Monetary Fund (IMF) and World Bank (WB) in the 1990s and 2000s. Those reliefs were named Heavily Indebted Poor Country (HIPC) initiative and Multilateral Debt Relief Initiative (MDRI)[3]. Such preventive measures (i.e. before an emergency total bailout of a country) seem to be appropriate in order to prevent some countries' financial weaknesses to become unbearable at the worst time. Eventually, the relief can provide the country in distress with some spare time to fix its financial weaknesses, reorganize its taxation and investment structure, as well as their respective efficiency.

> *As finance becomes more intertwined, most nations will become too big to fail. Without an effective sovereign debt restructuring mechanism, we will all end up subsidizing those nations that lack the political will or ability to be fiscally responsible.*

> Schwarcz, 2014, par. 8

With the loss of trust in the fiscal responsibility of the economically underprivileged countries, may come higher interest rates and stronger conditions for further borrowing, especially after a bailout. Additionally to debt sustainability, the IMF, when proceeding to relief, aims at reducing the debt overhang. This pressure might tend to discourage investments and reforms, and thus economic growth. With the fiscal space so created, and especially under the so called conditional relief of the 1990s by the IMF, the countries were forced to invest in particular fields, such as education or sanitation. This was in the hope of achieving the Millennium Development Goals (MDGs): designed by the IMF, they are a set of targets that should allow all countries to treat their population with a minimum of decency[4].

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[1]In academics, most notably Reinhart and Rogoff assessed that a precise debt boundary was not to be overstepped. Across 20 advanced economies, if the ratio of $\frac{debt}{GDP}$ was to exceed specifically 90%, GDP growth would decline (2010, p. 575). This boundary was then profusely used as a benchmark in media and politics (Herndon et al., 2014, pp. 260-261). Three years later, this idea of a universal boundary was abandoned, as the authors were vigorously criticized on their empirical framework and coding errors, which they admitted *ex post* (ibid., pp. 277-278).

[2]Krugman coined the term in 1988, see section 1.3.

[3]For simplification, we will sometimes refer to the two reliefs as the HIPC initiative.

[4]see section 1.3

The HIPC initiative is a recent phenomenon, and for some lately helped countries, only 10 years of post relief data is available. Consequently, literature on the general effect of fluctuations of debt levels are more common than studies on debt relief in particular. The latter contributions estimate the effect of relief through more or less sophisticated measures, which mostly consist in regressing relief on growth, with some control variables. We claim that this method might be confronted [**I**] with the inability to build a holistic regression model, in other terms there is a high risk of unobserved variable bias. Indeed, the causal link between relief and subsequent Gross Domestic Product (GDP) growth could be a rather complex one, depending on numerous factors. Among others, we claim that the efficiency of government institutions and the level of corruption might have a big impact on how well investments are processed to their end results. [**II**] The effects of relief on GDP could unfold over time in different ways. This motivates us to estimate a dynamic effect of relief on GDP.

As stated above, the HIPC reliefs were conditional, thus investments in particular fields were mandatory, with uncertain consequences[5]. One study of the effect of relief on government expenditures was found. Their research measures intermediate consequences of relief rather than the final effect on growth or MDG (Cassimon et al., 2015, p. 10). This way, it avoids the bias **I**, namely that the final results of relief may have a very indirect relationship to it.

On the contrary, the aim of this paper is to try to determine the final effects of relief, i.e. whether the IMF's actions were efficient at reaching its goals of GDP growth and fulfilling the MDGs. More precisely, the hypothesis is that **relieved countries would not have seen their performances rise that much, had they not benefitted from relief**. For that sake, we built a pooled cross-section sample, containing both relieved countries and comparable non-relieved countries. Our sample of "underprivileged countries" extends over 40 years (from 1974 to 2014). The statistical analysis can be subdivided into two main parts. First, we test whether it is possible to run an OLS regression of relief on GDP growth, with control variables, that should control for country and time effects; as control variables, we use the MDGs, defined by the IMF and a level of democracy measurement. We find that, due to missing data at various levels of the database, the number of observations is not sufficient for a conclusive analysis. Second, we build a counterfactual path for GDP (for countries that received relief) based on linear projections on its lags[6].

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[5]see table 5

[6]adapted from a study on the effect of democracy on GDP growth by Acemoglu et al. (2012, pp. 18-20)

The reminder of this paper unfolds along these lines. The next parts, 1.1 and 1.2, describe respectively the debt nomenclature and the existence of a debt threshold. Sections 1.3 and 1.4 deal with the history of debt intervention and the history of its related scientific contributions. Chapter 2 presents the central part of this paper, namely the statistical analysis. The rationale behind the country and data selection is introduced in sections 2.1 and 2.2. This is followed by an attempt at a linear regression of debt relief on GDP with control variables (section 2.3). Sections 2.4 and 2.5 present a more sophisticated and adapted regression analysis, based on counterfactuals. Subsequently, chapter 3 provides a comparative analysis of several subjects around relief. While section 3.1 bases its considerations on raw data, sections 3.2 and 3.3 exhibit a more qualitative study of eventual workarounds for a more efficient debt relief. Chapter 4 concludes.

1.1 Measuring Debt

The definition of the word debt requires to be narrowed, the way it is profusely used in this work. With the help of different sources, a topography of the debt nomenclature was produced. We distinguish between a private debt (owned by individuals or companies) and a public one (owned by states). Public debt can be owed to private institutions (commercial debt) or other countries (official creditors[7]). Our focus is public debt to official creditors[8]. The latter is either bilateral (a single loan for a country is financed through one creditor) or multilateral (a single loan for a country is financed through the coordination of several creditor countries) (Teunissen & Akkerman, 2004,

Figure 1 – Debt nomenclature

p. 4). The multilateral form is generally supervised by higher institutions such as the IMF and the WB, in order to guarantee equal treatments for creditors and debtors.
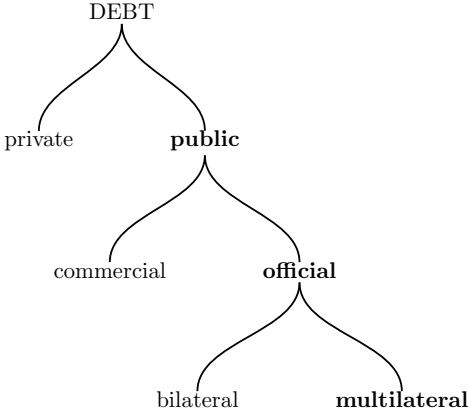
The paper will exclusively refer to *public multilateral debt to official creditors* when mentioning debt, except if explicitly specified otherwise. After defining relevant debt categories, the following will focus on its measurement.

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[7]as described by Hudes (1985, p. 554)

[8]The history of the Paris Club and its counterparts (IMF, WB) will be mentioned in section 1.3.

The amount of owed debt can vary, depending on its definition (Teunissen & Akkerman, 2004, p. 13).

    a. debt stock   the nominal amount of debt owed by a country

    b. debt service   annual amounts payable on the debt

    c. present value of debt service   aggregated debt service discounted to today's value

Teunissen & Akkerman argue that **debt stock** might be a preferable measure for debt relief amounts. They state that private market actors assess debt amount this way, rather than with aforementioned b or c methods. As an illustration, they mention how Guianese got confused after a government communication. As they were guaranteed a reimbursement of \$636 million of present value of debt, they were deceived to hear that this help was to be delivered not right away but over the next 30 years. In reaction, they burned down part of the finance ministry's offices (ibid., p. 13).

When granting debt relief, the IMF and WB negotiate the amounts of future interests to be paid. So when publishing yearly numbers on debt relief, they display nominal amounts of **debt service** relieved, instead of **debt stock**. In order to avoid any further burning down of government offices, it might be preferable to adopt Teunissen & Akkerman's nomenclature. But it is not possible to determine yearly amounts of debt stock relieved: when **debt stock** is relieved, its related interests decline in the consecutive years; but the IMF database doesn't display interest rates associated with each debt owed. For the construction of our database, the nature of this relief measurement means that we would have one observation on the year of relief and then zeros over the subsequent years, until an eventual next relief. As we look for country by country and year by year observations, this would be unsatisfactory.

The **debt service** measurement seems more appropriate for our study rather than **debt stock**. Regarding **present value of debt service**, it requires an accurate inflation or discounting rate[9]. Rather than going through the trouble of measuring the present value of debt service, we will use its nominal value in parallel with nominal GDP.

In addition to necessary theoretical background, the aim of section 1.1 was to allow the reassignment of the word "debt" as a *public multilateral debt to official creditors in the form of debt*

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[9]See Teunissen and Akkerman 2004, p. 14 for a discussion about apparently unfair discounting rates on HIPC relief by the IMF.

service. In order to shorten our arguments, this nomenclature will apply throughout our paper to any other instance of the word "debt".

1.2   A Debt Threshold: *How Much is Too Much?*

> *By a debt overhang I mean the presence of an existing, 'inherited' debt sufficiently large that creditors do not expect with confidence to be fully repaid.*

<div align="right">Krugman, 1988, p. 254</div>

Krugman's definition of debt overhang gives a broad but loose idea of a debt threshold, over which debt is definitely not sustainable anymore. In practice, the IMF and WB applied precise thresholds in order to determine if countries qualified for debt relief under the HIPC and MDRI initiatives (Canuto & Moghadam, 2011, p. 36):

$$\frac{\text{present value of debt (services)}}{\text{exports of goods and services}} > 150\%, \ \ with \ \ \frac{\text{exports of goods and services}}{\text{gross domestic product}} > 30\% \ and$$

$$\frac{\text{present value of debt}}{\text{fiscal revenue}} > 250\%, \ \ with \ \ \frac{\text{fiscal revenue}}{\text{gross domestic product}} > 15\%$$

whether these thresholds are adapted to measure the sustainability of a country's debt will be shortly discussed at several points of this paper, but an in-depth analysis may be a research question for another work. In section 1.4, we give evidence that could confirm the viability of those thresholds.

1.3   Debt Relief: *Solving High Indebtedness*

In order to deal with overindepted countries, creditor countries can either lend more money to those countries, in the hope of being repaid later ("financing"), or forgive a part of that debt overhang ("debt forgiveness"[10]) (Krugman, 1988, p. 267). While financing increases the liquidity of the country, debt relief increases its solvency. Because a higher liquidity means a higher solvency as well, Krugman claims this is all the same issue. The conflict rather resides on the creditors' side: as a group, the creditors might want to finance in order to keep the interests coming, while an individual creditor might want to cancel the loan agreement (debt relief), foreseeing no chance of repayment (ibid., p. 267). In practice, both alternatives are used.

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[10]Krugman uses this nomenclature, but will refer to "debt relief".

Official Development Assistance (ODA) is a widely known form of financing because it contains a part of granted amount which is not expected to be paid back. Through this alternative, "donor" countries provide the financing[11]. Along this paper, we will focus on debt relief rather than financing, more particularily on the HIPC and MDRI initiatives coordinated by the IMF and WB. The following paragraphs will briefly review the history of debt relief leading to HIPC and MDRI initiatives.

Prior to the recent relief of the HIPCs by the IMF, the Paris Club acted as a conglomeration of creditor countries. Between 1988 and 1998, it has relieved an estimated \$30 billion, in end-1997 net present value (Braga & Dömeland, 2009, p. 2).

We previously subdivided public debt into commercial and official debt. Respectively, the *London Club* and the *Paris Club* have been the main actors responsible for the restructuring of those two debt categories in the past. The next paragraph will shortly step on the turf of the London Club, devoted to commercial debt relief, before we focus on official debt relief with the Paris Club and its successors.

While the London Club (consisting of an advisory committee with representatives of major commercial banks (Gamarra et al., 2009, p. 22)) has provided considerable relief between 1978 to 1983 (4-8% of GNP of each relieved country) (Hudes, 1985, p. 561), it is hard to find trace of this club in the recent literature (it is doubtful whether this club still exists). In the mid 1980s, commercial banks realized that rescheduling debt service was not sufficient to guarantee the solvency of most countries it had operated in. U.S. Treasury Secretary Nicholas Brady launched in 1989 the Brady Plan that would coordinate those efforts for the cancellation of part of the commercial debt, aimed at the middle income countries, except for Nigeria and Côte d'Ivoire (Gamarra et al., 2009, p. 23). Since 1989, the Debt Reduction Facility (DRF) somehow overtook the role of the London Club, but this time supervised by an international institution, namely the WB[12]. It is financed by donor countries and wiped out about \$10 billion of commercial external debt (ibid., p. 24). Although relevant data is available about this form of relief, the fact that those reliefs were punctual debt cancellations in form of buybacks leaves us unable to compare it with year by year relief on debt service (Lewis, 2012, p. 29). Since no information is available on the interest rates associated with the buybacks, measuring buybacks would

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[11]At least 25% of the amount must be in form of grants in order to qualify as ODA, and the rest can be lent at an interest rate (Führer, 1994, p. 24).

[12]The DRF was created by the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) (Lewis, 2012, p. 1). Both IBRD and IDA are part of the WB structure (see `http://www.worldbank.org/en/about/what-we-do/brief/ibrd` and `http://ida.worldbank.org/about/what-ida`, respectively).

be equivalent to measuring debt stock. Section 1.1 described why this would be unsatisfactory.

Because mostly scientists linked to the WB in some way or another wrote about official debt relief, the evidence of forgiveness practices go back as far as the creation of the WB itself in 1946[13]. Until 1972 and mainly through the Paris Club, only Argentina, Brazil, Chile, Ghana, India, Indonesia, Pakistan, Peru, and Turkey asked for and were relieved on their public debt. This period stayed as a reference for future relief processes until today (Gamarra et al., 2009, p. 12). The Paris Club is an informal group of official creditor countries and like the London Club was not supervised by any international organization, but rather based decisions on concensus (ibid., p. 12). It was first in 1987, through the Special Program of Assistance (SPA), that the desire was expressed by the IMF and the WB to officially relieve debt burden for selected countries. This time, requirements were set for the eligibility of the countries for this program as well as objectives for the future (ibid., p. 15). This is the first shift from a system mainly centered on the demand of the creditors to a system caring more for debtors' needs (Martin, 2004, p. 18).

Those early initiatives illustrate the initial tendency of debt relief to be creditor oriented. They allow relieved countries to borrow again with smaller debt stock, thus lower debt overhang and eventually smaller initial interest rates. Apart from the ability to borrow more, the previously overindepted countries have no external incentive to proceed to structural changes. This may imply that the primary aim of those reliefs were mainly to allow those countries to borrow again, more than to impose rigorousness on their balance sheet. On the contrary, the following debt relief initiatives aimed at structurally changing low income debtors. On these grounds, the literature differentiates between unconditional and conditional relief (Schmid, 2009, p. 51).

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[13]Any attempt at trying to find other forms of relief that happened prior to that, would drive us particularly out of the scope of this thesis. This quantitative paper requires precise year-to-year and country-by-country observations.

Through the SPA, the IMF and WB operated several country-targeted reliefs until they decided to launch a massive relief program. In 1996, the HIPC initiative and later the MDRI, in 2005, both gathering the same 35 countries, formed a frame for debt relief mainly aimed at poverty reduction (Gamarra et al., 2009, p. 27). More precisely and especially for the MDRI initiative, the intent was to push those countries faster to the accomplishment of the MDGs (Saito et al., 2016, p. 15):

– End poverty and hunger

– Primary school completion rate

– Increase the ratio of girls to boys enrollment in primary and secondary education

– Decrease child mortality rate

– Decrease infant mortality rate

– Decrease maternal mortality rate

– Increase access to an improved water source

– Increase access to improved sanitation facilities

Originally settled for 2015, those goals were thought of as guidelines to test the reliefs' effectiveness in each country (IMF, 2015, p. 1). In section 3.1, we will refer to the MDGs in order to evaluate the efficiency of debt relief.

The HIPC and MDRI initiatives are the focus of this paper, because they are framed under transparent and strict rules that binds both creditor and debtor, but also because IMF documents provide detailed numbers for relief amounts, namely year-by-year and country-by-country.

In this section, we saw how relief initiatives shifted from a format where informal groups of creditors relieved the burden for their own interests, to a format where official organizations act with a focus on debtors countries' well-being. We will try to assess, in the next section and throughout the paper, if the treatment delivered by these official organizations is effective for HIPCs.

1.4 Previous Studies on Consequences of Debt Shifts

This paper is focused on estimating the efficiency of debt relief through its relationship with subsequent growth and MDG development values. In the literature, debt fluctuations are studied at multiple levels[14]:

– some have focused on periods prior to relief, did not include HIPCs in the analysis or did not differentiate them from other countries (we will refer to relationships with *indebtedness* in this case). The studies evaluate the level of indebtedness by fluctuation of debt stocks.

– other authors have dealt with debt relief amounts delivered under the HIPC and MDRI initiatives and their effect on growth, government spending and MDG developments (we will refer to relationships with *debt relief* in this case). Debt relief is measured either by debt stock (i.e. the diminution of debt stock) or by debt service (diminution of debt service).

The HIPC and MDRI are conditional debt relief initiatives, consequently this type of initiative should foster additional benefits to mere debt relief. Thus, it seems justified to differentiate the *debt relief – growth* relationship from the *indebtedness – growth*[15] relationship.

Following is a literature review of studies about interactions of first indebtedness and then debt relief with growth, government expenditures and MDGs. Mentioning studies on indebtedness will help introduce the contributions that provided inspiration to recent reviews on conditional debt relief and to mention theories of and around debt overhang. Moreover, one could assume that a diminution of debts through domestic measures (i.e. lower indebtedness with our nomenclature) could have similar consequences to a diminution of debt through international aid (i.e. debt relief). The following will allow this comparison. All sources with an asterisk refer to an article in which at least one of its contributors has a role in the IMF or WB. Unlike academic journals, those articles may not be subjected to external review.

In the literature, we find indications on the effect of indebtedness on growth. While Chowdhury finds evidence of a general negative influence of indebtedness on growth for countries similar to HIPCs (Chowdhury, 2015, p. 11), there seems to be a general view that a more subtle relationship takes place between growth and indebtedness. This view tends to confirm Krugman's debt overhang theory[16], as many contributors conclude after non-linear regression that a bell-curve best describes the relationship

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[14]The following list iterates over the general tendencies, before naming particular contributions on the next page.

[15]Essentially, *indebtedness – growth* studies did not include HIPCs or did not differentiate them from other countries.

[16]see section 1.2

(Pattillo, Poirson, & L. A. Ricci, 2011, p. 44*; Pattillo, Poirson, & L. Ricci, 2004, p. 30*; Benedict & Rina, 2014, p. 9*; Elbadawi et al., 1997, p. 61*): before a certain threshold, debt promotes growth and after that point more debt undermines growth. Presbitero and Cordella et al. add that for lower developed countries, the threshold of debt overhang might be lower (2012, p.621; 2008, p. 22*), i.e. debt is sustainable only at a lower level. Both papers assess that the weakness of institutions of lower developed countries is the root cause. Cordella et al. obtain a negative relationship from indebtedness on growth only for intermediate levels of debt burden, and find no evidence of such a relationship for either low or high levels of debt burden (Cordella et al., 2008, p. 21*). This tends to mitigate the relevance of a bell-curve indebtedness-growth relationship theory. Note that the studies mentioned above ignore the *indebtedness – government spending* relationship.

We will now focus on the effects of debt relief rather than indebtedness. Debt relief may have no impact on growth (Depetris & Kraay, 2005, p. 29*; Cordella et al., 2008, p. 21*: Johansson, 2010, p. 19)[17]. Others find that there is an impact only for countries with strong institutions (Presbitero, 2007, p.19-20; Bandiera et al., 2009, pp. 88-89). This would mean that strong institutions are a prerequisite to an efficient debt relief [18]. Some find a proof of a general positive impact of debt relief on growth (Marcelino & Hakobyan, 2014, p. 19*; Ralf, 2008, p.20; Chowdhury, 2015, p. 11)[19]. Notably, Chauvin & Kraay's work studies the inverted causality, namely the effect of GDP per capita level on the propensity to be relieved: they find no clear impact, which is, in a form, a critic of the way the IMF and WB chose the countries to be relieved (2007, p. 341*). Indeed, some confirm that the eligibility threshold set by the IMF, described in section 1.2, were set just low enough to include Côte d'Ivoire, but that "empirically unjustified sub-criteria" were included in order to exclude other countries and "keep down costs" (Martin, 2004, p. 17*)[20]. Whether this is true is less relevant than the fact that these thresholds exclude countries in high debt burden and are too static; thus eventually subject to arbitrary selection. This is again a link to the debt overhang theory: the point at which debt is judged unsustainable.

For the effect of debt relief on government spending, we can observe a similar trend towards diversity in results. A direct impact on government spending seems to be inexistent (Depetris & Kraay,

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[17] Here Johansson draws conclusions from mostly weakly robust regression results.

[18] We will come back to that point in section 3.

[19] It is noteworthy that Marcelino et al. do not refer to the fact that their regression analysis has results that explain less than 90% of the observations for the most part (Marcelino & Hakobyan, 2014, p. 28*).

[20] Matthew Martin worked in different non-profit organizations, as a consultant for African relieved countries and at the WB. It is conceivable that those positions allowed him to acquire inside information.

2005, p. 19*). This is contradicted by Cassimon et al. who provide an in-depth study of the effect of debt relief on expenditures and taxes, among other things. They show that at least debt relief from the HIPC initiative[21] significantly impacts public spending one year after (2015, p. 18). In a more indirect manner, Bird finds that for each dollar of relief, three further dollars are borrowed by HIPCs (Graham & Alistair, 2003, p. 57). This may represent a positive effect on present and future government expenditure.

We found two studies related to effects of debt relief on MDGs. The first from Cuaresma & Vincelette finds a positive impact on education (*in casu* repetition rates, educational expenditures, student-to-teacher ratio and primary enrollment) (2009, pp. 46-47). The second study is not conclusive regarding the effect on infant mortality rates and supposes that omitted variables is the reason for this lack of impact on mortality rates (Schmid, 2009, p. 66).

Analogically to the last mentioned paper and more generally, regarding this whole section 1.4, disparate results can be explained on one side by the heterogeneity of debt relief consequences, which lead to less robust results (this is recognized by most of the authors, except the ones specifically mentioned above). On the other side HIPC and MDRI initiatives are still recent, hence most of the studies were allowed only 10 years (or less) of observations.

Part 1 introduced the nomenclature of sovereign debt, before assessing that there may be a level of debt after which a country's economy becomes unsustainable. In the hope of bringing certain countries back to a sustainable level, exogenous debt relief interventions were performed by international organizations. A brief history of the latter and a literature review on debt shifts (endogenous debt fluctuations or external relief) permits to engage in the analytical part of this paper; namely assessing if debt relief (*in casu*, the HIPC and MDRI initiatives) was efficient at leading countries to more sustainable macroeconomic results.

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[21]The MDRI initiative which was included in the regression separately by Cassimon et al. did not have a significant effect.

2 Quantitative Analysis on Debt Relief

Cassimon et al. focused on elements, such as government expenditures, inferring that they are closely related to the amount of relief (2015, p. 10). Indeed a government receiving relief had to show an involvement in particular fields to the IMF as a prerequisite for relief, in form of expenditures. Cassimon et al.'s method provides a strong causal interaction between debt relief and the independent variables, but the result is agnostic regarding the outcome of the aforementioned spendings by the state. Because of frictions, lack of governance and corruption in government institutions, our set of underprivileged countries might never see the full amount initially invested at the end of the line (e.g. water facilities, education, infrastructure etc.). Some concluded with significant results that this is the case: government expenditures have a tendency to have weak correlations with its outcomes (Rajkumar & Swaroop, 2008, p. 108; Makuta & O'Hare, 2015, p. 9). But, studying the effect of relief directly on the final outcome of expenditures (e.g. primary education completion rate, poverty rate etc.) might create biased results.

In short, it appears that the observer can only choose between two options: either examine the indirect outcome (education level, sanitation etc.) leading to unsatisfactory causal relationships, or look at immediate consequences[22] (expenditures) which do not entirely reflect the end result.

This part 2, presents the rationale behind the country (section 2.1) and data (section 2.2) selection. Subsequently, section 2.3 will be a first try at estimating effects on GDP growth and MDGs (indirect outcomes, as mentioned above)[23]. In sections 2.4 and 2.5, we try to tackle the problem from another angle, by focusing on the effect of precedent GDP levels on the current level. This would be measured for countries that are equivalent to HIPCs in macroeconomic characteristics, but that did not benefit from external debt relief. The influence of the current GDP momentum in underprivileged countries is hoped to be isolated from the treatment effect (debt relief).

2.1 Country Selection

In order to measure the effect of debt relief on the GDP of a country, the first objective is to capture debt relief numbers for all countries helped through the HIPC and subsequent MDRI initiatives (all countries that were in the HIPC program were also in the MDRI program later). As of December

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[22]see Cassimon et al., 2015, p.18-23 for results

[23]In part 3, assumption 3 will illustrate that we consider that a weak causality lies between relief and indirect outcomes. Before formulating this assumption, the regression will nonetheless be processed, as an attempt to fill a gap in the literature.

2014, a total of 39 countries were eligible for both programs – the IMF is now considering to add Myanmar, Zimbabwe and Nepal to the eligible countries[24]. Out of the 39 countries, three of them (Eritrea, Somalia and Sudan) have not yet qualified for debt relief and Chad is in the interim phase. This leaves us with 35 countries which effectively received debt relief. Precise debt relief data and lists of countries that received help are retrievable in the IMF's *Article IV Consultation and Staff Report* for each country. A summary of all debt relief up to June 2015 was published recently by the IMF (Saito et al., 2016, pp. 33, 34). This is the source that is used for debt relief flows to the HIPCs in section 2.2[25].

The empirical framework is based on a treatment group (HIPCs) and a control group[26]. With this in mind, similar countries that did not receive relief were added. Throughout the paper we will refer to our sample of similar states – indifferently if they did or did not receive relief – as *underprivileged countries*[27]. For simplification purposes, the terms HIPCs and non-HIPCs will refer exclusively to subparts of that sample, thus excluding any unobserved countries.

For the selection of non-HIPCs, we need to find a common criterion that would gather a relatively homogenous sample, comparable with the HIPCs. In this context, GDP growth is not suitble as an indicator for the development of a state; certain countries could have benefitted from high recent GDP growth (thus disqualifying them from the category of underdeveloped countries), while providing a level of social infrastructure that would indicate underdevelopment[28]. Additionally, in order to measure the effect of debt relief on GDP growth, observing similar growths might produce results that are only valid for this level of growth.

Instead, the use of multiple criteria to determine if countries would qualify for our sample, guarantees a general similarity, but maintains particularities among the sample, thus avoiding heteroskedasticity. We include countries that some international organizations consider as underdeveloped under their own criteria. Two relevant Intergovernmental Organizations (IGOs) have a satisfactory catego-

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[24]This will be relevant to the extended sample used throughout this empirical analysis.

[25]Cambodia and Tajikistan received MDRI help even without being part of HIPCs. Similarly to the HIPCs, those countries have an outcome per capita under 380$. Exceptionally, this criteria alone was considered as sufficient for relief by the IMF. While Cambodia is present in our database because it is considered by instances as an underdeveloped country (see further on low Human Development Index (HDI) and Least Developed Countrys (LDCs)), Tajikistan is a young country born in 1991 and under civil war until 1997, which led to too sporadic data for the country to be considered.

[26]see justification in section 2.4

[27]This way we avoid confusion with the term *Least Developed Countries* coined by the Organization for Economic Co-operation and Development (OECD).

[28]Especially, a high GDP growth level from oil revenue is not likely to flow back to the population as a whole (Cassimon et al., 2015, p. 7).

rization of underdeveloped countries: the United Nations (UN) with the low HDI countries and the OECD with their list of LDCs[29]. Both organizations categorize the countries with their own criteria[30]. Those criteria are conveniently similar to the ones used by the IMF in order to determine if the countries categorized as HIPCs have met their goals (almost all HIPCs are also low HDIs and LDCs). This ensures that our list of underprivileged countries is similar to HIPCs.

The comparison of the three lists of HIPCs, Low HDIs and LDCs, shows that 23 countries are Low HDIs and LDCs but not HIPCs. But a number of countries could not enter into consideration. South Sudan (independent from Sudan as of 2011), East Timor (declared a sovereign state in 2002) and Yemen (South and North Yemen united in 1990) were created too late for observations to fit in our sampled timespan. Myanmar does not have enough data on GDP in the WB's Database, namely only from 2012 to 2014.

With this list (HIPCs, Low HDIs and LDCs), the four HIPCs that have not receive help yet could enter the sample as non-HIPCs (Eritrea, Somalia, Sudan and Chad). We have to eliminate Somalia, because analogically to Myanmar, it has only late GDP data, namely from 2013 to 2014. The three remaining countries are added to the list of non-HIPCs. The terminology is here distorted, since those three countries are de facto considered as HIPCs by the IMF, but to this study it is relevant whether they have already received help or not.

After describing the sampled population, we shall mention the individual observation variables.

2.2 Data

A period of 40 years is used, between 1975 and 2014. The following paragraph will look at GDP growth, which is the only dependent variable throughout this paper[31]. After that, the independent variables will be described.

Although debt relief only occurred from the year 1998 onwards, data from previous years were required in order to show the trend in evolution of GDP before the relief period took place. The ultimate year (2014) corresponds to the last available data. In order to measure GDP growth, we used

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[29]The Quality of Life index could also have been a solution, but it only observes 56 countries, among which two African countries only: Egypt and South Africa (`http://www.numbeo.com/quality-of-life/rankings_by_country.jsp`).

[30]see table 2

[31]it also plays a role as an independent variable in a set of lags in the counterfactual regression analysis

real GDP (in 2015 dollar terms). We then calculated GDP per capita (as in Acemoglu et al. 2016, p. 8, in order to account for the size of the country). The final GDP growth figure results from the difference in log real GDP per capita, between two years[32].

Debt relief measures, as the main independent variable, were extracted from the IMF document *Heavily Indebted Poor Countries (HIPC) Initiative And Multilateral Debt Relief Initiative (MDRI)— Statistical Update* (Saito et al., 2016). Cassimon et al. have already retrieved the debt relief data in April 2015 for a paper about the propensity of debt relief to release fiscal space for African HIPCs (2015, p. 7). Upon request, the authors shared their database. Because of the focus on Africa, five non-African countries, out of the 35 relieved, were not included in their database. Out of the 30 remaining countries, Cassimon et al. removed 6 countries that started receiving relief after 2005 (because the post debt relief period is very short, since their database finishes in 2012). Because of the focus of Cassimon et al.'s study, 11 states in total were not available to our use. Consequently, we went back to the original IMF documents and extracted again the data required for this paper. The measures are the difference in yearly nominal debt service due, before and after the relief by the IMF (ibid., p. 32), WB (ibid., p. 33) and the African Development Bank (AfDB) (ibid., pp. 35-36). Cohen (2000, p. 22) and Cassimon et al. (2015, p. 4) use the same method. The HIPC and MDRI initiatives called for other reliefs from other institutions like the Inter-American Development Bank, the Paris Club and other minor institutions, as well as for bilateral agreements. Those institutions decided to relieve debt stock instead of debt service[33]. The drop in debt stock triggered a drop in future debt service burden and ultimately in debt service. Unfortunately no year to year data is available regarding the debt service equivalent to that drop. We will therefore focus on the three main actors of the HIPC and MDRI reliefs, i.e. IMF, WB and AfDB[34]. The first part of our analysis does not take into account the amount of relief but its start. Therefore, rather than measuring the level of relief, we focus on MDG requirements applied on all the helped countries by the IMF before they could start receiving substantial relief. The relief over GDP measure was used for figure 2, as an average over periods around relief start. For every year and every country the nominal relief was divided by the nominal

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[32]Natural logarithm differences are a good approximation for marginal percentage changes

$$\lim_{(x_2 - x_1) \to 0} \left(\frac{x_2 - x_1}{x_1} \right) = ln \left(\frac{x_2}{x_1} \right)$$

Our regressions will focus on the effect of debt relief growth on log of GDP per capita, which directly delivers the effect on growth of GDP per capita ($ln(x_2) - ln(x_1) = ln(x_2/x_1)$). Throughout the paper, with some abuse of terminology, we refer to the effect of debt relief on GDP, instead of the effect of debt relief on GDP growth per capita, see Acemoglu et al. (2016, p. 1) for a similar conduct.

[33]see section 1.4

[34]For a full list of multilateral institutions that took part in the HIPC initiative, see Johnson (1998, p. 69).

GDP.

As control variables, equivalents of the Millennium Goals were used[35]:

– the births mortality rate for children under 5 years old and for infants respectively (per 1'000 births).

– the maternal mortality rate (per 100'000 births).

– the following indexes: undernourishment, water access and sanitation access (in percent).

– In order to account for education, primary, secondary and tertiary enrollment rates for both women and men were included (in percent).

This should allow to evaluate whether relief significantly improved the situation of those countries, based on the precise goals set by the IMF. We were unable to find enough data on poverty rate: among 6 different measures of poverty, none displayed more than 10% of the expected number of observations over all the countries and years[36]. Poverty rate will thus be ignored in our analysis.

As for democracy levels, they consist of an index that summarizes data from 10 different democracy scores[37]. Each of the 10 different democracy scores are rated on different scales. The United Democracy Scores (UDS) provides a unified ranking, scaling them all on one scoring system (Pemstein et al., 2010, p. 436)[38].

For a preliminary analysis, we wanted a broad visualization of the evolution of debt level in our set of countries. Debt over GDP is extracted from the IMF Database. It is a contribution described in a working paper released by the IMF [39]. It contains a few missing values. The WB's database on debt over GDP while very sporadic, did provide a fill up, for a marginal amount of observations (it was controlled that those observations from crossed sources did coincide with the previous and following span

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[35] For this and all subsequent allusion to the WB Data Bank, see `http://databank.worldbank.org/`.

[36] Namely the *Survey mean consumption or income per capita, bottom 40% (2011 PPP $ per day)*, the *Poverty gap at national poverty lines (%)*, the *Poverty gap at $1.90 a day (2011 PPP) (%)*, the *Poverty gap at $3.10 a day (2011 PPP) (%)*, the *GINI index (WB estimate)* and the *Income share held by lowest 10%*. All were retrieved from the WB Data Bank.

[37] The goal of this paper is to estimate the efficiency of government expenditures, independently of the quality of government institutions. It is not intended to identify which of corruption or governance quality is impairing outcomes of government expenditures. A unified democracy level index already encompasses these notions evaluated by different specialists in the domain. Under the advice of Prof. Freyburg (HSG), this specific consolidation of democracy scores was used.

[38] The database is available at `http://www.unified-democracy-scores.org/uds.html`.

[39] The database is available at `http://www.imf.org/external/pubs/ft/wp/2010/data/wp10245.zip`, see Abbas et al. (2012, pp. 6-8) for data sources and methodology.

Figure 2 – Debt/GDP and relief/GDP around relief
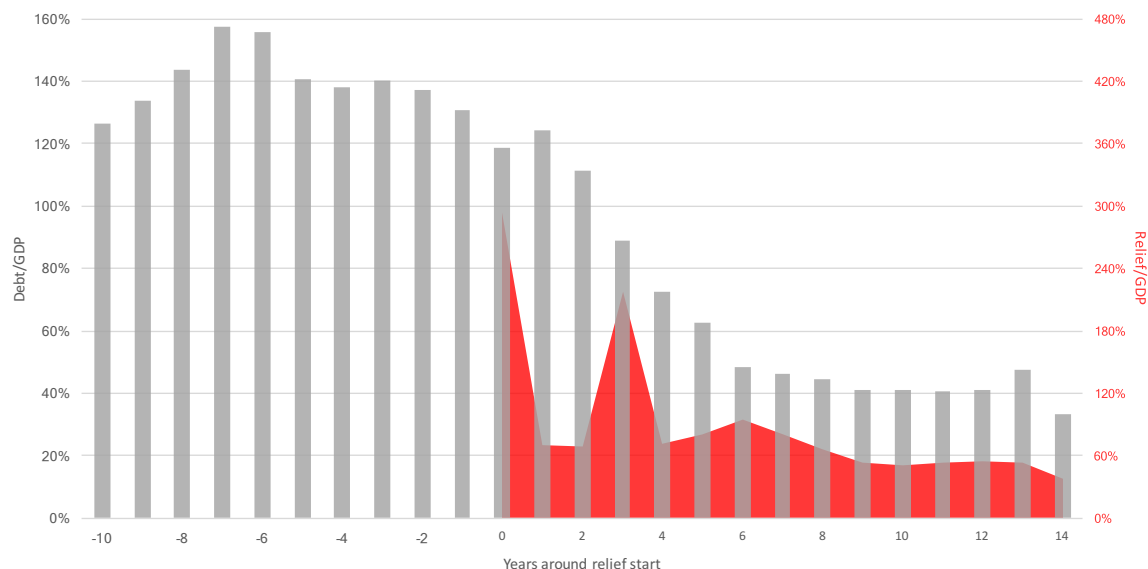
of years) (Cassimon et al., 2015, p. 11). Figures 2 and 3 show the evolution of different macroeconomic figures around relief start for HIPCs. The first, displays the evolution of debt over GDP and relief over GDP. The second displays GDP growth. This raw data allows for a premature conclusion: after relief, most countries saw their debt over GDP level decrease, while experiencing increasing GDP growth.

The following sections will attempt to assess the reasons for an increase in GDP growth, i.e. whether the increase is due to the granted relief, or if countries would have experienced a similar growth anyway. For the statistical analysis that follow in the two subsequent sections, tables 3 and 4 illustrate summary statistics of the variables in use[40].

2.3 Preliminary Attempt at a Relief and Outcome Regression Analysis

As mentioned earlier[41], a regression of debt relief on GDP and indirect outcomes (MDGs) as control variables is assumed to provide unsatisfactory results. Nevertheless, we retrieved the necessary data in order to attempt to disprove this assumption and fill a gap in the literature. We additionally control for democracy score, which would eventually eliminate the effect of inefficiencies and corruption:

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[40]see listing 1 for the Stata code
[41]see beginning of section 2

Figure 3 – Real GDP around relief for HIPCs
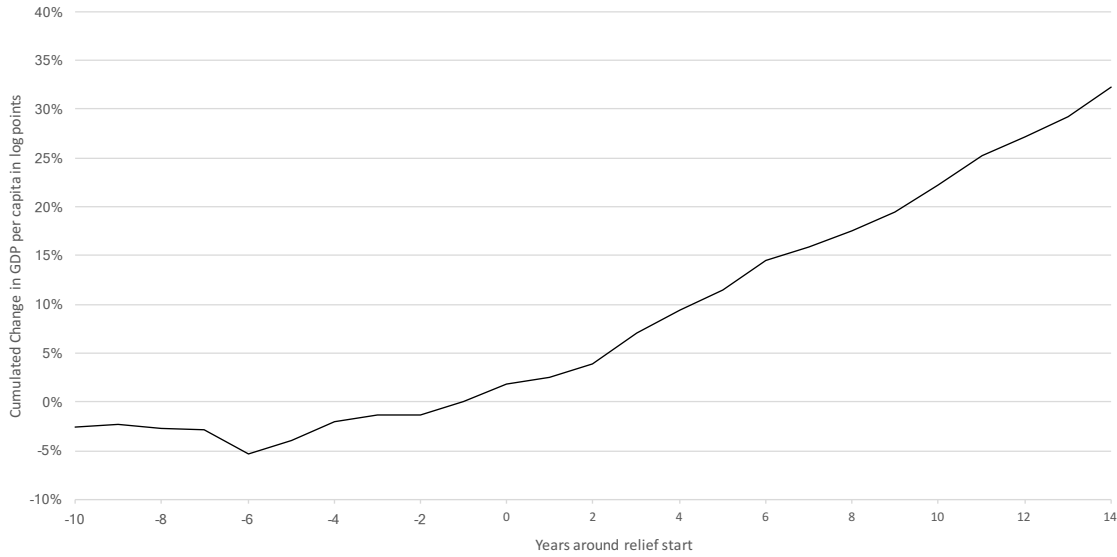
Note: GDP growth is normalized one year before relief. Before and after, logs of GDP are serially subtracted or aggregated respectively.

$$y_{ct+i} = \beta R_{ct} + \sum_{j=1}^{S} \sigma^j g_{ct}^j + \omega d_{ct} + \varepsilon_{ct}, \quad \text{for } i = 0 \text{ to } 4 \tag{1}$$

We thus have one observation for every country c at each time t over 40 years (1975-2014). We processed five regressions that correspond to one regression with GDP level in year t and four with positive lags (for $i = 0, 1, 2, 3, 4$). We expect the effect of relief on GDP to be higher for GDP levels further away from the relief. R is a dichotomous variable for relief: its value is $\{1\}$, if relief is happening or had already happened in a particular country[42]. β is the estimated effect of relief (R) on GDP growth. Each MDG measure g^j has its own estimator σ^j. S is the number of MDG variables, *in casu* 14. Finally, d represents democracy along with its estimator ω. ε is the error term, including all other time-varying unobservable shocks to GDP per capita.

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[42]Ideally, debt relief would be factorized by a value representing the country's macro economical health. But either GDP, exports or imports are all highly correlated with the dependent value ln GDP per capita. This forces us to use raw data. Keeping raw debt relief numbers in millions of dollars would have produced a considerable amount of zero values and a small amount of high values. Thus the measured estimator of debt relief would be pushed near to zero. With so many zero values, the natural logarithm is not a possibility either. We therefore used a dummy variable *Got Relief* as described above.

Before mentioning results, let's note that these complementary variables, such as sanitation, education rates and others, might not be capable of explaining yearly GDP growth, for several reasons:

- The causal relation between those supplementary variables and GDP is very indirect

- The effect can be both beneficial and disadvantageous for GDP Growth

- Those variables are sometimes tightly correlated, so that isolating their effect might not be possible (e.g. primary and secondary education completion rates)[43].

As a basic method, an OLS regression is processed. If this provides satisfactory results, it is conceivable to use other methods, such as building independent time periods pooled cross sections (Wooldridge, 2013, pp. 468-473). The regression results are shown in table 6[44]. With only around 130 observations, the regression has an unsatisfactory number of observations. Summary statistics tables 3 and 4 show that the pooled crossed-section sample has a total potential of around 2000 observations[45], while most MDGs were covered by 500-1000 observations. MDG values for each goal come from different studies. Consequently, missing data was scattered all over the database, instead of being focussed on the same observations. While this statistical analysis attempted to fill a gap in the literature (since no article has been found that related relief to all MDGs), we can not consider this result firstly because of the low amount of observations, secondly because of the indirect relationship between relief and MDGs. Building independent regressions for different time periods as suggested above is thus not a possibility.

2.4   A Dynamic Panel Model

Similarily to Acemoglu et al. (2016, p. 8), let us assume that for each country c, at time t, the GDP Growth per capita (the difference in log GDP per capita between two subsequent years) is influenced by its own momentum and factors exogenous to GDP growth:

$$y_{ct} = \beta R_{ct} + \sum_{i=1}^{L} \gamma_i y_{ct-i} + \delta_c + \zeta_t + \varepsilon_{ct} \tag{2}$$

β, the effect of relief, only affects GDP growth if the country already received relief. This is represented by the dummy variable R_{ct} (equals {1} if the country got relief). Debt relief should act as a

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[43]While it is possible to test for intercorrelations between explanatory variables, it will not be done here, because the regression has an insufficient number of observations. See next paragraph.

[44]see listing 2 for the Stata code

[45]sum of numb. of obs. for ln GDP

treatment [46]. A set of control variables should then allow to extract the effect of the treatment only: L lags of GDP growth control for the dynamic in economic growth already in place. δ_c are country fixed factors and ζ_t are time fixed factors. ε_{ct} is the error term.

We assume sequential exogeneity:

Assumption 1 $E(\varepsilon_{ct}|y_{ct-1}, ..., y_{ct_0}, R_{ct}, ..., R_{ct_0}, \delta_c, \zeta_t) = 0$ for all $y_{ct-1}, ..., y_{ct_0}, R_{ct}, ..., R_{ct_0}, \delta_c$ and ζ_t and for all c and $t \geq t_0$.

The error term ε_{ct} is serially uncorrelated, so that past relief and GDP do not have an effect on future shocks of GDP. In other terms, only the effects accounted for in equation 2 are truly affecting the shock in time t and all unobserved variables shall not be influenced by past or present events explained by our independent variables.

Unlike Cassimon et al., we will refrain from studying the effect of debt relief on government expenditures in MDGs. Instead, we will measure the effect of debt relief on the progression of each field (education level, sanitation level, etc.). While section 2.5 aims to estimate β, the effect of relief, section 3.1 tries to estimate the average country and time fixed effects by analytical rather than statistical observations. Because of assumed inefficiencies in the way investments are made by each country, we will presume that the fixed effects are the efficiency of those government expenditures. More precisely, we will use the MDGs as references for fixed effects in order to attest if the government spendings were effective. Due to missing data (as mentioned in section 2.2), we can only try to explain some of the fixed effects.

2.5 Semi Parametric-Estimates and Treatment Effects

This part contains the method for the OLS regression to account for counterfactuals and is inspired by Acemoglou et al.'s method (2016, pp. 17-19). Their study aimed at explaining GDP growth spikes in countries that democratized. The year zero would be the year of democratization and the years around (-25 < p < 15) would show the evolution of GDP growth. All the countries that Acemoglu et al. integrated into this model eventually democratized and sometimes countries would democratize, go back to a non-democratic regime and democratize again[47]. We did not encounter the latter issue

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[46] because of the conditionality of HIPCs reliefs, see section 1.3

[47] This allowed them to use propensity scores, depending on the propensity to democratize. Democratization is endogenous and thus such a method makes sense. But debt relief happens on an exogenous basis (IMF intervention), so there is no way, or no point to predict a propensity to receive relief depending on previous GDP growth trends.

with relief, since the IMF did not go back on his decision for relief for any of the countries. Not all of our countries received relief. Thus, we could not put them all on this time span around relief, since non-HIPCs have per definition no year zero (year of relief). We will further explain how we used and adapted Acemoglou et al.'s model to our needs.

$y_{ct}^p(r)$ will denote the potential GDP level (in logs) at time $t + p$ for country c. $r \in \{0, 1\}$, in case the country is part of the control group (no relief (yet)[48]) or is treated (got relief), respectively. Specifically, if the country obtains relief at t, we write $r = 1$ and $(R_{ct} = 1, R_{ct-1} = 0)$. Inversely, a country which has not been relieved (yet) is denoted with $r = 0$ and $(R_{ct} = R_{ct-1} = 0)$. Let $\Delta y_{ct}^p(r)$ express the potential change in (log) GDP per capita from time $t - 1$ to time $t + p$ for any country. This nomenclature will help answer the question: what would have been the GDP growth of countries that received relief, had they not received relief? This infers estimating the Treatment Effects on the Treated (TET)[49], as proposed by Acemoglu et al. (2016, p.17):

$$\beta^p = \mathbb{E}(\Delta y_{ct}^p(1) - \Delta y_{ct}^p(0)|R_{ct} = 1, R_{ct-1} = 0) \tag{3}$$

The difference of GDP per capita for relieved countries can be modeled as a function of observables from the collected data.

Assumption 2 $\Delta y_{ct}(d) \perp R_c, y_{ct-1}, y_{ct-2}, y_{ct-3}, y_{ct-4}, t$ for all $y_{ct-1}, ..., y_{ct-4}$, and for all c and t.

By taking into account dynamics in preceding growth, we assume that we can already grasp all effects on present potential outcome, and this independently if the country was relieved or not. We thus rule out any other time-varying omitted independent variable, or we assume that they shift GDP by the same amount every year. This assumption is central to our counterfactual analysis, because while we do have supplementary panel data, their inclusion into the counterfactual regression rendered unsatisfactory results [50].

We introduce X_{ct}, a vector containing the four lags of log GDP per capita, y_{ct-1}, y_{ct-2}, y_{ct-3}, y_{ct-4}. Thanks to the *law of iterated expectations* (Wooldridge, 2013, pp. 743-744), it is possible to

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[48]Before a HIPC country gets relief it is also considered as non treated, until it receives relief.

[49]The Stata Manual for the `teffects` package, was used to get familiarized with treatment effects nomenclature and theory. It is available at `http://www.stata.com/manuals13/te.pdf`.

[50]see section 2.3

write our counterfactual path for GDP growth around relief (equation 3) as such:

$$\beta^p = \mathbb{E}(\Delta y_{ct}^p(1)|R_{ct} = 1, R_{ct-1} = 0) - \mathbb{E}(\Delta y_{ct}^p(0)|R_{ct} = 1, R_{ct-1} = 0)$$
$$= \mathbb{E}(\Delta y_{ct}^p(1)|R_{ct} = 1, R_{ct-1} = 0) - \mathbb{E}\left[\mathbb{E}\left[\Delta y_{ct}^p(0)|X_{ct}, R_{ct} = 0, R_{ct-1} = 0\right]|R_{ct} = 1, R_{ct-1} = 0\right]$$

(4)

The second line can be expressed as such, since, per definition, $r = 0$ implies $(R_{ct} = R_{ct-1} = 0)$. Assumption 2 guarantees that a country's GDP growth can be modeled by its precedent lags of log GDP per capita. We now have to deal with the fact that not all our observations can be represented inside this time span around relief, because some of the countries never got relief. On this point in particular, there is a divergence from Acemoglou et al.'s work. We measure the effect of previous GDP levels on GDP at time $t = [1974; 2014]$, instead of at period p around relief:
$\mathbb{E}[\Delta y_{ct}^p(0)|X_{ct}, R_{ct} = 0, R_{ct-1} = 0] = X_{ct}^{'}\pi^t$. Now, $X_{ct}^{'}$ stands for the accumulated growth over the four lags of GDP. Whereas π^t will be estimated by a succession of OLS regressions of y_{ct} on our lags of GDP, for the subset of countries with $(R_{ct} = 0, R_{ct-1} = 0)$. $X_{ct}^{'}\pi^t$ is an approximation of the counterfactual effect on growth for countries that have received relief, had they not been relieved.

When estimating β^p, we have:

$$\widehat{\beta^p} = \widehat{\mathbb{E}}(\Delta y_{ct}^p(d)|R_{ct} = 1, R_{ct-1} = 0) - \widehat{\mathbb{E}}(X_{ct}^{'}|R_{ct} = 1, R_{ct-1} = 0)\widehat{\pi}^t$$

(5)

In practice, this boils down to first subtracting the observed GDP growth, by the counterfactual, before computing the average of the result[51]:

$$\widehat{\mathbb{E}}(\Delta y_{ct}^p(d)|R_{ct} = 1, R_{ct-1} = 0) - \widehat{\mathbb{E}}(X_{ct}^{'}|R_{ct} = 1, R_{ct-1} = 0)\widehat{\pi}^t = \widehat{\mathbb{E}}[\Delta y_{ct}^p(d) - X_{ct}^{'}\widehat{\pi}^t|R_{ct} = 1, R_{ct-1} = 0]$$

Tables 7, 8, 9 and 10 show the counterfactual OLS regressions results[52]. The adjusted GDP growth rate in the years around relief is rather negative (figure 4). This curve represents the average treatment effect: after 4 years, there is no particular effect on GDP; after 14 years, debt relief will have depreciated GDP growth by 10%. The average *R-squared* is of $0,9935$, which proves that the OLS regression method provides a very good fit for the data. In other terms, the relationship between GDP growth and its lags is *de facto* almost linear. The dashed lines of the 95% confidence intervals show the level of precision of this methodology and mitigate this conclusion[53]. We can not definitely conclude that

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[51] according to the law of iterated expectations, see previous page

[52] see listing 3 for the Stata code

[53] Compared to Acemoglu et al.'s results of GDP counterfactuals around democratization, this spread of 95% confidence intervals is 1.5 times wider after 14 years. The higher level of imprecision in our paper can be explained in part by the lower number of observations in each counterfactual regression. For other remarks, see subsection *Shortcomings* of section 3.3

debt relief had a negative impact on GDP growth. Rather that, countries that received relief were not placed at a particular advantageous position. We will try to confirm that view in the following section. Similarly to this counterfactual analysis, we will try to assess whether relieved countries really had an advantage in the set of underprivileged countries. Rather than measuring impact on GDP growth, we will compare impact on the MDGs. As concluded above, MDGs observations, by being scarce and by having indirect relation with relief, are less appropriate for regression analyses. Section 3.1 explains the methodology.

Figure 4 – GDP around relief with yearly counterfactual OLS estimators
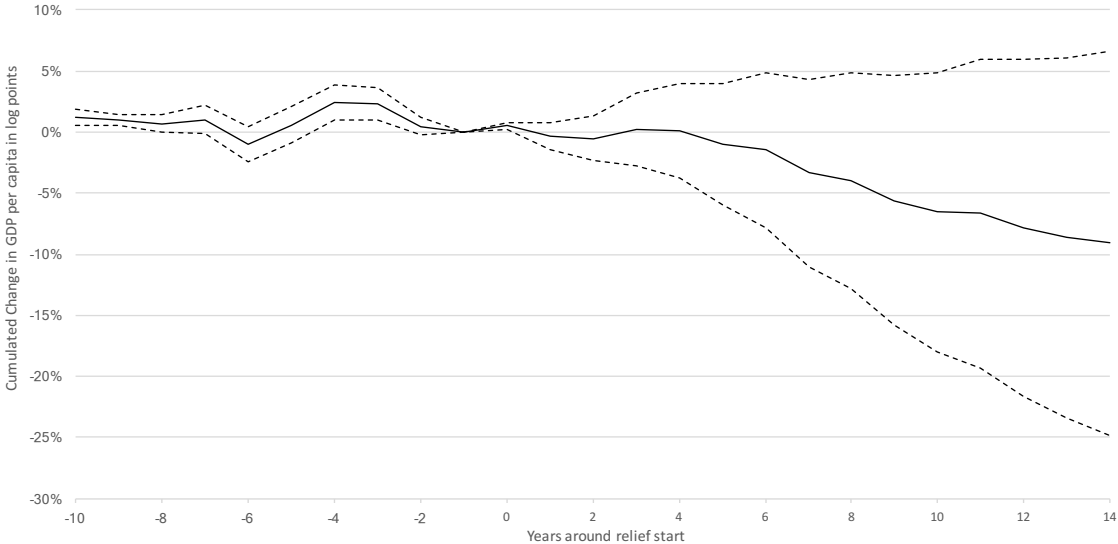
Note : GDP growth is normalized one year before relief. Before and after, logs of GDP are serially subtracted or aggregated respectively. The dashed lines represent the accumulated 95% confidence intervals. The years prior to relief shown here are represented for esthetic reasons but are not representative of a real counterfactual effect: relief could not have had an ex post effect on previous growth (this might explain the unexpected tightening of the confidence interval in the very first years). This chart is interesting to compare with figure 3.

3 Qualitative Analysis and Improvement Proposals

After observing that debt relief might not have a positive impact on GDP growth, this chapter provides a numerical (section 3.1) and dialectical (section 3.2 and 3.3) analysis of eventual causes for this result.

> **Assumption 3** The set of underprivileged countries' government expenditures are inefficient: either inappropriate resource allocations or corruption or different types of frictions makes it impossible for these expenditures to be of truly added value to the corresponding domains (health, education, etc.).

The latter motivates for focussing on expected results of government expenditures (MDGs) and on the efficiency of government institutions. Presbitero argues that the quality of institutions and policies are the primary constraints to growth for countries, independently from their income level (2012, p. 621).

3.1 Unprocessed Data Analysis

Evidence exists to suggest that debt relief has a certain impact on government expenditures (Cassimon et al., 2015, p. 18). We assume that public spending from the state is subject to corruptions and inefficiencies[54]; thus, we wish to observe the outcome of the expenditures. We will restrain ourselves to the outcomes in relation with the MDGs (as listed in section 1.3). Since the MDGs are goals set by the IMF itself during the HIPC and MDRI initiatives, we will refer to them in order to attest of the efficiency of that relief.

Regarding the empirical framework, we choose to simply compare graphically HIPCs' MDG figures with non-HIPCs'. The following elements prevent us from proceeding to a regression analysis for that part. First the number of observations on MDG figures is a lot more scarce. Secondly, a counterfactual regression like the one in the previous section would not make sense, since unlike with growth, there is no true momentum on access to water for example (more access to water in time t does not intrisinquely implicate even more access to water in $t + 1$; rather, it is expected to be developed in a long period of time, and depends on the exogenous actions taken by government institutions and NGOs). Thirdly, the quality of the observations may not be sufficient[55]. Fourthly, it can take several years for those final outcomes to be affected (it may require ten to twenty years in order to see results in edu-

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[54]see assumption 3

[55]We assume MDGs are particularly difficult to measure in rural areas of underprivileged countries.

cation for example, since schools, roads, have to be built, teachers formed and kids schooled *inter alia*).

Our method guarantees in particular that the third point mentioned above is avoided. We assume that measurements of each of those variables (sanitation access, undernourishment, ...) has been made in a very similar manner for each country, without assuming individual accuracy of each measurement. This way we can trust those values as a basis of comparison and put less focus on the intrinsic accuracy of each measurement.

Results

In the analysis of the following figures, we want to emphasize again that the spread between HIPCs (with an asterisk) and non-HIPCs is our focus. We thus concentrate on the spread in 1999, i.e. right at the start of relief for most countries, and compare it with the spread in 2014. The remaining yearly observations aim at insuring a coherent evolution.

Figure 5 – Education statistics

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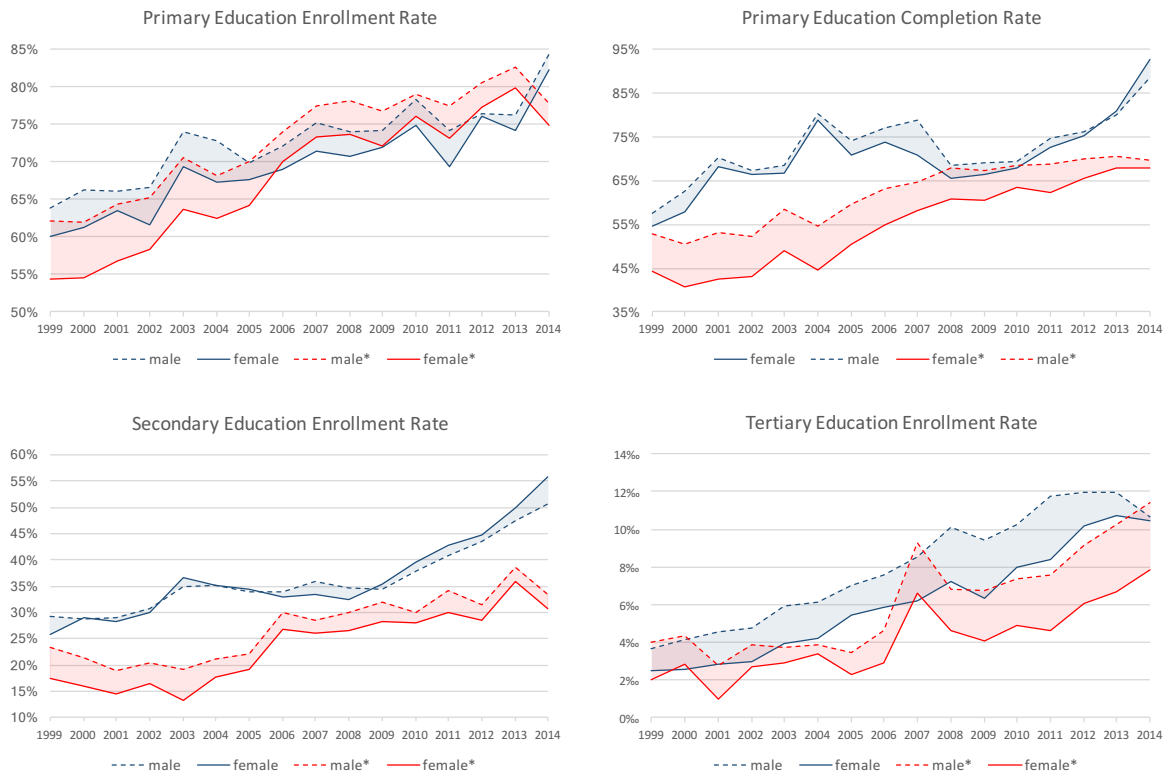
The education observations (Figure 5) inform on both the spread between helped and non-helped countries and the spread between male and female school attendance. Additionally, primary education completion rates are added in order to fit the correspondent MDG and tertiary education is added even if not part of the MDGs. For primary education, we can see a narrowing of the spread of male and female attendance in HIPCs for both enrollment and completion rate. However, the narrowing does not happen as fast as for non-HIPCs. The same phenomenon occurs in secondary education. In tertiary education, the contrast is even stronger, as the spread for HIPCs male and female enrollment unexpectedly expands. Regarding differences in progress between HIPCs and non-HIPCs for combined male and female statistics (observing the middle of the spread), for non-HIPCs we can clearly see a stronger growth in primary education completion rate ($\sim 40\%$ for HIPCs and $\sim 64\%$ for non-HIPCs) and in secondary education enrollment rate ($\sim 63\%$ for HIPCs and $\sim 91\%$ for non-HIPCs). The two remaining graphs show about the same evolution, as both groups of countries start and finish at around the same rates.

Figure 6 – Mortality rates linked to birth
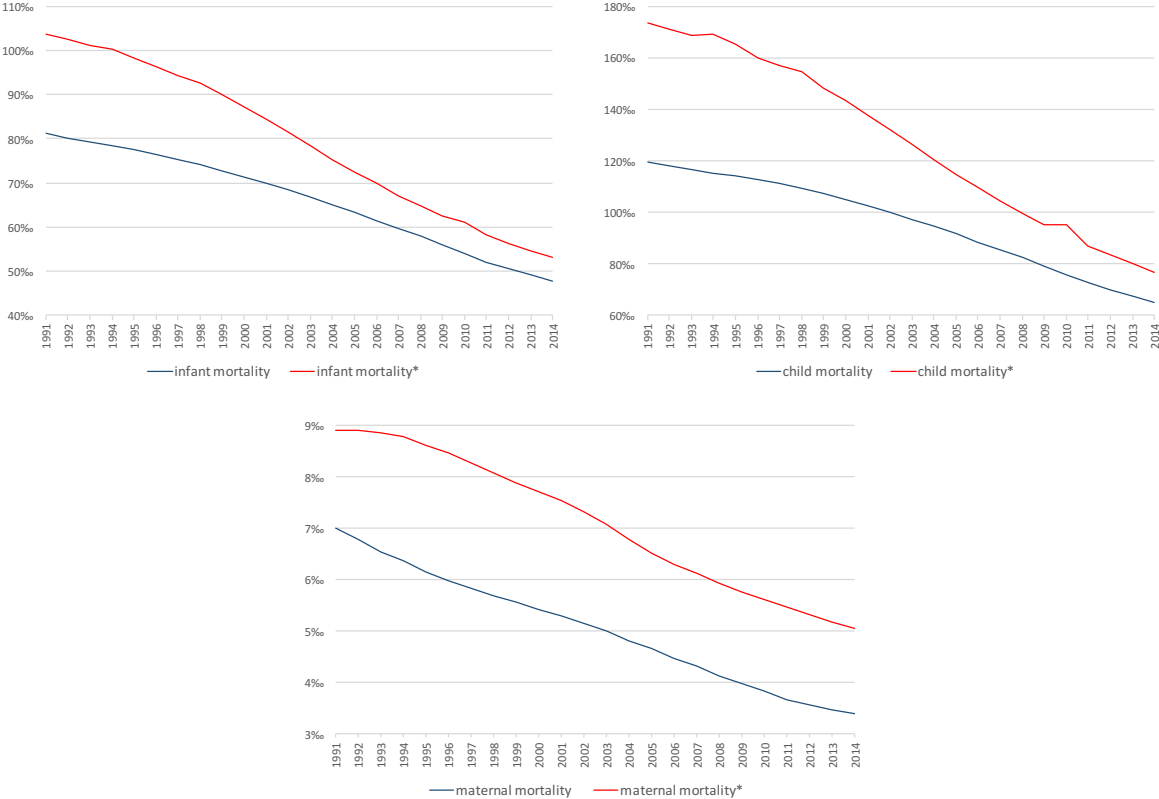
As to mortality rates linked with birth and young children (figure 6), both infant and child mortality rates show a tightening of the gap between HIPCs and non-HIPCs and especially after 1999 and the start of the relief. This tightening of the gap is more subtle for maternal mortality rates.

Figure 7 – Undernourishment, water and sanitation access

An analogical behavior is observable on sanitation access [56], where, except for the kink in non-HIPCs in 2014, the spread stays about the same. While water access displays a clear tightening of the gap, undernourishment (even if consequently lowered for both HIPCs and non-HIPCs) displays a widening of the spread.

Our analysis of treated (HIPCs) and control (non-HIPCs) countries shows that although HIPCs obtained better results after relief, they often did not do better or as well as non-HIPCs. In other terms, HIPCs were worse or just on a par with the conjuncture, assuming that our two groups of HIPCs and non-HIPCs are comparable countries which are subject to about the same externalities. Both the counterfactual OLS regression analysis on growth and the analysis of the MDGs show relief

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[56]see figure 7

does not deliver a positive treatment effect on the macroeconomic health of a country.

Let's note that, for almost all MDGs, relieved countries were worse off compared to unrelieved ones in the 1990s, i.e. before the relief. This tends to mitigate previous remarks about how the eligibility threshold to debt relief might be inadequate in choosing which country deserves relief[57]. On the other hand, the thresholds presuppose that once a HIPC country has reached them, it might not receive relief again in the future. Because the economical and social health of HIPCs has not been particularly better than the conjuncture around them, it is questionable whether these eligibility thresholds are low enough for debt to be again profitable under the debt overhang theory (remember that for underdeveloped countries, some even mentioned that the debt overhang threshold might be lower than occidental countries[58]. Figure 8 further illustrates this point with debt over GDP levels around the beginning of the HIPC initiative, for our entire set of underprivileged countries. This period was the crucial decision phase, in which the IMF chose which countries to include in the program. Notably, four underprivileged countries; namely Central African Republic and Cote d'Ivoire (HIPCs), as well as Kiribati and Tuvalu (non-HIPCs) had not enough available data for those years.

Figure 8 – Debt over GDP 5 year average (1996-2000)

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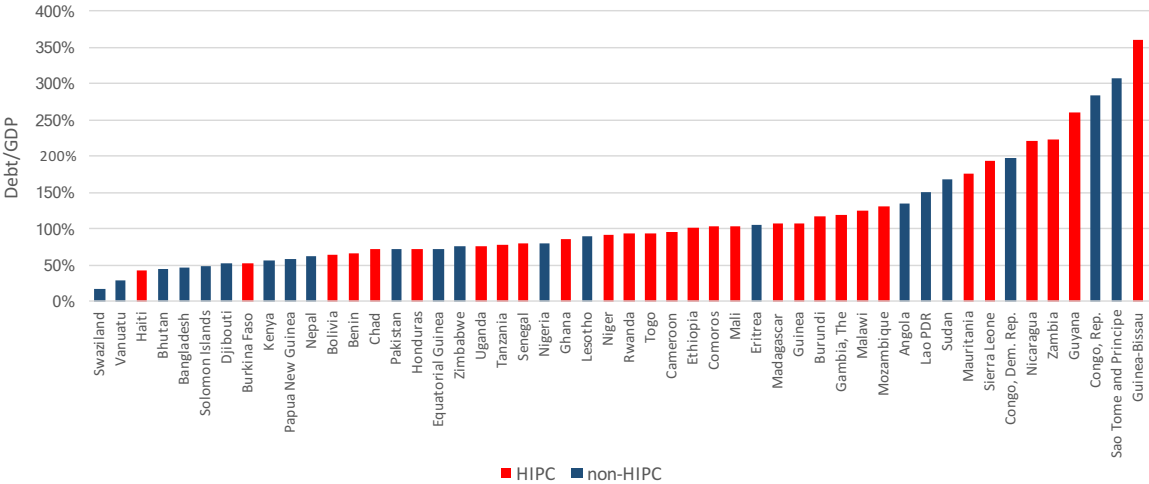
[57]see sections 1.2 and 1.4
[58]see section 1.4)

3.2 The Swiss Debt Brake

Debt ceilings exist in certain countries, such as in the US, which was recently raised (Ostry, Loungani, et al., 2016, p. 41). The objective of a debt ceiling is to reduce debt burden, by forcing countries to use budgetary surpluses in order to reimburse sovereign debt. There has been a debate (ibid., p. 40) whether a country should impose higher taxes or lower investments in order to refinance the debt and provide fiscal space (Ostry, Ghosh, et al., 2015, p. 15). Others assess that debts are to be seen as sunk cost, that should be rarely paid off. Rather they advise to let the debt ratio decline through growth (ibid., p. 19). The latter definition of the debt ceiling and its problematic nature help differentiate it from the idea of a debt brake. Our proposition ignores debt burden, in order to focus on efficiency of governance. This section will present the particularities of a debt brake measure and how it could be adapted for HIPC countries.

Followed by a similar rule in Germany in 2009 (Frankel, 2012, p. 4), the debt brake, included in the constitution in 2001 (art. 126, FCSC) under a mandatory referendum and implemented in 2003, compels Switzerland to balance its budget. Sweden or Netherland already applied debt brake measures in the 1990s. If the national rules in place were not to be respected by the government, there would be reputational sanctions, through media attention for example (Danninger, 2002, p. 12). The *Institut Economique Molinari* published a report in 2015. It displayed the date at which every European country spent all its last annual revenues[59]. This mean remains a very soft threat for countries concerned. The Swiss debt brake introduced the idea of legal binding, in case its tight debt brake conditions were not respected (ibid., p. 12). It included the following elements:

- The state's maximal expenditures $[\bar{G}]$ have to be below or equal to the amount of revenues $[O]$, adjusted by a certain factor. This factor is called the *business cycle adjustment factor* $[k]$:

$$\bar{G} \leq O \cdot k, \ \ with \ \ k = \frac{y_t^*}{y_t}$$

Where y_t is the approximated previous year's real GDP and y_t^* is the expected real GDP measured by the *smoothed trend of expected real GDP*. When actual GDP is lower than was expected, the cycle adjustment factor is over $\{1\}$, i.e. in bad times expenditures a bit higher that revenues are allowed. And vice versa, in case k is lower than $\{1\}$ (Waldmeier et al., 2015, p. 43-44).

If expenditures are 6% over the allowed threshold $(O \cdot k)$, the Swiss Debt Brake formula must be again equalized in a timespan of three years (ibid., p. 45).

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[59]see `http://www.institutmolinari.org/IMG/pdf/recettes-fiscales-eu-2015.pdf` for more details

- For exceptional payment requirements, the state can allow a one-time exemption from the previous mentioned rule. As examples, the Swiss Federal Council mentions recessions, natural catastrophes or wars (Waldmeier et al., 2015, p. 46).

- Any amount exceeding the threshold at a certain year must be booked in an account for exceptional expenditures. It is expected that this account will be lowered in following years, if expenditures are below the debt brake threshold. The law stays flexible regarding the time required to lower the exceptional expenditures account to zero (ibid., p. 48-49).

The debt brake has been active for more than 10 years, so it is possible to observe its consequences for the economy. For that, we used figure 9: a chart from Beljean and Geier[60] (2013, p. 2). It is tempting to find statistical links between debt brake and investments in the country, government expenditures, unemployment and even the MDGs and GDP growth. This will not be put into practice in this paper, because only measurements over approximately 10 years are available and

Figure 9 – Swiss debt brake history

for only one country up to now. It may be one of the reasons why we still fall short of scientific studies on this subject.
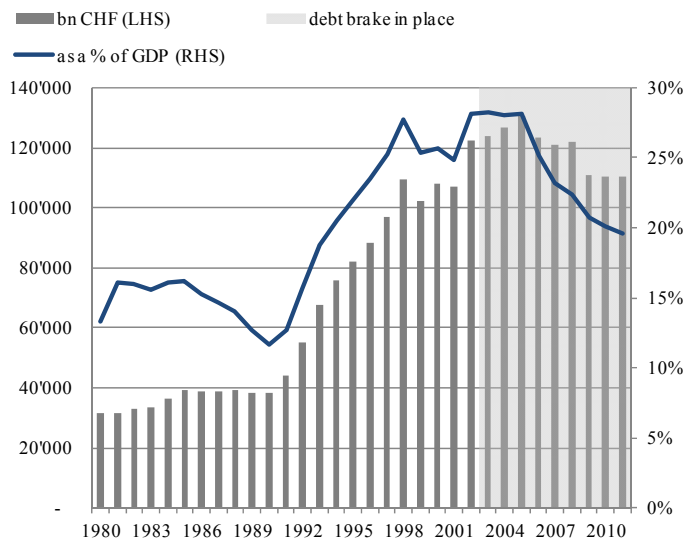
If we insisted on the threshold and a bell-shaped curve debt stock to growth relationship in the introduction, it is because we think that the correct debt to growth ratio is the key to managing a country's future solvability. There is however no definition of what is an "acceptable" sovereign debt limit (Hausner & Simon, 2015, p. 105). As seen in section 1.4, the limit should depend on a country's governance and macroeconomic figures. The subsequent lines will deal with the possibility of a debt

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[60]It was not possible to retrieve values of debt over GDP later than 2011 either on the website of the Swiss Finance Ministry (https://www.efv.admin.ch/efv/de/home/themen/finanzpolitik_grundlagen/schuldenbremse.html), or the WB Data Bank (http://databank.worldbank.org/data/reports.aspx?source=2&series=SL.AGR.EMPL.MA.ZS&country=). It has been decided to use an already existing chart on debt brake, which is up to date until 2011, i.e. the last available data.

brake as a condition of relief for underprivileged countries.

Maintaining expenditures under a threshold might prove hard for underprivileged countries. But it may force governments to produce very accurate financial planning, therefore leaving most inefficiencies out. If a method similar to the Swiss one is used, calculating the threshold might prove difficult. Actual and expected GDP can diverge a lot more than in the Swiss economy, because of instability in those countries. In particular, some are constantly living under war or regular natural catastrophes, which would qualify for exceptional payment requirements almost every year (if they strictly followed the Swiss rule).

The IMF might have the option to adapt the rule to the needs of underprivileged countries: higher and more flexible thresholds. This would add one more conditionality to relief, on top of required investments in the MDGs. Unlike traditional debt ceiling or debt brake measures, a high threshold should be here to provide reasonable limits to spendings rather than a fiscal space[61]. Eventually, we could hope that governments will invest more efficiently, because they would have limits to the expenditures, leading to a result based conditional relief instead of an investment based relief. Whether this is possible in practice and/or advantageous could be the subject of another work.

3.3 More Efficiency

This section is subdivided into two parts. The first iterates over possible means to administer more efficient debt reliefs. The second pinpoints elements that could have provided a more efficient statistical analysis.

Various Complementary Improvement Proposals

Our set of underprivileged countries contains non-relieved countries. The UN and the OECD, with respectively the low HDIs countries and the LDCs, formed each a separate group of underprivileged countries[62]. The fact that each institution considers the countries in these groups to be similar[63],

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[61]As seen at the beginning of this chapter, the debate exists between reimbursing debt and let the debt to GDP ratio decrease through the increase of the latter. The studies mentioned earlier use data from developed countries. There is less doubt, that for our set of underprivileged countries, growth is necessary because some of the population does not have enough money to buy food and a social net, if available, is not sufficient (see section 3.1 for evidence). We claim the focus should be put on raising the denominator of the formula $\frac{debt}{GDP}$.

[62]see section 2.1 for a broader description

[63]see again table 2 for the factors used for the categorization of those states

allows us to question whether debt relief for these countries should not be considered as well. Figure 10 summarizes the last available data for Debt/GDP levels[64]. For each country, a bar represents the average debt level over five years (2008-2012). Notably, five underprivileged countries; namely Central African Republic and Cote d'Ivoire (HIPCs), as well as Republic of Congo, Kiribati and Tuvalu (non-HIPCs) had not enough available data for those years. This table tends to confirm that, especially in the recent years, the line between HIPCs and non-HIPCs is hard to draw. This was already the case at at the end of the 1990s, at the time the IMF decided which country to relieve[65]. There is now an accumulation of evidences discrediting the static eligibility thresholds described in section 1.2.

Figure 10 – Debt over GDP 5 year average (2008-2012)
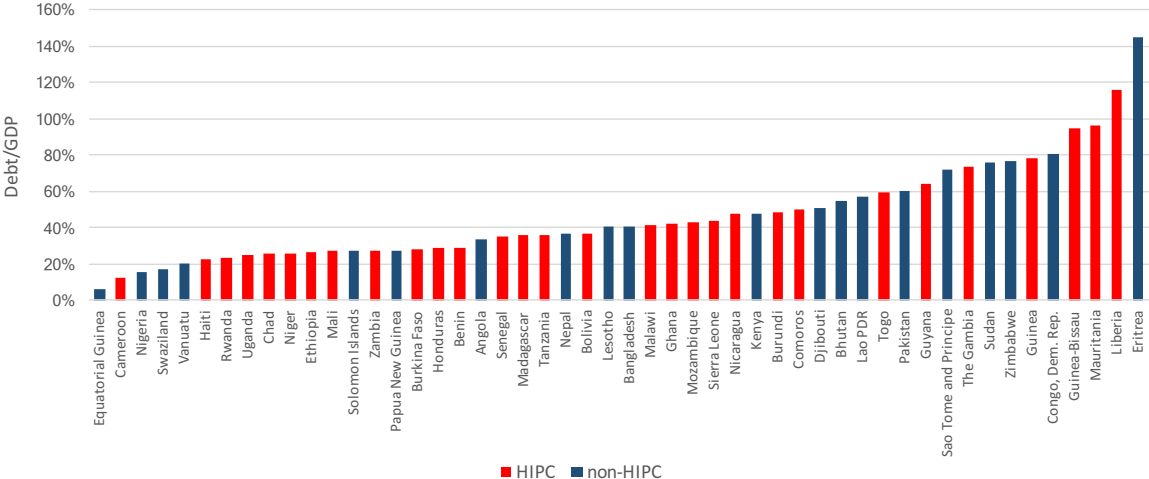
While including more countries in debt relief programs seems possible, including more types of debt seems problematic. Sovereign debt is owned by both states and private companies. The latter is difficult to quantify. Some argue that there may be abusive behavior by so called "vulture funds" (Schwarcz, 2014, par. 4). In the course of the research for this paper, it was not possible to find numbers or evidence about particular behaviors of these commercial public debt owners. The private domain is a lot more complicated to administrate, due to their relative independence compared to states and due to the lack of official listings of private debt owners, among other possible reasons. An intrusion of the IMF in this domain might be infeasible.

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[64]see section 2.2 for sources

[65]see figure 8

Perceived excessive intrusion might be a prevalent element preventing the IMF to impose policies on HIPCs as it pleases. In the following two paragraphs elements that could be characterized as more intrusive are mentioned. But they are factors that can influence the efficiency of government expenditures. If there is an appropriate value that can represent the notion of efficiency of state expenditures, these elements may be added as a condition to relief. Alternatively, the elements could be used as factor to balance the eventual debt brake threshold in each country, instead of or in addition to the factor k[66].

Alesina and Passalacqua propose several reasons for deviating from the *optimal path of government debt*: lobbying, diverse fiscal policies and bureaucracy[67]. In a recent literature review, they note that contributions in those fields are still rare or inexistent (2015, p. 47).

Democracy level was used as a control variable to account for the level of political efficiency in section 2.3. Whether this or another variable is the most appropriate to measure the level of effectiveness of state investments is questionable. In the course of a subsequent study one may test whether the IMF could relieve more countries on publicly owned sovereign debt, conditional on democratic or corruption level, but also on the efficiency of beaurocrats and/or the strength of lobbies. This could incentivize government policies to be more efficient and strengthen governance. Some already suggest to proceed to relief under the condition of efforts for stronger domestic institutions (Presbitero, 2007, p. 20; Collier, 2007, p. 184)).

Shortcomings

The OLS regression analysis for treatment effects of debt relief, ignored any factors other than GDP growth. Furthermore, we ignored country (e.g. local war, local typhoon) and year (e.g. financial crisis) fixed effects. Let's mention that the counterfactual regressions were run on small samples. Consequently, only the first GDP lag had consistent significant estimators. Let alone the supposed difficult measurement of MDGs' completion rate, it seems important to even doubt the accuracy of

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[66]see section 3.2

[67]"Highly ranked bureaucrats may have an influence which goes well beyond the implementation of executive decisions" (Alesina & Passalacqua, 2015, p. 47).

GDP levels for very low developed countries[68]. Even with a wide sample, big inaccuracies might not cancel each other out.

The relation of GDP growths to previous ones may be non-linear. In other terms, going from a 1% growth to a 2% growth might not require the same effort as from 2% to 3%. The same can be said about MDGs, such as education for example. As an illustration, let's consider water access on figure 7 and its related approximated Pareto effect: to achieve that the first 80% of the population has water access, it requires 20% of the total effort. But the remaining population without access might be in remote locations, which supposes less accessibility to the population and to the locations, longer pipes etc. Thus a much higher effort is required. We are not aware of non-linear non-binomial regression methods that could fit the model. In order to isolate the effect of HIPC and MDRI reliefs only, it would have been appropriate to control for other types of external debt aid (e.g. ODA, see section 1.3). These represent potential improvements to our empirical framework.

Because of the inevitable country fixed effects, maybe a case by case analysis can be more appropriated to observe the effect of debt relief. This supposes in-depth research in the respective countries' policies and history.

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[68]see `http://data.worldbank.org/indicator/NY.GDP.MKTP.CD`, under `details|Limitations and Exceptions`:
World Bank staff review the quality of national accounts data and sometimes make adjustments to improve consistency with international guidelines. Nevertheless, significant discrepancies remain between international standards and actual practice. Many statistical offices, especially those in developing countries, face severe limitations in the resources, time, training, and budgets required to produce reliable and comprehensive series of national accounts statistics. Among the difficulties faced by compilers of national accounts is the extent of unreported economic activity in the informal or secondary economy. In developing countries a large share of agricultural output is either not exchanged (because it is consumed within the household) or not exchanged for money.

4   Conclusion

The HIPC and MDRI debt relief initiatives have changed the practice of debt forgiveness, by adding conditionality to it. With countries having started the program more than 15 years ago, it is now possible to analyze data with a reasonable hindsight. A substantial body of literature is available on consequences of debt relief on GDP levels and government expenditures. Empirical conclusions regarding the end results of those expenditures remain scarce. The aim of the paper is to fill this gap.

After demonstrating the impracticability of a statistical analysis of *debt relief – growth* and *debt relief – MDGs* effects, we turned to other methods. A counterfactual regression analysis helped build an adjusted path of GDP growth around debt relief, based on the method of Acemoglou et al. The latter leaves no evidence whether relief really affected GDP growth. In order to confirm this result, we processed to a comparative analysis of MDGs fulfillment for HIPCs and non-HIPCs alike. There is empirical evidence that non-HIPCs have sometimes better performed over the years than HIPCs. Regarding the research question, it is now possible to declare that **HIPCs may have seen their performances rise as much as in the last years, had they not benefitted from relief**, since no positive treatment effect was observed.

On top of already existing expenditures constraints, we claim the IMF should impose other conditions to relief, for those expenditures to be efficient. We suggest an adaptation of the Swiss debt brake approach in order to force countries to commit to investment with the constraint of yearly maximal thresholds. This might improve financial planning, and help fight against corruption and the inefficiency of government institutions.

In practice those measures imply a non negligible incursion in HIPCs' policies. While the IMF is already dictating investment requirements, imposing limits on each HIPC's balance sheet might be too intrusive. On the IMF's side, this would require very close monitoring over the years; up to now the IMF only monitored HIPCs' investments around the pre-relief phase.

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Appendix

Table 2 – Criteria of categorization

HDI	LDC
Life expectancy at birth	Percentage of undernourished population
Mean years of schooling	Child mortality ratio
Expected years of schooling	Gross secondary school enrolment ratio
GNI per capita	Adult literacy ratio
	Index of instability of agricultural production
	Share of victims of natural disasters
	Index of instability of exports of goods and services
	Share of population living in low-lying areas
	Share of agriculture, forestry and fisheries in GDP
	Index of merchandise export concentration
	Population in logarithm
	Index of remoteness

Table 3 – Summary statistics for non-relieved countries

Variable	Mean	Std. Dev.	N
ln GDP	6.633	0.765	768
Male Primary Enrollment Rate	69.815	18.45	285
Female Primary Enrollment Rate	66.611	20.644	285
Male Secondary Enrollment Rate	31.379	13.984	203
Female Secondary Enrollment Rate	31.576	15.083	203
Male Tertiary Enrollment Rate	5.884	4.476	287
Female Tertiary Enrollment Rate	3.805	4.113	287
Female Primary Completion Rate	67.522	24.639	357
Male Primary Completion Rate	69.218	22.727	357
Child Mortality (under 5 yo), per thousand	112.175	52.916	903
Infant Mortality, per thousand	76.489	31.869	903
Maternal Mortality, per thousand	5.128	2.882	550
Undernourishment	23.798	14.99	384
Water Access	67.291	17.579	546
Sanitation Access	36.894	18.281	539
Democracy Level	-0.266	0.777	880

Table 4 – Summary statistics for relieved countries

Variable	Mean	Std. Dev.	N
ln GDP	6.125	0.605	1209
Male Primary Enrollment Rate	65.59	18.967	539
Female Primary Enrollment Rate	57.232	22.986	539
Male Secondary Enrollment Rate	22.911	17.056	220
Female Secondary Enrollment Rate	19.395	18.035	220
Male Tertiary Enrollment Rate	3.974	4.33	598
Female Tertiary Enrollment Rate	2.333	4.032	598
Female Primary Completion Rate	42.259	25.185	782
Male Primary Completion Rate	52.777	22.647	782
Child Mortality (under 5 yo), per thousand	155.857	68.105	1269
Infant Mortality, per thousand	94.161	35.206	1269
Maternal Mortality, per thousand	7.173	4.283	800
Undernourishment	29.109	14.298	720
Water Access	62.846	16.311	796
Sanitation Access	27.248	19.414	790
Democracy Level	-0.378	0.560	1280

Table 5 – HIPCs' Completion of Millenium Development Goals

	End poverty and hunger	Primary school completion rate	"Increase the Ratio of girls to boys enrollment in primary and secondary education"	Decrease child mortality rate	Decrease infant mortality rate	Decrease maternal mortality rate	"Increase access to an improved water source"	Increase access to improved sanitation facilities
Afghanistan	Insufficient data	Insufficient data	Sufficient progress	Moderately off target	Seriously off target	Insufficient progress	Insufficient progress	Seriously off target
Benin	Seriously off target	Insufficient progress	Insufficient data	Seriously off target	Seriously off target	Seriously off target	Target met	Seriously off target
Bolivia	Insufficient progress	Seriously off target	Sufficient progress	Target met	Insufficient progress	Moderately off target	Target met	Seriously off target
Burkina Faso	Sufficient progress	Insufficient progress	Insufficient progress	Insufficient progress	Seriously off target	Seriously off target	Target met	Seriously off target
Burundi	Seriously off target	Insufficient progress	Sufficient progress	Moderately off target	Moderately off target	Seriously off target	Seriously off target	Seriously off target
Cameroon	Moderately off target	Seriously off target	Sufficient progress	Sufficient progress	Seriously off target	Seriously off target	Target met	Seriously off target
Cent. Afr. Republic	Insufficient progress	Moderately off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target
Chad	Sufficient progress	Sufficient progress	Seriously off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target
Comoros	Seriously off target	Seriously off target	Insufficient data	Seriously off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target
Dem. Rep. Congo	Seriously off target	Moderately off target	Moderately off target	Moderately off target	Moderately off target	Seriously off target	Seriously off target	Seriously off target
Rep. Congo	Sufficient progress	Seriously off target	Target met	Insufficient progress	Seriously off target	Seriously off target	Insufficient data	Insufficient data
Cote d'Ivoire	Seriously off target	Moderately off target	Insufficient data	Seriously off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target
Eritrea	Insufficient data	Insufficient data	Insufficient data	Target met	Insufficient progress	Target met	Seriously off target	Seriously off target
Ethiopia	Seriously off target	Sufficient progress	Sufficient progress	Target met	Sufficient progress	Insufficient progress	Target met	Seriously off target
The Gambia	Target met	Seriously off target	Target met	Insufficient progress	Seriously off target	Seriously off target	Target met	Seriously off target
Ghana	Target met	Sufficient progress	Target met	Moderately off target	Moderately off target	Seriously off target	Target met	Seriously off target
Guinea	Target met	Moderately off target	Insufficient progress	Insufficient progress	Moderately off target	Seriously off target	Target met	Seriously off target
Guinea-Bissau	Seriously off target	Insufficient data	Moderately off target	Insufficient progress	Moderately off target	Seriously off target	Target met	Insufficient data
Guyana	Insufficient progress	Seriously off target	Insufficient data	Seriously off target	Seriously off target	Seriously off target	Target met	Seriously off target
Haiti	Seriously off target	Insufficient data	Insufficient data	Moderately off target	Seriously off target	Seriously off target	Seriously off target	Seriously off target
Honduras	Target met	Moderately off target	Target met	Insufficient progress	Insufficient progress	Seriously off target	Target met	Target met
Liberia	Insufficient progress	Seriously off target	Seriously off target	Target met	Target met	Seriously off target	Insufficient data	Insufficient data
Madagascar	Seriously off target	Seriously off target	Insufficient progress	Insufficient progress	Insufficient progress	Seriously off target	Seriously off target	Seriously off target
Malawi	Seriously off target	Moderately off target	Target met	Target met	Target met	Seriously off target	Target met	Seriously off target
Mali	Seriously off target	Seriously off target	Moderately off target	Moderately off target	Seriously off target	Seriously off target	Target met	Seriously off target
Mauritania	Seriously off target	Seriously off target	Target met	Seriously off target	Seriously off target	Moderately off target	Moderately off target	Seriously off target
Mozambique	Insufficient progress	Seriously off target	Moderately off target	Target met	Sufficient progress	Moderately off target	Seriously off target	Seriously off target
Nicaragua	Target met	Moderately off target	Target met	Target met	Insufficient progress	Seriously off target	Target met	Insufficient progress
Niger	Sufficient progress	Moderately off target	Moderately off target	Target met	Moderately off target	Target met	Moderately off target	Seriously off target
Rwanda	Seriously off target	Moderately off target	Target met	Target met	Target met	Seriously off target	Insufficient data	Moderately off target
Principe	Seriously off target	Insufficient progress	Target met	Moderately off target	Moderately off target	Seriously off target	Insufficient progress	Insufficient data
Senegal	Seriously off target	Seriously off target	Target met	Target met	Seriously off target	Seriously off target	Insufficient progress	Seriously off target
Sierra Leone	Seriously off target	Insufficient data	Target met	Target met	Moderately off target	Seriously off target	Moderately off target	Seriously off target
Somalia	Insufficient data	Insufficient data	Insufficient data	Seriously off target	Seriously off target	Seriously off target	Insufficient data	Insufficient data
Sudan	Target met	Insufficient data	Moderately off target	Seriously off target	Sufficient progress	Moderately off target	Seriously off target	Seriously off target
Tanzania	Sufficient progress	Seriously off target	Target met	Target met	Sufficient progress	Seriously off target	Seriously off target	Seriously off target
Togo	Seriously off target	Insufficient progress	Sufficient progress	Moderately off target	Seriously off target	Moderately off target	Seriously off target	Seriously off target
Uganda	Sufficient progress	Seriously off target	Target met	Target met	Target met	Moderately off target	Target met	Seriously off target
Zambia	Seriously off target	Seriously off target	Insufficient data	Target met	Insufficient progress	Moderately off target	Moderately off target	Seriously off target

Note : The content of this table and the following comment in italic are an exact reproduction of two tables from the IMF (Saito et al., 2016, pp. 16,17) (they are reproduced here for better readability*:

The category "Target met" indicates that the MDG has already been met. The category "Sufficient progress" means that the last observed five year average growth rate indicates that MDG is on track to be met if growth rate is maintained. The category "Insufficient progress" is defined as meeting the MDG between 2015 and 2020. The category "Moderately off target" indicates that MDG might be met between 2020 and 2030. The category "Seriously off target" indicates that MDG will not be met even by 2030 unless a reversal in progress has occurred. The category "Insufficient data" is defined as having not enough data points to be able to estimate 5 year average or that the starting value is missing.

*www.smallpdf.com is a great tool, that allowed to extract the data from the pdf to a csv format. It was then possible to display it in LaTeX.

Table 6 – OLS regression on ln GDP per capita of that year and on four consecutive years

	ln GDP	gdp_lag1	gdp_lag2	gdp_lag3	gdp_lag4
Got Relief	0.117	0.182	0.123	0.225	0.217
	(1.16)	(1.39)	(0.84)	(1.40)	(1.27)
Male Secondary Enrollment Rate	-0.0794***	-0.0545***	-0.0468*	-0.0528*	-0.0449*
	(-6.49)	(-3.39)	(-2.50)	(-2.59)	(-2.08)
Female Secondary Enrollment Rate	0.0876***	0.0666***	0.0636**	0.0748**	0.0702**
	(6.50)	(3.71)	(3.07)	(3.25)	(2.88)
Male Tertiary Enrollment Rate	0.0594***	0.0789***	0.0722**	0.0835**	0.0692*
	(3.38)	(3.43)	(2.76)	(2.84)	(2.22)
Female Tertiary Enrollment Rate	-0.0942***	-0.124***	-0.116**	-0.145***	-0.128**
	(-4.05)	(-4.09)	(-3.32)	(-3.78)	(-3.15)
Female Primary Completion Rate	-0.0112	0.00967	0.00620	0.00478	0.00277
	(-1.19)	(0.78)	(0.45)	(0.32)	(0.17)
Male Primary Completion Rate	0.0134	-0.0122	-0.0162	-0.0163	-0.0172
	(1.57)	(-1.09)	(-1.31)	(-1.21)	(-1.20)
Undernourishment	-0.0177***	-0.0145**	-0.0173**	-0.0147*	-0.0156*
	(-4.67)	(-2.94)	(-3.17)	(-2.44)	(-2.46)
Water Access	0.00404	-0.000948	-0.00513	-0.00597	-0.00831
	(1.14)	(-0.20)	(-0.98)	(-1.04)	(-1.37)
Sanitation Access	0.0228***	0.0253***	0.0234***	0.0263***	0.0242***
	(6.70)	(5.56)	(4.40)	(4.46)	(3.87)
Maternal Mortality, per thousand	0.0141	0.00271	-0.00891	-0.0110	-0.0186
	(0.56)	(0.08)	(-0.25)	(-0.28)	(-0.44)
Male Primary Enrollment Rate	0.0291*	0.0453**	0.0444*	0.0530**	0.0470*
	(2.31)	(2.76)	(2.44)	(2.65)	(2.22)
Female Primary Enrollment Rate	-0.0351**	-0.0474**	-0.0424*	-0.0490*	-0.0419*
	(-2.79)	(-2.90)	(-2.33)	(-2.46)	(-1.99)
Child Mortality (under 5 yo), per thousand	-0.00767**	-0.00741*	-0.00992*	-0.00963*	-0.0107*
	(-2.78)	(-2.06)	(-2.51)	(-2.22)	(-2.34)
Infant Mortality, per thousand	0.00970*	0.00789	0.0124	0.0121	0.0147
	(2.10)	(1.32)	(1.87)	(1.67)	(1.91)
Democracy Level	-0.115	-0.0596	0.0115	-0.00679	0.0131
	(-1.59)	(-0.61)	(0.10)	(-0.06)	(0.10)
Constant	5.870***	6.118***	6.622***	6.344***	6.631***
	(12.72)	(10.18)	(9.98)	(8.74)	(8.65)
Observations	132	131	128	126	126

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 – Counterfactual regression (1/4)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
gdp_lag1	1.341***	1.122***	1.362***	1.284***	1.053***	1.112***	0.908***	1.636***	1.091***	1.106***
	(0.300)	(0.0941)	(0.146)	(0.153)	(0.148)	(0.167)	(0.121)	(0.276)	(0.151)	(0.184)
gdp_lag2	-0.777	-0.141	-0.460**	-0.196	0.194	-0.0818	0.102	-0.905**	-0.251	0.0839
	(0.518)	(0.178)	(0.132)	(0.265)	(0.255)	(0.286)	(0.186)	(0.262)	(0.324)	(0.231)
gdp_lag3	0.595	0.231	0.141	-0.180	-0.149	-0.202	0.0575	0.248	0.476	-0.149
	(0.673)	(0.349)	(0.111)	(0.177)	(0.206)	(0.319)	(0.143)	(0.173)	(0.267)	(0.258)
gdp_lag4	-0.197	-0.205	-0.0457	0.0889	-0.0983	0.156	-0.0829	0.00347	-0.335	-0.0526
	(0.432)	(0.245)	(0.100)	(0.0605)	(0.105)	(0.166)	(0.109)	(0.151)	(0.167)	(0.201)
Constant	0.225	-0.0347	0.00174	-0.00215	-0.00388	0.107	0.0937	0.108	0.124	0.0657
	(0.247)	(0.131)	(0.127)	(0.0919)	(0.0783)	(0.117)	(0.0703)	(0.0817)	(0.0706)	(0.0890)
Observations	38	38	38	39	43	44	45	45	46	46

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8 – Counterfactual regression (2/4)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
gdp_lag1	2.546***	1.009***	1.379***	1.217***	1.223***	0.696***	1.677***	2.613***	1.324***	1.067***
	(0.525)	(0.0783)	(0.250)	(0.115)	(0.315)	(0.0755)	(0.380)	(0.504)	(0.0841)	(0.0394)
gdp_lag2	-1.480*	0.388	0.0419	0.0557	-0.260	0.386*	-0.427*	-2.312*	-0.572	0.0693
	(0.678)	(0.246)	(0.287)	(0.225)	(0.686)	(0.177)	(0.209)	(1.043)	(0.311)	(0.0669)
gdp_lag3	-0.239	-0.283	-0.433	0.101	0.393	0.253	-0.223	0.401	0.197	0.0122
	(0.373)	(0.154)	(0.395)	(0.347)	(0.562)	(0.205)	(0.262)	(0.372)	(0.329)	(0.0908)
gdp_lag4	0.189	-0.120	0.0313	-0.392**	-0.318	-0.353***	-0.0507	0.291	0.0543	-0.156*
	(0.217)	(0.109)	(0.280)	(0.112)	(0.241)	(0.0972)	(0.145)	(0.298)	(0.111)	(0.0621)
Constant	-0.108	0.0305	-0.132	0.116	-0.246	0.132	0.172*	0.0492	-0.00939	0.0387
	(0.112)	(0.0804)	(0.0969)	(0.0917)	(0.254)	(0.0693)	(0.0804)	(0.175)	(0.0520)	(0.0329)
Observations	47	47	48	48	51	51	52	52	51	49

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9 – Counterfactual regression (3/4)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
gdp_lag1	1.632***	0.919**	1.332***	1.681*	1.239***	1.133***	1.607***	1.260***	1.474***	0.881***
	(0.260)	(0.306)	(0.0751)	(0.714)	(0.175)	(0.175)	(0.237)	(0.280)	(0.344)	(0.146)
gdp_lag2	-0.627*	1.494*	-0.242	-0.608	-0.0921	-0.0457	-0.595	-0.0822	0.363	0.0273
	(0.278)	(0.672)	(0.126)	(0.981)	(0.337)	(0.202)	(0.298)	(0.462)	(0.573)	(0.412)
gdp_lag3	0.0682	-1.381*	-0.0819	-0.628	0.309	0.191	0.0102	-0.108	-0.723	0.436
	(0.138)	(0.503)	(0.161)	(0.670)	(0.329)	(0.241)	(0.130)	(0.359)	(0.684)	(0.298)
gdp_lag4	-0.0798	-0.00336	-0.00951	0.588	-0.463***	-0.281	-0.0273	-0.0631	-0.101	-0.365*
	(0.0723)	(0.293)	(0.134)	(0.489)	(0.116)	(0.206)	(0.0551)	(0.111)	(0.431)	(0.164)
Constant	0.0374	-0.177	0.00795	-0.222	0.0680	0.0307	0.0505	-0.0175	-0.110	0.141*
	(0.0669)	(0.148)	(0.0620)	(0.158)	(0.0725)	(0.0549)	(0.0538)	(0.0519)	(0.0762)	(0.0556)
Observations	40	29	28	28	29	27	25	23	23	22

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10 – Counterfactual regression (4/4)

	2010	2011	2012	2013	2014
gdp_lag1	1.626***	1.550***	1.489***	0.757**	1.758***
	(0.339)	(0.162)	(0.266)	(0.225)	(0.172)
gdp_lag2	-0.695	-1.086***	-0.684	0.310	-0.608**
	(0.394)	(0.273)	(0.511)	(0.354)	(0.184)
gdp_lag3	0.214	0.486*	0.519	0.0612	-0.252
	(0.316)	(0.213)	(0.391)	(0.196)	(0.249)
gdp_lag4	-0.157	0.0376	-0.326	-0.156	0.108
	(0.217)	(0.0848)	(0.156)	(0.0829)	(0.131)
Constant	0.0936	0.110	0.0394	0.212***	-0.0350
	(0.0705)	(0.0561)	(0.0429)	(0.0436)	(0.0545)
Observations	22	22	21	21	21

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Listing 1 – Summary Statistics

```stata
1   set more off
2
3   import excel "/Users/gabrielbenedict/Google_Drive/docs/UNISG/Faecher/BA/Data/Compiled/
        Last Version/Compiled - V4 - Stata - Final.xlsx", sheet("Stata Output") cellrange(B1
        :AK2201) firstrow
4
5   label variable ln_GDP "ln GDP"
6   label variable Primary_enrol_m "Male Primary Enrollment Rate"
7   label variable Primary_enrol_f "Female Primary Enrollment Rate"
8   label variable Secondary_enrol_m "Male Secondary Enrollment Rate"
9   label variable Secondary_enrol_f "Female Secondary Enrollment Rate"
10  label variable Tertiary_enrol_m1000 "Male Tertiary Enrollment Rate"
11  label variable Tertiary_enrol_f1000 "Female Tertiary Enrollment Rate"
12  label variable primary_comp_f "Female Primary Completion Rate"
13  label variable primary_comp_m "Male Primary Completion Rate"
14
15  label variable Mortality_under51000 "Child Mortality (under 5 yo), per thousand"
16  label variable Mortality_infant1000 "Infant Mortality, per thousand"
17  label variable Maternal_mortality1000modeled "Maternal Mortality, per thousand"
18  label variable Undernourishment "Undernourishment"
19  label variable water_access "Water Access"
20  label variable sanitation_access "Sanitation Access"
21  label variable Democ_UDS "Democracy Level"
22  ///////////////////////
23
24  //summary statistics
25
26  sutex ln_GDP Primary_enrol_m Primary_enrol_f Secondary_enrol_m Secondary_enrol_f ///
27  Tertiary_enrol_m1000 Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
28  Mortality_under51000 Mortality_infant1000 Maternal_mortality1000modeled ///
29  Undernourishment water_access sanitation_access Democ_UDS if Got_relief == 1, ///
30  labels title("Summary statistics for relieved countries") ///
31  file("/Users/gabrielbenedict/Desktop/For_Review/Tables/summary_1.tex") replace
32
33  sutex ln_GDP Primary_enrol_m Primary_enrol_f Secondary_enrol_m Secondary_enrol_f ///
34  Tertiary_enrol_m1000 Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
35  Mortality_under51000 Mortality_infant1000 Maternal_mortality1000modeled ///
36  Undernourishment water_access sanitation_access Democ_UDS if Got_relief == 0, ///
37  labels title("Summary statistics for non-relieved countries") ///
38  file("/Users/gabrielbenedict/Desktop/For_Review/Tables/summary_0.tex") replace
```

Listing 2 – OLS regression of relief, MDGs and democracy level on GDP lags

```
1   set more off
2
3   import excel "/Users/gabrielbenedict/Google_Drive/docs/UNISG/Faecher/BA/Data/Compiled/
        Last Version/Compiled - V4 - Stata - Final.xlsx", sheet("Stata Output") cellrange(B1
        :AX2201) firstrow
4
5   label variable ln_GDP "ln GDP"
6   label variable Primary_enrol_m "Male Primary Enrollment Rate"
7   label variable Primary_enrol_f "Female Primary Enrollment Rate"
8   label variable Secondary_enrol_m "Male Secondary Enrollment Rate"
9   label variable Secondary_enrol_f "Female Secondary Enrollment Rate"
10  label variable Tertiary_enrol_m1000 "Male Tertiary Enrollment Rate"
11  label variable Tertiary_enrol_f1000 "Female Tertiary Enrollment Rate"
12  label variable primary_comp_f "Female Primary Completion Rate"
13  label variable primary_comp_m "Male Primary Completion Rate"
14
15  label variable Mortality_under51000 "Child Mortality (under 5 yo), per thousand"
16  label variable Mortality_infant1000 "Infant Mortality, per thousand"
17  label variable Maternal_mortality1000modeled "Maternal Mortality, per thousand"
18  label variable Undernourishment "Undernourishment"
19  label variable water_access "Water Access"
20  label variable sanitation_access "Sanitation Access"
21  label variable Democ_UDS "Democracy Level"
22
23  label variable Got_relief "Got Relief"
24
25  //Positive lags
26
27  gen gdp_lag1 = ln_GDP[_n+1]
28  gen gdp_lag2 = ln_GDP[_n+2]
29  gen gdp_lag3 = ln_GDP[_n+3]
30  gen gdp_lag4 = ln_GDP[_n+4]
31
32
33  ////////////////////
34
35  //linear regression
36
37  estimates clear
38
```

```stata
eststo: reg ln_GDP Got_relief  ///
Secondary_enrol_m Secondary_enrol_f Tertiary_enrol_m1000 ///
Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
Undernourishment water_access sanitation_access ///
Maternal_mortality1000modeled Primary_enrol_m Primary_enrol_f ///
Mortality_under51000 Mortality_infant1000 Democ_UDS

eststo: reg gdp_lag1 Got_relief  ///
Secondary_enrol_m Secondary_enrol_f Tertiary_enrol_m1000 ///
Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
Undernourishment water_access sanitation_access ///
Maternal_mortality1000modeled Primary_enrol_m Primary_enrol_f ///
Mortality_under51000 Mortality_infant1000 Democ_UDS

eststo: reg gdp_lag2 Got_relief  ///
Secondary_enrol_m Secondary_enrol_f Tertiary_enrol_m1000 ///
Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
Undernourishment water_access sanitation_access ///
Maternal_mortality1000modeled Primary_enrol_m Primary_enrol_f ///
Mortality_under51000 Mortality_infant1000 Democ_UDS

eststo: reg gdp_lag3 Got_relief  ///
Secondary_enrol_m Secondary_enrol_f Tertiary_enrol_m1000 ///
Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
Undernourishment water_access sanitation_access ///
Maternal_mortality1000modeled Primary_enrol_m Primary_enrol_f ///
Mortality_under51000 Mortality_infant1000 Democ_UDS

eststo: reg gdp_lag4 Got_relief  ///
Secondary_enrol_m Secondary_enrol_f Tertiary_enrol_m1000 ///
Tertiary_enrol_f1000 primary_comp_f primary_comp_m ///
Undernourishment water_access sanitation_access ///
Maternal_mortality1000modeled Primary_enrol_m Primary_enrol_f ///
Mortality_under51000 Mortality_infant1000 Democ_UDS

esttab using "/Users/gabrielbenedict/Desktop/TB/Stats/linear_reg.tex", ///
nonumber replace booktabs label title("OLS regression on ln GDP per capita of that year"
    ///
" and on four consecutive years")
```

Listing 3 – OLS regression of GDP levels on their 4 year lags, for the construction of a counterfactual path

```stata
1   set more off
2
3   import excel "/Users/gabrielbenedict/Google_Drive/docs/UNISG/Faecher/BA/Data/Compiled/
        Last Version/Compiled - V4 - Stata - Final.xlsx", sheet("Stata Output") cellrange(B1
        :AK2201) firstrow
4
5   label variable ln_GDP "ln GDP"
6   label variable Primary_enrol_m "Male Primary Enrollment Rate"
7   label variable Primary_enrol_f "Female Primary Enrollment Rate"
8   label variable Secondary_enrol_m "Male Secondary Enrollment Rate"
9   label variable Secondary_enrol_f "Female Secondary Enrollment Rate"
10  label variable Tertiary_enrol_m1000 "Male Tertiary Enrollment Rate"
11  label variable Tertiary_enrol_f1000 "Female Tertiary Enrollment Rate"
12  label variable primary_comp_f "Female Primary Completion Rate"
13  label variable primary_comp_m "Male Primary Completion Rate"
14
15  label variable Mortality_under51000 "Child Mortality (under 5 yo), per thousand"
16  label variable Mortality_infant1000 "Infant Mortality, per thousand"
17  label variable Maternal_mortality1000modeled "Maternal Mortality, per thousand"
18  label variable Undernourishment "Undernourishment"
19  label variable water_access "Water Access"
20  label variable sanitation_access "Sanitation Access"
21  label variable Democ_UDS "Democracy Level"
22
23  //Negative lags
24
25  gen gdp_lag1 = ln_GDP[_n-1]
26  gen gdp_lag2 = ln_GDP[_n-2]
27  gen gdp_lag3 = ln_GDP[_n-3]
28  gen gdp_lag4 = ln_GDP[_n-4]
29
30  ///////////////////////
31
32  //Big Table
33
34  forval i = 1980/2014 {
35          reg ln_GDP  gdp_lag1 gdp_lag2 gdp_lag3 gdp_lag4 if Got_relief == 0 & Year == `i',
                vce(robust)
36          // save first gdp lag coeff and std deviation values
```

```stata
37          estimates store m`i'
38 }
39
40 esttab * using "/Users/gabrielbenedict/Google_Drive/docs/UNISG/Faecher/BA/Data/
        reg_results/Counterfactuals2/rob_and_small_ci.tex", nonumber se label booktabs
        legend replace
41 /*alignment(D{.}{.}{-1}) width(\vsize)*/
42
43 esttab * using "/Users/gabrielbenedict/Google_Drive/docs/UNISG/Faecher/BA/Data/
        reg_results/Counterfactuals2/rob_and_small_ci_r2.csv", nostar label legend ci
        replace stats(r2)
44
45
46 ////////////////////
47
48 //For display
49
50 estimates clear
51
52 forval i = 1980/1989 {
53          reg ln_GDP  gdp_lag1 gdp_lag2 gdp_lag3 gdp_lag4 if Got_relief == 0 & Year == `i',
                vce(robust)
54          // save first gdp lag coeff and std deviation values
55          estimates store m`i'
56 }
57
58 esttab * using "/Users/gabrielbenedict/Google Drive/docs/UNISG/Facher/BA/Data/reg_results
        /Counterfactuals2/rob_and_small_1.tex", ///
59 replace nonumber se label booktabs legend title("Counterfactual regression (1/4)") ///
60 mtitles("1980" "1981" "1982" "1983" "1984" "1985" "1986" "1987" "1988" "1989")
61
62 estimates clear
63
64 forval j = 1990/1999 {
65          reg ln_GDP  gdp_lag1 gdp_lag2 gdp_lag3 gdp_lag4 if Got_relief == 0 & Year == `j',
                vce(robust)
66          // save first gdp lag coeff and std deviation values
67          estimates store m`j'
68 }
69
70 esttab * using "/Users/gabrielbenedict/Google Drive/docs/UNISG/Facher/BA/Data/reg_results
        /Counterfactuals2/rob_and_small_2.tex", ///
```

```stata
71   replace nonnumber se label booktabs legend title("Counterfactual regression (2/4)") ///
72   mtitles("1990" "1991" "1992" "1993" "1994" "1995" "1996" "1997" "1998" "1999")

73

74   estimates clear

75

76   forval k = 2000/2009 {
77           reg ln_GDP  gdp_lag1 gdp_lag2 gdp_lag3 gdp_lag4 if Got_relief == 0 & Year == `k',
                  vce(robust)
78           // save first gdp lag coeff and std deviation values
79           estimates store m`k'
80   }

81

82   esttab * using "/Users/gabrielbenedict/Google Drive/docs/UNISG/Facher/BA/Data/reg_results
         /Counterfactuals2/rob_and_small_3.tex", ///
83   replace nonnumber se label booktabs legend title("Counterfactual regression (3/4)") ///
84   mtitles("2000" "2001" "2002" "2003" "2004" "2005" "2006" "2007" "2008" "2009")

85

86   estimates clear

87

88   forval l = 2010/2014 {
89           reg ln_GDP  gdp_lag1 gdp_lag2 gdp_lag3 gdp_lag4 if Got_relief == 0 & Year == `l',
                  vce(robust)
90           // save first gdp lag coeff and std deviation values
91           estimates store m`l'
92   }

93

94   esttab * using "/Users/gabrielbenedict/Google Drive/docs/UNISG/Facher/BA/Data/reg_results
         /Counterfactuals2/rob_and_small_4.tex", ///
95   replace nonnumber se label booktabs legend title("Counterfactual regression (4/4)") ///
96   mtitles("2010" "2011" "2012" "2013" "2014")
```

Declaration of Authorship

I hereby declare

– that I have written this thesis without any help from others and without the use of documents and aids other than those stated above,

– that I have mentioned all the sources used and that I have cited them correctly according to established academic citation rules,

– that the topic or parts of it are not already the object of any work or examination of another course unless this has been explicitly agreed on with the faculty member in advance,

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November 20, 2016