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The short and long run effects of debt reduction

Evidence from debt relief under the enhanced HIPC and MDR initiatives

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Abstract

Purpose – The purpose of this paper is to estimate benefits to debt reduction by using the natural experiment provided by the debt relief programs: the Heavily Indebted Poor Countries Initiative launched by the International Monetary Fund and World Bank in 1996 and the Multilateral Debt Relief Initiative extension in 2005.

Design/methodology/approach – The authors apply a time-shifted difference-in-differences strategy to evaluate the effects of this intervention. The date of each country's decision to participate in the program is used as one treatment point while the date of the completion of the debt relief program is used as another treatment point. The exercise compares different economic outcomes such as domestic and foreign investment, schooling, and employment of the treated observations to the counterfactual of untreated country-years. The period between the decision and completion points is a short run while the period after the completion point is considered a long run.

Findings – The authors found that debt relief increased capital investment as much as 1.63 percent in the short run and 5.79 percent in the long run. However, there was no effect on foreign direct investment suggesting that debt overhang does not affect incentives of foreign investors. Output and schooling enrollment increased both in the short and long run.

Originality/value – This paper exploits a natural experiment of debt relief in a number of developing countries to shed light on the possible benefits to debt reduction. The authors are able to separate the short- and long-run effects of debt reduction. The finding that domestic but not foreign investment responds to debt reduction is suggestive of the differences in incentives across these two sources of investment.

Keywords Debt overhang, Debt relief, Sovereign debt

Paper type Research paper

1. Introduction

The problem of high public debt plagues many countries but is especially burdensome for developing countries. Servicing the debt can crowd out needed public investment in education, infrastructure, and poverty alleviation. Government deficits and debt increase the demand for loanable funds which raises interest rates which crowds out private investment. Risk of default on the debt puts devaluation pressure on the currency which also increases the covered interest rate. Debt overhang (Myers, 1977; Krugman, 1988) for heavily indebted countries also makes it difficult to access new credit which leaves the country even more vulnerable to crisis.

JEL Classification — F34, H63, O11, O19

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In this paper, we evaluate the benefits of debt reduction in developing countries by exploiting a natural experiment of debt relief under two programs: the International Monetary Fund's (IMF) and the World Bank's Heavily Indebted Poor Countries (HIPC) Initiative launched in 1996 and the Multilateral Debt Relief Initiative (MDRI) in 2005. The HIPC Initiative aimed to reduce the debt burden to manageable levels to promote growth and to end continual debt rescheduling. Each country that was eligible for the HIPC Initiative first worked with the World Bank and the IMF to create a track record. Countries rescheduled debt payments and worked on macroeconomic reform for three years whereupon they reached the decision point. It was then determined if the country would be able to reduce its debt burden enough through the rescheduling and reforms or if further assistance under the HIPC Initiative was necessary. Once a country reached the decision point, it started receiving marginal debt relief and continued to work on macroeconomic reform. To reach the completion point, in which debt relief was delivered in full, each country must have created and implemented a poverty reduction strategy for at least a year. Once a country reached the completion point, it received debt relief without any further requirements.

After review of the program up to 1999, the World Bank and the IMF enacted changes and renamed it the Enhanced HIPC Initiative. Thresholds were lowered, more countries were eligible, and countries began receiving debt relief in the stage between the decision point and the completion point. In 2005, the MDRI was established to further help countries reach the goals. It was essentially an extension of the Enhanced HIPC Initiatives in that it applied to countries once they reached the completion point under those initiatives. In total, there were 36 HIPCs that received debt relief under the Enhanced HIPC Initiative and the MDRI.

The staggered implementation of debt relief for 36 countries over more than a decade creates a panel of treated countries that allows us to identify the effects of debt reduction controlling for country and year fixed effects. We apply a time-shifted difference-in-differences estimation strategy to account for different decision and completion points as well as different duration between decision and completion. With data from the World Development Indicators and the Millennium Development Goals database, we find that debt reduction increased investment in physical capital in both the short run and the long run with bigger increases in the long run. Human capital investment, as measured by schooling enrollment, was also positively affected by debt relief. Debt reduction had a positive effect on male employment but not female employment rates. Both GDP per capita growth rates and household consumption increased with debt reduction.

Our paper contributes to a literature on the effects of debt reduction (see Occhino, 2010; Afxentiou and Serletis, 1996; Romero-Barrutieta *et al.*, 2015; Haider and Qayyum, 2012; Cassimon *et al.*, 2015). In particular, our results can be contrasted with the results of two papers. Romero-Barrutieta *et al.* (2015) studied debt relief in Uganda over the period 1982-2006 but found that debt relief discouraged investment and incentivized high rates of consumption and repeated debt accumulation. The authors proposed that donors need to credibly signal that debt relief will not be offered in the future to ensure that debt relief has the intended effects of increased investment and decreased debt burdens. Our analysis extends the analysis to a bigger set of countries and a longer time series.

Cassimon *et al.* (2015) investigated the effect of the HIPC Initiative and the subsequent MDRI expansion on the countries in Africa that were HIPCs using data from 1996 to 2011. They found that the Enhanced HIPC Initiative increased domestic revenue and investment. The MDRI also increased domestic revenue and investment but to a lesser degree. Our paper extends this analysis by distinguishing between the decision point and the completion point. With data through 2016, we are also better able to evaluate the long-run effects of debt reduction.

In the next section, we describe the data, the empirical strategy, and identifying assumptions. We report results in Section 3. Concluding remarks are found in Section 4.

2. Data and empirical strategy

We obtained outcome indicators from the World Bank's World Development Indicators and Millennium Development Goals database for over 200 countries from 1980 to 2016. The main outcome variables we studied were gross fixed capital formation, foreign direct investment (FDI), adjusted net enrollment rates, employment rates, GDP per capita growth, and household consumption. Gross fixed capital formation, FDI, and household consumption are reported as percentages of GDP. The adjusted net enrollment rate is the percentage of children who are enrolled in primary school out of children in the eligible age range. The employment rate is the percentage of the population that is employed measured for the entire population and then by gender.

The dates each HIPC reached the decision point and the completion point are available from the IMF. The IMF provided the month and year for each landmark point as can be seen in Table I. Countries' decision points ranged from 2000 to 2010 while completion points were spread between 2001 and 2015. Countries could spend as little as 1 year to as long as 14 years between the decision and completion points.

Each HIPC reached the decision point and the completion point independently. There was also variation in how long each country was in the state between the decision point and the completion point. We apply a time-shifted difference-in-differences strategy to estimate

HIPCs	Decision point	Completion point
Afghanistan	July 1, 2007	January 1, 2010
Benin	July 1, 2000	March 1, 2003
Bolivia	February 1, 2000	June 1, 2001
Burkina Faso	July 1, 2000	April 1, 2002
Burundi	August 1, 2005	January 1, 2009
Cameroon	October 1, 2000	April 1, 2006
Central African Republic	September 1, 2007	June 1, 2009
Chad	May 1, 2001	April 1, 2015
Comoros	July 1, 2010	December 1, 2012
Democratic Republic of Congo	July 1, 2003	July 1, 2010
Republic of Congo	March 1, 2006	January 1, 2010
Côte d'Ivoire	March 1, 2009	June 1, 2012
Ethiopia	November 1, 2001	April 1, 2004
The Gambia	December 1, 2000	December 1, 2007
Ghana	February 1, 2002	July 1, 2004
Guinea-Bissau	December 1, 2000	December 1, 2010
Guyana	November 1, 2000	December 1, 2003
Haiti	November 1, 2006	June 1, 2009
Honduras	June 1, 2000	April 1, 2005
Liberia	March 1, 2008	June 1, 2010
Madagascar	December 1, 2000	October 1, 2004
Malawi	December 1, 2000	August 1, 2003
Mali	September 1, 2000	March 1, 2003
Mauritania	February 1, 2000	June 1, 2002
Mozambique	April 1, 2000	September 1, 2001
Nicaragua	December 1, 2000	January 1, 2004
Niger	December 1, 2000	April 1, 2004
Rwanda	December 1, 2000	April 1, 2005
São Tomé and Príncipe	December 1, 2000	March 1, 2007
Senegal	June 1, 2000	April 1, 2004
Sierra Leone	March 1, 2002	December 1, 2006
Tanzania	April 1, 2000	November 1, 2001
Togo	November 1, 2008	December 1, 2010
Uganda	February 1, 2000	May 1, 2000
Zambia	December 1, 2000	April 1, 2005

Table I.
Dates each HIPC reached debt relief decision point and completion point

the effect of the debt relief treatments on the different outcomes. The treatment of debt relief is of course not randomly assigned. The countries that qualified had specific characteristics, namely massive debt burdens and low development, that led them to need debt relief. Including country fixed effects controls for those confounding characteristics that are time-invariant. We also include year fixed effects to control for macro shocks that affect all countries equally.

The baseline model that we estimate is the following:

$$Y_{it} = \alpha + \sum_{i}^{N} \beta_i \text{Country}_i + \sum_{t}^{T} \gamma_t \text{Year}_t + \delta \text{Country}_i \times d_{t > \tau_d} + u_{it} \quad (1)$$

where Y_{it} is the outcome variable of interest for country i in year t, Country_i is a dummy variable that is equal to 1 for country i and 0 for every other country; Year_t is a dummy variable that is equal to 1 for year t and 0 for every other year; $d_{t > \tau_d}$ is a time-varying dummy variable that is equal to 1 for each year after the country has reached the decision point and 0 otherwise; u_{it} is the error term, which is identically independently distributed normal.

Including all the country dummy variables and the year dummy variables controls for country fixed effects and year fixed effects. The main coefficient of interest is δ. When Country_i is an HIPC, then $d_{t > \tau_d}$ is 1 for every year after that country has reached the decision point. When Country_i is not an HIPC, then $d_{t > \tau_d}$ is equal to 0 since the country never reaches the decision point. The interaction term measures a different time period for each HIPC, capturing the fact that the treatment was applied to each country independently. The coefficient δ measures the effect of debt relief on the outcome Y after the decision point. This period after the decision point averages 14 years in the data set.

HIPCs began receiving debt relief after they reached the decision point, but full debt relief was not received until they reached the completion point. HIPCs were also working specifically on poverty reduction strategies and macroeconomic reform after the decision point in order to qualify for the remaining debt relief. Once HIPCs reached the completion point, they received debt relief with no further conditions and they also received additional debt relief under the MDRI. To account for the distinctions between the period after the decision point – the short-run effect – and the period after the completion point – the long-run effect – we estimate the following model:

$$Y_{it} = \alpha + \sum_{i}^{N} \beta_i \text{Country}_i + \sum_{t}^{T} \gamma_i \text{Year}_t + \delta_1 \text{Country}_i \times d_{\tau_c \geq t > \tau_d} + \delta_2 \text{Country}_i \times d_{t > \tau_c} + u_{it} \quad (2)$$

where, $d_{\tau_c \geq t > \tau_d}$ is a dummy variable that is equal to 1 for each year when the country is between the decision point and the completion point; $d_{t > \tau_c}$ is a dummy variable that is equal to 1 for each year after the country has reached the completion point.

This specification teases out the difference between the short-run and the long-run effects. The coefficient δ_1 captures the short-run effect of debt relief that is received between the decision point and the completion point. The average amount of time each HIPC is in this between period is four years. The coefficient δ_2 captures the long-run effect of debt relief. The period after the completion point is an average of ten years in the data set.

The original HIPC Initiative required countries to establish a track record of three years of stable macroeconomic policies to indicate that the resources freed up through debt relief would be used properly (Andrews *et al.*, 1999). The prior results could be biased if countries are ramping up certain policies in order to reach the decision point. To investigate this,

we also included a three-year window before each HIPC reached the decision point. The model with the lead up to decision is specified below:

$$Y_{it} = \alpha + \sum_{i}^{N} \text{Country}_i + \sum_{t}^{T} \text{Year}_t + \delta_0 \text{Country}_i \times d_{\tau_{d-3} \geqslant t > \tau_c}$$

$$+ \delta_1 \text{Country}_i \times d_{\tau_c \geqslant t > \tau_d} + \delta_2 \text{Country}_i \times d_{t > \tau_c} + u_{it}$$

where $d_{\tau_{d-3}}$ is a dummy variable that is equal to 1 for each of the three years before the country reaches the decision point. The coefficient δ_0 captures whether HIPCs were changing policies specifically to prepare for the decision point.

We also include regressions with continent instead of country fixed effects and also an HIPC dummy instead of continent or country fixed effects.

The key identifying assumption for difference-in-difference estimation is parallel trends of the treatment and control units. This means that the variable of interest for the treatment countries follows the same time trends as that in the control countries had they not received debt relief. Each HIPC reached the decision point at different times, ranging from 2000 to 2010. This complicates verifying the assumption since there is not one treatment date to compare trends before and after. However, 22 out of the 36 HIPCs reached the decision point in 2000. We can at least visually inspect the time trends before and after this date to check parallel trends.

Figure 1 shows the trends of gross fixed capital formation for countries that are HIPCs and non-HIPCs for the years 1980-2016. The trends track closely prior to 2000. However, after 2000, there is a sharp increase in gross fixed capital formation for HIPCs. The trends of the two groups clearly diverge after 2000 with the slope of HIPCs being significantly steeper than that of non-HIPCs. Remarkably, for the years 2012-2016, HIPCs even had a greater average gross fixed capital than non-HIPCs. This graph suggests that gross fixed capital formation was positively affected by debt relief.

We can also look at gross fixed capital formation averaged over all HIPC countries for the years relative to the year the country reached the decision point. Presenting the trends of

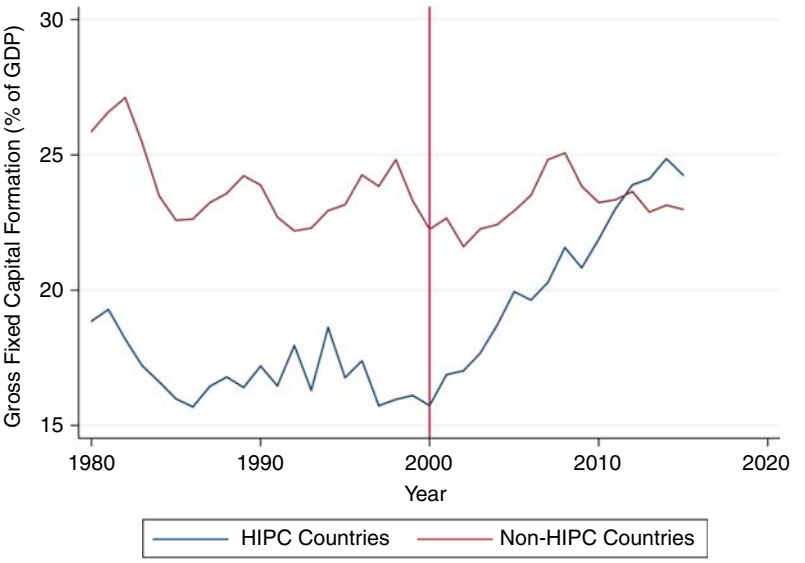

Figure 1.
Investment rates for HIPC vs non-HIPC countries

the outcome variable by relative year for HIPCs provides a visual of how the treatment affected countries by showing the trends just for HIPCs based on the year relative to receiving debt relief. Gross fixed capital formation was beginning to increase for HIPCs leading up to the decision point, but there is an immediate spike in the year directly after the decision point followed by steep increases. There are undoubtedly sharp increases in capital investment for HIPCs after receiving debt relief (Figure 2).

Figure 3 shows the trends in enrollment rates for HIPCs and non-HIPCs. The trends prior to 2000 satisfy the parallel trends assumption, even though there is slightly more volatility

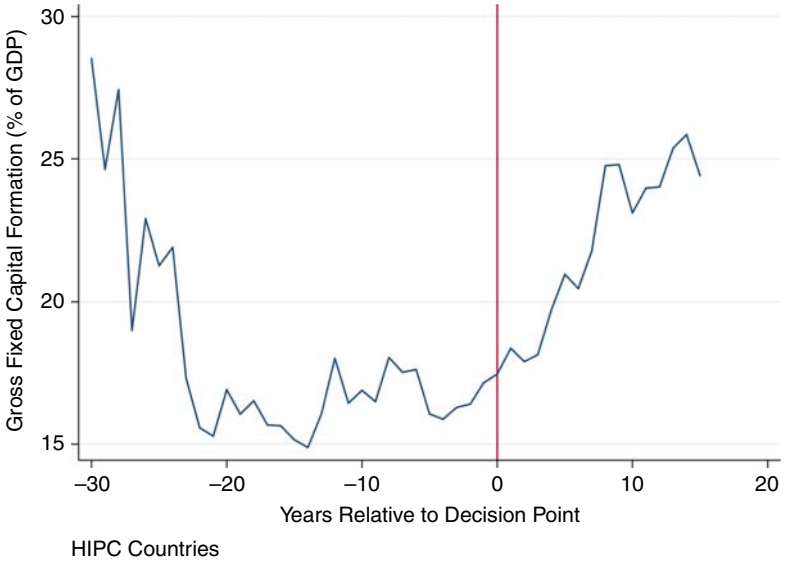

Figure 2.
Investment rates for HIPC countries before and after the debt relief decision point

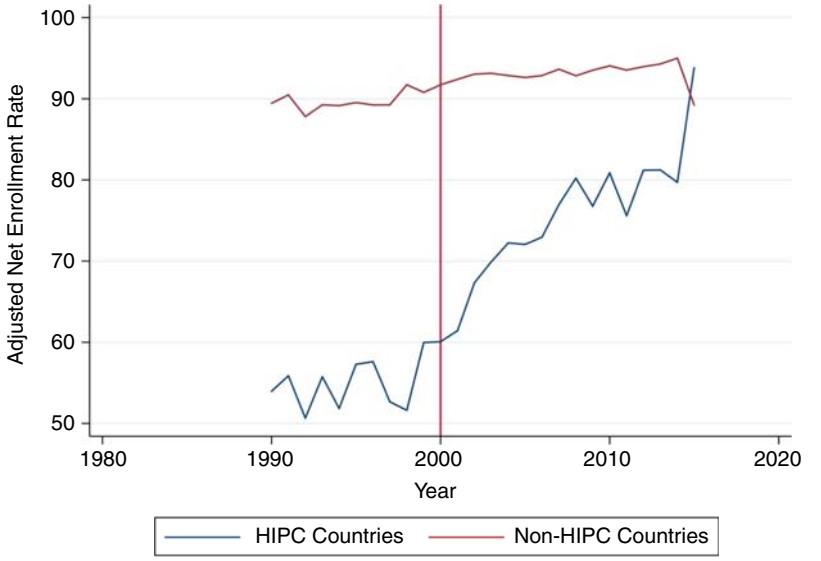

Figure 3.
Enrollment rate of primary school-aged children

among HIPCs than non-HIPCs. After 2000, there are large gains in enrollment rates for HIPCs. These countries clearly deviate from their pre-treatment trends and increase rapidly until the average enrollment rates equal to that of the non-HIPCs. This suggests that the Enhanced HIPC Initiative led to an increase in human capital investment and that the second Millennium Development Goal is being reached.

Figure 4 shows the average adjusted net enrollment rate for HIPCs relative to the year each country received debt relief. There is an obvious increase in enrollment rates following the decision point with the sharpest increases occurring within the first few years. This finding is not that surprising considering each HIPC had to enact a poverty reduction strategy, which included boosting education, in order to receive debt relief.

3. Results

We report results estimating the effect of debt relief on measures of physical capital investment, human capital investment, employment, and standard of living.

Investment is broken down into two different measures: gross fixed capital formation and FDI. Gross fixed capital formation is a measure of physical capital investment. FDI measures capital investment by other nations into a country's economy and firms. Myer's debt overhang theory suggests that significant outstanding debt discourages both domestic investment and foreign investment. Theoretically, debt relief should lead to increases in both gross fixed capital and FDI.

Table II shows the econometric results of debt relief on gross fixed capital formation. This table is formatted similar to subsequent tables. The first column shows the baseline results of the effect following the decision point. It controls for country fixed effects and year fixed effects. The second column estimates the long-run effect as the coefficient on the period after the completion point. The third column breaks down the baseline effect into the short run and the long run while also controlling for country fixed effects and year fixed effects. The short-run period is defined as the time each country is between the decision point and the completion point. The long-run period is defined as the time following the completion point. The short run is four years on average and the long run is ten years on average. These effects

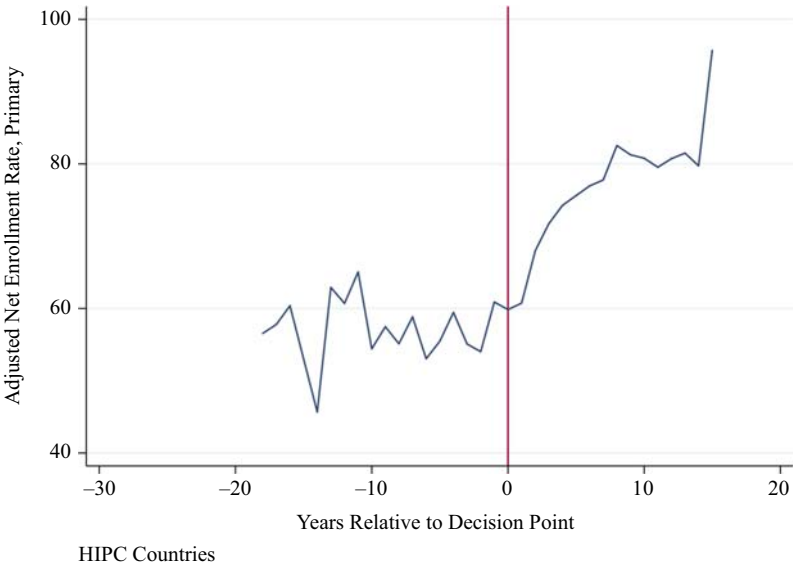

Figure 4.
Enrollment rate of primary school-aged children in HIPC countries before and after the debt relief decision point

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	4.471*** (0.480)			0.434 (0.536)			
aftercompletionpoint		5.478*** (0.491)	5.787*** (0.510)		1.844** (0.563)	2.108*** (0.546)	6.753*** (0.593)
betweendecisionandcompletion			1.632* (0.743)		−2.873*** (0.855)		1.884* (0.843)
Constant	34.56*** (0.790)	34.57*** (0.787)	34.56*** (0.787)	25.57*** (0.908)	25.56*** (0.909)	25.63 *** (0.908)	25.86*** (0.740)
Observations	5,691	5,691	5,691	5,691	5,691	5,691	5,691

Notes: Dependent variable is gross fixed capital formation (per cent of GDP). All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. $*p < 0.05$; $***p < 0.001$

Table II.
The effect of debt relief under the Enhanced HIPC Initiative and the MDRI on gross fixed capital formation

are compared to the omitted group which are the years before the decision point. The fourth through sixth columns remove the country fixed effects and include controls for continent. The excluded continent is Oceania. The seventh column removes the country fixed effects and includes a dummy for HIPC.

Debt relief positively impacted gross fixed capital formation. When controlling for country fixed effects, there are many positive, statistically significant results. Gross fixed capital formation increased by 4.47 percent after countries reached the decision point. Decomposing the effect into the short run and the long run reveals that the increase is both a short-run and a long-run phenomenon. While both are positive and significant, the long-run effect is greater and more significant. Debt relief increased gross fixed capital formation by 1.63 percent in the short run and by 5.79 percent in the long run. Including the three years leading up to the decision point in the analysis does not change the short-run and long-run effects. There is no significant effect during those three years, which implies that HIPCs were not increasing capital investment to prepare for the decision point.

Overall, debt relief under the Enhanced HIPC Initiative and the MDRI increased investment through gross fixed capital formation. There were short run increases, but greater effects were seen in the long run. This makes sense given how debt relief was apportioned. Countries began receiving debt relief once they reached the decision point, but they received debt relief in full upon reaching the completion point. The MDRI was activated upon reaching the completion point as well. These results align with the debt overhang theory. The debt burden was lowered after the decision point and so investment increased. It was lowered even more after the completion point which led to larger increases in investment.

Table III shows the results of the impact of debt relief on FDI. The alleviation of the debt burden via the Enhanced HIPC Initiative and the MDRI increased HIPC's investment into their own countries through gross fixed capital formation, but it did not affect foreign investment. This suggests that the FDI activities are distinct from domestic investment and could be driven by different considerations.

After physical investment, the next important measure is human capital investment. Table IV presents the results of debt relief on enrollment rates. When controlling for country fixed effects, every treatment period indicates significant, positive effects of debt relief on enrollment rates. There was an increase in the adjusted net enrollment rate for primary school-aged children of 15.72 percent after countries reached the decision point. There was a 10 percent increase in the enrollment rate in the short run, but an even larger increase of 18.23 percent in the long run.

Enrollment rates for primary school-aged children are impacted positively by debt relief when controlling for country fixed effects. The effects are larger in the long run at almost 20 percent increases in primary school enrollment. After the completion point, HIPCs have significantly less debt service and thus have freed up resources that can be spent on education and increased investment in human capital. This supports a story of debt crowding out public investment in education. Additionally, increased enrollment rates are an expected result given that the Enhanced HIPC Initiative required countries to develop and implement a poverty reduction strategy prior to receiving debt relief. These strategies often included increased spending on education. These results indicate progress toward the second Millennium Development Goal of achieving universal education.

To see how debt relief impacted the labor force, we analyzed the effect on the employment to population ratio. Table V shows the effects of debt relief on the employment rate. There is a 0.62 percent increase in the total employment rate following the decision point. Breaking the effects down into short run and long run yields a 0.32 percent increase in the short run and a 0.78 percent increase in the long run. These results indicate that the total employment rate increased in the long run following debt relief, but the increases were quite

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	0.840 (0.525)			−0.126 (0.493)			
aftercompletionpoint		1.140* (0.545)	1.167* (0.593)		0.217 (0.584)	0.303 (0.573)	0.546 (0.696)
betweendecisionandcompletion			0.125 (0.613)		−0.893 (0.679)		−0.502 (0.754)
Constant	290.1* (121.8)	290.1* (121.8)	290.1* (121.8)	0.967 (0.745)	0.968 (0.745)	0.999 (0.747)	1.616*** (0.339)
Observations	5,916	5,916	5,916	5,916	5,916	5,916	5,916

Notes: Dependent variable is foreign direct investment (per cent of GDP). All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. *$p < 0.05$; ***$p < 0.001$

Table III.
The effect of debt relief on foreign direct investment

Table IV.
The effect of debt relief on primary school enrollment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	15.72*** (1.051)			−2.267 (1.206)			
aftercompletionpoint		14.58*** (0.958)	18.23*** (1.091)		0.0393 (1.282)	0.993 (1.253)	17.21*** (1.982)
betweendecisionandcompletion			10.01*** (1.311)		−7.931*** (2.046)		8.193** (2.609)
Constant	103.0*** (3.224)	102.6*** (3.417)	102.3*** (3.336)	103.7*** (4.893)	103.0*** (4.578)	103.1*** (4.488)	95.08*** (6.268)
Observations	2,597	2,597	2,597	2,597	2,597	2,597	2,597

Notes: Dependent variable is adjusted net enrollment rate of primary school-aged children. All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	0.618*** (0.140)			9.056*** (0.671)			
aftercompletionpoint		0.688*** (0.147)	0.779*** (0.163)		9.389*** (0.801)	8.371*** (0.781)	2.389* (0.961)
betweendecisionandcompletion			0.318* (0.152)		8.375*** (0.878)		1.698 (1.001)
Constant	77.63*** (0.340)	77.62*** (0.340)	76.83*** (0.637)	62.19*** (0.988)	62.23*** (0.984)	61.86*** (0.979)	55.82*** (0.816)
Observations	4,176	4,176	4,176	4,176	4,176	4,176	4,176

Notes: Dependent variable is total employment to population ratio. All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. *$p < 0.05$; ***$p < 0.001$

Table V.
The effect of debt relief on employment

small. Controlling for continents rather than country fixed effects produces larger, significant increases in the employment rate for each treatment period. Overall, the total employment to population ratio was positively impacted by debt relief, but the effects were more clearly seen in the long run.

Table VI shows how the female employment ratio was affected by debt relief. The results indicate that the female employment rate was unaffected by the debt relief that was administered under the Enhanced HIPC Initiative and the MDRI. There was no short-run effect or long-run effect. The third Millennium Development Goal was to promote gender equality. Even though female employment rates do not fully capture the success or failure of this goal, they inform its implementation. Debt relief does not appear to have helped HIPCs reach this goal.

Since there was no effect of debt relief on female employment rates, it must be that the positive effect found for the entire population is comprised of increased employment for males. Table VII shows the results of debt relief on the male employment to population ratio. After the decision point, the male employment rate increased by 0.99 percent. Unlike the total employment rate, the male employment rate had a significant increase in the short run. Employment increased by 0.6 percent in the short run and increased by 1.21 percent in the long run.

To determine whether the impact of debt relief was felt by HIPC populations, we investigated two standard of living measures: GDP per capita and household consumption. Table VIII shows the effects of debt relief on GDP per capita growth rates. At the baseline, there is an increase in GDP per capita growth of 1.95 percent after the decision point. Investigating further, the effects are realized both in the short run and the long run. The long-run effects are larger and more significant. GDP per capita growth increased by 1.38 percent in the period between the decision point and the completion point. It increased by 2.22 percent after the completion point.

Table IX shows the effects of debt relief on household consumption. There is a baseline effect of an increase in household consumption of 1.87 percent following the decision point. Decomposing the treatment period into the short run and the long run yields only a short-run effect. During the period between the decision point and completion point, household consumption increased by 3.86 percent.

Finally, we perform one falsification exercise considering the effect of debt relief on a country's average precipitation. Debt relief should of course have no effect on rainfall. The results can be seen in Table X. Debt relief under the Enhanced HIPC Initiative and the MDRI has no impact on average precipitation.

4. Concluding remarks

We investigated the effects of the debt relief that was delivered under the Enhanced HIPC Initiative and the MDRI. Each HIPC reached the decision point and the completion point at different times. To account for this variation in treatment dates, we applied a time-shifted difference-in-differences strategy that allowed the treatment to be country-specific. We found that debt relief increased gross fixed capital formation, but did not affect FDI. Gross fixed capital formation increased both in the short run and the long run, but had greater increases in the long run. This increase in capital investment is in line with debt overhang theory and is encouraging given that investment is key to long-run growth.

Human capital investment was also positively affected by debt relief under the Enhanced HIPC Initiative and the MDRI. Adjusted net enrollment rates increased by almost 20 percent in the long run following debt relief. Debt relief had no effect on female employment rates, but did positively impact male employment rates, especially in the long run. Standards of living were improved through increased GDP per capita growth rates and greater household consumption.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	0.134 (0.184)			11.59*** (1.006)			
aftercompletionpoint		0.271 (0.188)	0.248 (0.211)		11.91*** (1.181)	10.58*** (1.150)	2.454 (1.497)
betweendecisionandcompletion			−0.0798 (0.200)		10.93*** (1.357)		2.159 (1.634)
Constant	76.33*** (0.564)	76.34*** (0.562)	75.33*** (0.934)	52.11*** (1.592)	52.47*** (1.587)	51.99*** (1.581)	42.93*** (1.198)
Observations	4,176	4,176	4,176	4,176	4,176	4,176	4,176

Notes: Dependent variable is female employment to population ratio. All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. ***$p < 0.001$

Table VI.
The effect of debt relief on female employment

Table VII.
The effect of debt relief on male employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	0.994*** (0.156)			6.466*** (0.490)			
aftercompletionpoint		1.035*** (0.165)	1.207*** (0.183)		6.834*** (0.585)	6.139*** (0.574)	2.395*** (0.724)
betweendecisionandcompletion			0.597*** (0.163)		5.714*** (0.659)		1.213 (0.759)
Constant	79.02*** (0.180)	78.99*** (0.179)	78.46*** (0.379)	72.26*** (0.722)	72.00*** (0.719)	71.75*** (0.715)	68.41*** (0.723)
Observations	4,176	4,176	4,176	4,176	4,176	4,176	4,176

Notes: Dependent variable is male employment to population ratio. All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. ***$p < 0.001$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	1.953*** (0.346)			0.573* (0.272)			
aftercompletionpoint		1.939*** (0.335)	2.218*** (0.365)		0.866** (0.288)	0.874** (0.278)	2.430*** (0.374)
betweendecisionandcompletion			1.380** (0.492)		−0.0825 (0.441)		1.430** (0.496)
Constant	−8.243 (6.778)	−8.285 (6.774)	−8.206 (6.777)	0.412 (0.662)	0.413 (0.662)	0.415 (0.662)	1.323* (0.608)
Observations	6,484	6,484	6,484	6,484	6,484	6,484	6,484

Notes: Dependent variable is growth of GDP per capita. All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table VIII.
The effect of debt relief on growth

Table IX.
The effect of debt relief on household consumption

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
afterdecisionpoint	1.870* (0.815)			10.80*** (1.026)			
aftercompletionpoint		0.198 (0.816)	0.939 (0.869)		9.500*** (1.107)	8.233*** (1.107)	−0.164 (1.278)
betweendecisionandcompletion			3.859** (1.197)		13.80*** (1.840)		4.738* (1.931)
Constant	83.96*** (1.340)	83.96*** (1.343)	83.95*** (1.339)	67.50*** (1.950)	67.52*** (1.950)	67.13*** (1.941)	63.23*** (1.717)
Observations	5,695	5,695	5,695	5,695	5,695	5,695	5,695

Notes: Dependent variable is household consumption as share of GDP. All regressions include year fixed effects. (1) (2) and (3) include country fixed effects; (4) (5) and (6) include continent dummies; (7) includes dummy for Heavily Indebted Poor Countries (HIPC). Robust standard errors in parentheses. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

	(1)	(2)	(3)
afterdecisionpoint	3.329 (4.766)		
aftercompletionpoint		4.455 (4.565)	4.444 (5.115)
betweendecisionandcompletion			−0.0574 (5.001)
Constant	381.2*** (5.531)	674.2*** (5.398)	674.2*** (5.553)
Observations	1,444	1,444	1,444

Notes: Dependent variable is average annual rainfall. All regressions include year and country fixed effects. Robust standard errors in parentheses. ***$p < 0.001$

Table X.
The effect of debt relief on precipitation

Taken together, these results suggest that a strategy of debt reduction can reduce the overhang that impedes investments in physical as well as human capital. Reducing the debt level should thus be an important goal for developing countries. Especially during good times when revenue is more abundant, governments should prioritize paying down the debt as a pro-growth development strategy.

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