Debt Relief, Investment and Growth

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Abstract

Between 1989 and 2003, the donor community provided $200 billion in debt relief to developing countries. In the paper, the impact of debt relief on investment and growth is empirically assessed. Two different mechanisms are examined: the resource mechanism which takes into account the resources made available by debt relief, and the incentive mechanism which considers the incentive effects of a reduced debt burden. Debt relief does not seem to have influenced investment or growth. Neither the resource mechanism nor the incentive mechanism is found to be significant. The conclusion drawn is that a growth effect of debt relief should not be taken for granted.

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1 Introduction

Debt relief has rapidly gained importance as a policy tool over the past decade. The share of debt relief to aid has risen from an average of four percent in the 1990s to 22 percent in 2005 in nominal terms (World Bank 2006). Between 1989 and 2003, the donor community provided 200 billion U.S. dollar as debt relief in nominal terms to developing countries.[1] Whereas bilateral debt relief has been provided through the Paris Club since the 1950s, multilateral debt relief is a recent phenomenon. In 1996, the World Bank and the International Monetary Fund launched the Heavily Indebted Poor Countries (HIPC) initiative, through which multilateral debt relief is granted. Following the request from the G-8 countries to extend the debt relief efforts to the world's poorest and most indebted countries, the Multilateral Debt Relief Initiative (MDRI) took off in 2006. The measures have attracted increasingly generous promises of funding from donors and are viewed as important growth enhancing and poverty reducing efforts.

In spite of the growing importance of debt relief as a policy tool, few empirical studies assess the growth effect, whereas the effect of aid has been extensively evaluated both within academic research and development institutions (see Roodman 2004 for an overview). This is somewhat surprising as aid and debt relief rely on distinct channels. While aid implies a flow of resources to the recipient country, debt relief makes resources available from reduced debt service payments. In addition, debt relief reduces the debt stock which might affect incentives in the country. The debt overhang literature implies that debt relief spurs growth in the recipient countries through improved incentives to invest and potential new capital inflows (Krugman 1988 and Sachs 1989). In addition, the literature on the crowding-out theory implies that investment and growth are increased through released resources from debt relief (Cohen 1993). Another strand of the literature, however, argues that debt relief does not enhance growth because of deficient institutions and the signalling effect of revealing an unsustainable debt (Bulow and Rogoff 1989, Bird and Milne 2003). These contradictory theoretical outcomes leave the effect of debt relief on growth and investment to an empirical question.

The empirical research on how the stock of external debt affects growth provides mixed evidence. Some studies find a negative impact of debt on growth when the debt ratio reaches a certain threshold (Pattillo et al. 2004, Clements et al. 2003 and Pattillo et al. 2002), while others find evidence of a negative linear relation (Presbitero 2005). This suggests that debt relief can spur growth in recipient countries by reducing the debt burden. Based on a growth and debt equation, Pattillo et al. (2002) predict that halving the debt of highly indebted poor countries from the levels in 2000 would raise per capita growth by about one percentage point. Others reject any statistically significant effect of external debt on growth, indicating that debt relief might not enhance growth (see Dikjstra and Hermes 2001 for an overview). Few empirical studies explicitly assess the growth effect of debt relief. Depetris and Kraay (2005) study the effect of debt relief on growth and investment in low-income countries between 1989 and 2003. They provide simple descriptive evidence of the relation, excluding control variables from the analysis. They find no evidence of debt relief raising growth or investment rates among recipient countries. Similarly, Hepp (2005) does not find a general

[1] Own calculations based on Global Development Finance 2005.

effect of debt relief on growth judged from growth equations using annual data. However, he finds that countries that are not classified as HIPCs have benefited significantly from debt relief.

The purpose of this paper is to study the growth effect of debt relief in developing countries. It contributes to the emerging literature on the impact of debt relief and develops the previous framework in various ways. The study allows for debt relief to affect growth trough two different mechanisms. The resource mechanism takes into account the resources made available by debt relief, while the incentive mechanism considers the effects of a reduced debt burden. Moreover, since the theoretical discussion emphasises the impact of debt relief on growth through capital investment, the investment channel is explicitly assessed. Contrary to previous studies, the approach follows the growth and aid literature. A standard growth model and an accompanying investment equation are estimated using a generalised method of moments estimator. The method yields consistent estimates in the presence of both endogenous regressors and country specific effects. The data set used is a panel of 60 low- and middle-income countries[2] with data averaged over four-year periods between 1989 and 2003. World Development Indicators 2005 and the Global Development Finance 2005 are the main data sources. The findings are not supportive of a growth effect of debt relief neither regarding the incentive mechanism nor the resource mechanism. Neither a direct effect on growth nor an indirect effect thorough investment is evident in the data. The results hold when the implications of debt relief are allowed to be different in low- and middle-income countries.

The paper proceeds as follows. In the next section, the concept of debt relief is presented and an overview of its history is provided. In section three, the channels through which debt relief might affect growth are discussed. Variables, data and estimation method are introduced in section four. Section five presents the estimation results and section six concludes.

[2] Developing countries consist of low- and middle-income countries as defined by the World Bank. Low-income countries are those in which 2004 GNI per capita was no more than $825; middle-income countries are those in which GNI per capita was between $826 and $10,065 (WDI 2005).

2 Background

2.1 The Concept of Debt Relief

Debt relief includes any form of debt reorganisation that relieves the overall burden of debt. The three main types of reorganisation include debt rescheduling, debt forgiveness and debt conversion. Debt rescheduling is defined as a change in the terms and conditions of the amount owed. Alternatively, debt forgiveness involves a reduction in the amount of a debt obligation. A debt conversion is implemented when a creditor exchanges the debt claim for something of economic value other than another debt claim on the same debtor (IMF 2003).

Two basic accounting identities can be used to illustrate the implications of debt relief: (2.1) the evolution of indebtedness and (2.2) the fiscal constraint of an individual debtor:

$$\Delta D \equiv (S - P) + (L - W) \quad (2.1)$$

$$G \equiv T + L - P + A \quad (2.2)$$

where ΔD is the change in indebtedness, S is the contracted debt service payments, P is actual debt service payments, L is new borrowing, W is debt relief, G is non-debt related government expenditure, T is tax receipts, and A is development aid from abroad.

The direct impact of debt relief is a reduction of the debt stock.[3] Although debt relief is represented by W, it is also possible that S is reduced. To fully account for the effect on the debt stock, the terms of the loan has to be taken into account. The implication of debt relief on non-debt related government expenditure arises through its impact on the actual debt service payments and depends on the level of tax receipts, new borrowing and development aid from abroad. If a country, for example, has been in complete default for many years and not been servicing any of its debts to a particular creditor, i.e. P=0, it would not be possible for any amount of debt relief to reduce further the cash payments actually being made by the debtor. Still, debt relief reduces indebtedness in this case. On the other hand, if the recipient was previously paying all contractual debt service, such that S=P, then debt relief will relax the budget constraint to the full extent of the fall in S and reduce the debt burden correspondingly. More generally, conditioned on the level of tax receipts, new borrowing and development aid from abroad being equal, if P<S, then the fiscal impact will be reduced accordingly, and will only occur to the extent of the fall in P (Bird and Milne 2003).

2.2 History and Statistics

Debt relief is not a new phenomenon. Since the mid-1950s, the Paris Club has been a framework for rescheduling sovereign debt to bilateral creditors. In the 1970s and early 1980s, a severe debt crisis developed, mainly in Latin American countries. Eight countries had to reschedule their debt payments in 1982 to escape the liquidity problems. Since the

[3] For a debt rescheduling to reduce the debt stock, the rescheduling has to be made on more concessional terms than the original loan.

debt problems were also related to solvency, actions such as debt forgiveness were introduced (Daseking and Powell 2000). In the mid-1990s, debt relief became an important tool for delivering development aid. Multilateral debt relief was considered for the first time in 1996, with the launch of the HIPC Initiative by the World Bank and the IMF. The link between debt relief and poverty-reducing efforts was strengthened by providing relief under the condition for the recipient country to develop a Poverty Reduction Strategy. Moreover, debt relief became closely linked to other aid-allocation decisions (Powell 2003). As of today, there are 40 eligible HIPCs, most of them in Sub-Saharan Africa.[4] In 2006, multilateral debt relief was again a priority on the development agenda with the decision to cancel the debt of the eighteen poorest countries in the world through the Multilateral Debt Relief Initiative.

The debt of developing countries accrues to a large extent to official creditors, including an increasing share provided by multilateral agencies. Whereas the share of the external debt of developing countries to official creditors has decreased since 1990, it has increased for Heavily Indebted Poor Countries (HIPCs). In 2003, about 90 percent of total external debt of HIPCs accrued to official creditors. The share of the official debt that is provided by multilateral agencies has increased since the 1980s for HIPCs, as well as for developing countries in general. In 2003, more than half of all official external loans to HIPCs were provided by multilateral creditors. Several developing countries experience a high debt burden, measured as the total external debt as a share of exports and as a share of GDP. Although the debt burden has decreased since the peak in the 1990sm the debt ratio is still high, especially in HIPCs (see Appendix A).

During the period between 1989 and 2003, debt relief to developing countries has been substantial with 200 billion U.S. dollars in nominal terms. The data also reveals that debt relief does not consist of a one shot flow. On average, each country receives debt relief about five times during the period (see Appendix B). Although debt relief, in itself, reduces the debt burden of developing countries, other factors influence the total change in the external debt stock of the countries. One important source of change is net flows on debt, including new borrowing. Moreover, cross-currency valuation effects arising from movements in the value of the dollar against other world currencies show a significant impact during the period (see Appendix A).

[4] To be part of the HIPC Initiative, a country must face an unsustainable debt situation after the full implementation of traditional debt relief mechanisms, be only eligible for highly concessional assistance from the International Development Association, establish a track record of reform, and develop a Poverty Reduction Strategy Paper (See www.worldbank.org/hipc for more information).

3 Theoretical aspects on debt relief and growth

The theoretical effects of debt relief on growth are disputed. Proponents focus on two different channels: the incentive mechanisms and the resource mechanism. On the other hand, opponents question the existence of the both the incentive and resource mechanism, particularly in low-income countries. Also, one strand of the literature emphasises the signalling effect of revealing an unsustainable debt.

3.1 The incentive mechanism

The argument that debt relief affects growth trough an incentive mechanism is based on the theoretical literature that links a high debt to low growth. Increasing the level of debt may hamper growth through the effects of debt overhang (Krugman 1988, Sachs 1989). A debt overhang exists when a country's debt exceeds its expected ability to repay, and expected debt service is likely to be an increasing function of the country's output level. In this setting, creditors are the major beneficiaries from increased output while the total cost of economic adjustment accrues to the indebted country.

According to the debt overhang theory, high debt affects growth through lower investment volumes as well as reduced efficiency of investments. Investment is discouraged in the debtor country since part of the returns accrues to foreign creditors in the form of debt service. High future debt service is viewed as an implicit tax on investment, which dampens investment efforts. Debt overhang makes it also more difficult to obtain credit for investment efforts. Moreover, in a high debt environment, the uncertainty about the actions and policies of the government to meet its debt service obligations increases. The literature on investment under uncertainty emphasises that in highly uncertain and unstable environments, investors are reluctant to invest in costly, irreversibly projects (Servén 1997). As in other high uncertainty environments, investments that do take place in high debt environments will likely be in trading activities with quick returns, rather than long-term, high-risk investment. This misallocation of investment will lower the efficiency of overall capital accumulation, suggesting that high levels of debt and associated uncertainty might affect growth also via investment efficiency and productivity (Pattillo et al. 2002). In sum, a country suffering from debt overhang is unable to service its debt, to obtain new loans and to invest as much or as efficient as it otherwise would.

When a country suffers from debt overhang, debt relief can improve economic efficiency. By reducing the stock of debt, debt relief reduces the implicit tax on investment and possibly reduces uncertainty.[5] This is assumed to reinstate the incentive for the country to undertake efficient investments and for new lenders to extend credit. Hence, growth can be enhanced through increased volumes of investment and higher productivity growth. Taken together, the incentive mechanism can be summarised in the following hypothesis:

[5] Krugman (1988) shows that debt relief can make the creditor better of as well if it increases the likelihood that the debtor will repay what remains of the loan.

Hypothesis 1: Debt relief increases growth, through higher investment volumes as well as increased efficiency of investments, in the case of a high debt burden.

3.2 The resource mechanism

The resource mechanism draws upon the crowding-out theory (Cohen 1993). In the case of a high debt burden, debt service payments crowd out investment and thereby impede growth. In this setting, debt relief might affect investment and growth through an expansion in public spending by easing the government's budget constraint. As can be seen from accounting identity (2.2), for debt relief to actually generate resources and easing the government's budget constraint, some premises need to be fulfilled. Resources are only freed if the country has actually been servicing its debt (P) and if the revenue collection in the country is not reduced (T). Moreover, debt relief has to be provided in addition to aid (A) (Bird and Milne 2003).

The channels through which resources from aid, in the form of budget support, and released resources from debt relief affect growth are assumed to be identical. As in the case of aid, debt relief is supposed to increase growth by providing resources that could be used for productive investments. Dalgaard et al. (2004) present theoretical aspects within a two-period Diamond model. They show how transfers improve steady state productivity by raising the capital stock per person. The resource mechanism argument can be summarised as follows:

Hypothesis 2: Debt relief increases growth by freeing resources that are used for productive investments.

3.3 Contrasting theoretical aspects

There is disagreement on the implications of debt relief, particularly regarding the consequences in low-income countries. The debt overhang model, which lays the foundation for the incentive mechanism, is designed for countries that suffer from heavy debt burdens under non-concessional private debt. However, the debt burden of the heavily indebted countries of today consists mainly of official and concessional debt.[6] Official debt only generates a debt overhang if higher levels of debt stock mean that debtors anticipate lower levels of net resource transfers in the future.[7] Bird and Milne (2003) show that higher levels of outstanding debt are associated with higher levels of net resource transfers from official sources. The implication is that a high debt burden does not limit the access to new capital inflows in these circumstances. Moreover, the investment channel, which plays a central role in models of debt overhang, is argued to be absent in low-income countries (Arslanalp and Henry 2004). For debt overhang to discourage investment, the country must have a private sector with potential investment projects to discourage. This is argued not to be the case in many low-income countries due to the absence of functional economic institutions. Without foundations for profitable economic activity, it is not likely that debt relief will stimulate foreign capital inflows, investment and growth in heavily indebted poor countries (Arslanalp

[6] See Appendix A for figures.
[7] Net resource flows are defined as new borrowing and development grants less debt service.

and Henry 2004). Koeda (2006) develops a theoretical model of how debt overhang could be generated in low-income countries. The implication is that a one-time debt stock treatment might enhance growth depending on the country's initial conditions. However, debt relief does not consist of a one shot treatment.[8] This leaves the effect of debt relief to an empirical question.

Bird and Milne (2003) emphasise the unimportance of the resource mechanism in heavily indebted countries. Despite the debt service obligations, these countries receive more capital, in the form of loans and grants, than they pay out to their creditors. Inflows of official resources net of debt service payments are substantial and positive for virtually all the severely indebted low-income countries (Bird and Milne 2003). The implication is that debt relief could only have a minimal impact on net resource transfers, and a growth enhancing effect through the resource mechanism is therefore not expected.

One strand of the literature emphasises that the signalling effect of debt relief might have a detrimental effect mainly in middle-income countries. In the debt literature, reputation models are developed to explain enforcement mechanisms. Since debtors find it painful to be excluded from future credit markets, they are assumed to avoid defaulting (see for example Eaton and Gersovitz 1981 and Bulow and Rogoff 1989). Whereas the debt overhang literature assumes that a reduced debt stock pave the way to new lending, the reputation literature emphasises that rewriting debt contracts may hurt a debtor's reputation and hinder its ability to obtain future loans (Easterly 2002). Moreover, debt relief could intensify uncertainty about actions of the government to meet its debt service obligations in the future. The investment under uncertainty literature predicts that this dampens investment efforts in the country (Servén 1997). The result is that countries receiving debt relief do not attract new investments or capital and growth is not enhanced. Taken together, debt relief is not expected to enhance growth in neither low- nor middle-income countries. The contrasting theoretical aspects can be summarised as:

Hypothesis 3: Debt relief does not increase growth or investment, neither through the incentive nor the resource mechanism.

[8] See Appendix B for figures.

4 Data and empirical model

The purpose of the empirical investigation is to estimate the effect of debt relief on growth. As discussed above, the investment channel is emphasised both regarding the incentive and the resource mechanism, and the channel is therefore analysed explicitly. In line with previous literature, the relationships are estimated separately using a growth model and an investment model (Barro 1999, Borensztein et al. 1998, Hansen and Tarp 2001). The growth model follows the basic empirical set-up in Barro (1991), augmenting the specification by adding debt and aid variables. The framework combines basic features of the neoclassical growth model – especially conditional convergence which suggests that poor economies tend to catch up with rich ones – with extensions that emphasise the role of government policies and institutions. The investment equation is estimated within the same framework, the difference being the treatment of investment as the dependent variable.

Observations cover the period from 1989 to 2003. Data on debt relief is available from 1989, thereby restricting the estimation period. World Development Indicators (WDI) 2005 and the Global Development Finance (GDF) 2005 are the main data sources. The entire sample consists of all low- and middle-income countries that are available in the GDF database, which in total accounts to 136 countries. The panel used in the analysis is unbalanced with data for at least one period for 60 countries, of which 19 are HIPCs. Countries included in the empirical analysis are listed in Appendix C. To avoid short run cyclical movements, the sample is divided into four-year-periods, which is the general convention in the aid effectiveness literature.[9] The last period includes 3 years; however, for expositional simplicity it is throughout denoted four-year-periods.

4.1 Data and variables

Two different dependent variables are applied in the analysis. In the investment model, gross capital formation as a percentage of GDP is used.[10] Hence, the specification allows an assessment of the effect of debt relief on the volume of investment. In the growth equation, the average real per capita GDP growth is treated as the dependent variable. Growth is calculated as the annual average growth rate for each four-year-period.[11] Appendix D provides details of the variables used and their sources.

4.1.2 Debt relief variables

It is not obvious how to measure debt relief. When the interest lies in measuring the impact of debt relief in the receiving country it is important to take the impact on the debt burden as well as the released resources into account. As the theoretical section illustrates, a reduced debt burden can affect investment and growth through the incentive mechanism, while the released resources might influence through the resource mechanism. The nominal variables

[9] The sub-periods are 1989-1992, 1993-1996, 1997-2000 and 2001-2003.

[10] The variable is calculated as an average for each four-year-period. When data is missing, averages for non-missing data are used. This method is applied to all variables that are treated as averages.

[11] $growth = ((gdp_{t+3} - gdp_t) / gdp_t) / 4$

of debt relief available in the GDF database do not capture these characteristics.[12] Therefore, two measures of debt relief are calculated to capture the different mechanisms. The following section provides a presentation of the two measures, while a more detailed description is provided in appendix.

The change in the debt stock is captured by calculating a present value measure of debt relief (pvdr). A present value reflects the degree of concessionality of loans and thus more correctly measures the change in the expected burden of the debt.[13] It is of particular importance to use the present value measure in developing countries, since a significant fraction of their loans is on concessional terms.[14] However, there exist no international statistical standards on how to measure debt relief in present value terms. Depetris and Kraay (2005) provide a first attempt, and their approach is closely followed here. In short, the calculation is based on the assumption that the concessionality rate of the debt forgiven or rescheduled equals the concessionality rate of the debt stock in the country. Since the present value measure of debt relief captures the change in the debt stock, it corresponds to the incentive mechanism. Turning to the resources freed by debt relief, the nominal variable of debt relief needs to be adjusted to reflect whether the debt was likely to be serviced or not. A market value of debt relief (mvdr) is calculated to capture this mechanism.[15] The market value takes into account the previous debt service situation, thus reflecting the resources actually released by debt relief. Since the loans of most countries in the sample are not traded on the secondary market, the market value has to be estimated. Following Cohen (2000), the value is calculated building upon econometric evidence of the relationship between the secondary market prices and the debt stock, arrears and rescheduling commitments of middle-income debtors during the 1980s. The market value of debt relief corresponds to the resource mechanism. See Appendix E for a more detailed description of the two measures of debt relief.

Figures for the two different measures of debt relief are presented in Table 4.1. Since the present value of debt relief is discounted to the beginning of each four-year-period and aggregated, while the market value of debt relief is expressed as the average over the period, the magnitudes are not comparable. Debt relief has been sizeable and it has been spread over the entire sample period. However, the magnitude has gradually decreased as a percentage of GDP since the first period. When the sample is divided into low- and middle-income countries, it is apparent that low-income countries received more debt relief than middle-income countries. Moreover, HIPCs received considerable higher amounts of debt relief compared to non-HIPCs.

[12] Depetris and Kraay (2005) provide a thorough discussion of the problems related to the available data.
[13] The present value of debt is defined as "the discounted sum of all future debt service at a given rate of interest" (IMF 2003, p. 264). The concessionality rate is the present value of the debt expressed as a percentage of the nominal value (ibid, p. 250). A loan is concessional if it is extended on terms more generous than market terms.
[14] See figures of the concessionality rate of loans in Appendix A.
[15] The measure tries to capture the reduction in actual debt service paymants (P) in contrast to contractual debt service payments (S).

Table 4.1 Measures of debt relief, 1989–2003

	1989-1992	1993-1996	1997-2000	2001-2003
Debt relief ratio (pvdr)[a]				
Total sample	***4.2%***	***5.9%***	***3.0%***	***3.1%***
Low-income countries	5.2%	10.1%	5.9%	6.6%
Middle-income countries	3.5%	2.8%	1.0%	0.6%
HIPC	8.4%	17.1%	8.0%	10.6%
Non-HIPC	2.3%	1.6%	1.2%	0.3%
Debt relief ratio (mvdr)[a]				
Total sample	***1.2%***	***1.1%***	***0.7%***	***0.6%***
Low-income countries	1.4%	1.3%	1.0%	1.2%
Middle-income countries	1.1%	1.1%	0.4%	0.2%
HIPC	2.1%	2.0%	1.1%	1.7%
Non-HIPC	0.8%	0.8%	0.5%	0.2%

[a] Expressed in percentage of GDP

4.1.2 Additional variables

The debt stock is included in the analysis to capture the effect of a high debt burden on investment and growth. The initial present value of the long-term public external debt stock is used (Dikhanov 2006). To assess the significance of development aid, other than debt relief, the regressions include Effective Development Assistance, EDA (Chang et al. 1998). EDA includes grants and disbursements of all development loans regardless of how concessional they are, but counts only their grant element. EDA is a relevant measure in the study since official financial flows in the form of loans are measured in accordance with the debt literature and, in particular, because debt relief is excluded.[16] Following previous studies on aid effectiveness, aid squared is also included to capture the assumed diminishing returns of aid (Hansen and Tarp 2001, Lensink and White 2001).

Control variables are included in the regressions to capture the effect on investment and growth of other variables than debt relief, the debt stock and aid. The same variables are used in the investment and growth regressions (Borensztein et al. 1998, Barro 1999). The presentation of the variables focuses, however, on the growth model. Conditional convergence implies that poor countries catch up with rich countries once factors such as human and physical capital are taken into account (Barro and Sala-i-Martin 1992, Mankiw et al. 1992). Real GDP per capita the year prior to the beginning of each four-year period is therefore included. Education, measured as average years of schooling of the population aged 15 and above is used as a proxy of human capital. Moreover, gross capital formation and foreign direct investment are included to capture the main sources of physical capital accumulation. In the investment model, GDP growth is included as an additional explanatory variable (Hansen and Tarp 2001). Political and institutional factors are, moreover, emphasised in the growth literature (Hall and Jones 1999). Following Knack and Keefer (1995), an indicator of institutional quality is calculated from the International Country Risk Guide. The indicator is computed as the average of corruption, bureaucratic

[16] The leading measure of foreign aid flows, the net Official Development Assistance (ODA), is not used in the analysis since it includes debt relief of certain categories of loans and the focus of measurement is on the cost of the donor.

quality and rule of law.[17] The macroeconomic policy environment is captured by including inflation and the budget balance (Burnside and Dollar 2000). Whereas inflation is a measure of monetary policy, the budget balance represents the fiscal environment.[18]

4.2 Empirical model and estimation method

The empirical model, where countries are indexed by *i* and time by *t*, can be formulated as:

$$y_{it} = \alpha_0 + dr_{it}'\beta_{dr} + x_{it}'\beta_x + \alpha_t + \mu_i + \varepsilon_{it} \quad (4.1)$$

Here y_{it} is the dependent variable of interest, dr_{it} is a vector of the measures of debt relief, x_{it} is a vector of additional variables, α_t is a period specific effect, μ_i is a country fixed effect, and ε_{it} is a random noise error term.

Once time-averages are used in a growth regression, potential endogeneity problems arise (Dalgaard et al. 2004). When dependency between the regressors and past levels of income is expected within the period over which the variables are averaged, endogeneity occurs. Hence, the regressors that depend on real per capita income lagged somewhere between one and three years are expected to be endogenous. There is a problem of biased estimates when using OLS in the case of endogeneity. Also, an IV-estimator is inconsistent in this setting (Hansen and Tarp 2001). To address the problem, the equations are estimated using the system GMM estimator (Blundell and Bond 1998).[19] The estimator is consistent in the presence of both endogenous regressors and country specific effects. Moreover, the estimation method works for unbalanced panels and situations with few time periods and many countries.[20] An advantage of the system GMM estimator is that the set of instruments for the difference equation is enriched with instruments for the levels equation. The equation in first-difference and in levels is jointly estimated, with first-differences instrumented by lagged levels of the dependent and explanatory variables and levels instrumented by first-differences of the regressors.

In the model, the explanatory variables are defined as exogenous, predetermined or endogenous. The strictly exogenous variables are neither dependent on current nor past error terms. In the regression analysis, the period dummy is treated as exogenous.

[17] The variable is revised compared to the original indicator. Originally, the indicator also included the variables expropriation risk and repudiation of contracts of government.

[18] In addition, a number of variables were tested in the regressions to control for political and institutional factors: ethnic fractionalisation; number of assassinations; financial depth measured as M2 in percent of GDP; openness measured as exports and imports as a percentage of GDP; and electoral competitiveness. Also, a dummy variable for Sub-Saharan Africa and a dummy variable for transition economies were tested. The variables were not significant and their inclusion did not change the results. As a consequence, they were left out of the analysis.

[19] See Roodman (2006) for an outline of the method. The xtabond2 command in Stata is used to estimate the system GMM.

[20] An alternative estimator is the difference GMM estimator (Arellano and Bond 1991). However, in the context of estimation of empirical growth models, the estimator has been shown to perform poorly since the time dimension is not rich enough to provide for highly relevant instruments (Bond et. al. 2001). Since the panel dataset of this study is limited to four periods, the problem applies in this context and the system GMM estimator is preferred.

Predetermined variables are variables that may be influenced by random events in past growth rates but not by contemporaneous events, while endogenous variables are potentially correlated with past and present errors.[21] Debt relief can potentially be endogenous since the level of income determines the ability to service the debt and hence if debt relief is needed or not. However, it is not likely that the time horizon is between one and three years and the debt relief variables are therefore treated as predetermined. The variables that are defined as initial values are, moreover, treated as predetermined: GDP per capita, education, and the debt ratio. In addition, institutional quality is treated as predetermined since the variable is potentially influenced by random events in past growth rates, however, since it is slow-moving no correlation is assumed between the variable and current random events. Aid allocation decisions are expected to be influenced by random events in current growth rates, which empirical studies confirm (Dalgaard et al. 2004, Alesina and Dollar 2000). Hence, the aid variables are treated as endogenous. Moreover, foreign direct investments and domestic investments are treated as endogenous since both are expected to be correlated with contemporary growth shocks. Whether the policy variables are exogenous or not has been discussed in the growth literature. Previous studies point to persistent correlations between macroeconomic policy indicators and country-specific characteristics (Easterly and Levine 1997 and Temple 1998), indicating that inflation and the budget surplus should be treated as endogenous. The variables are treated in the same manner in the investment model, however, GDP growth is added as an endogenous variable. In addition to using lagged variables as instruments, population is included as an instrument since the aid literature suggests a small country bias of the allocation of aid.

[21] In the estimation, a predetermined variable is instrumented by at least one lag of the variable, while an endogenous variable is instrumented by at least two lags of the variable.

5 Empirical analysis

5.1 Descriptive statistics

Summary statistics of the variables included in the analysis is provided in table 4.2. On average, the growth rate of GDP is about one percent. Liberia, Lebanon and Equatorial Guinea show the highest growth rates with 19, 18 and 15 percent, respectively. The majority of the countries with the most negative growth rates are former Soviet Union countries, particularly in the beginning of the 1990s. The investment ratio averages around 23 percent over the period. The average of aid as a percentage of GDP is 6 percent during the period, while the mean of the market value of debt relief in percent of GDP is around one percent. Sao Tome and Principe received most aid over all four periods, while Guyana, Yemen, and Democratic Republic of Congo received most debt relief when measured as the market value. When debt relief is measured in terms of the present value as a percentage of GDP, Mozambique, Nicaragua, Yemen and Democratic Republic of Congo received most relief in each period, respectively.

Table 4.2 Summary statistics, 1989–2003

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
GDP growth	517	0.01	0.04	-0.19	0.19
Investment ratio[a]	517	0.23	0.09	0.03	0.79
Debt relief ratio (pvdr)[a]	514	0.04	0.15	0.00	2.74
Debt relief ratio (mvdr)[a]	508	0.01	0.02	0	0.18
Initial debt ratio[a]	530	0.06	0.09	0	0.73
Aid[a]	530	0.06	0.09	0	0.73
Initial GDP per capita	515	1644	1778	49	9651
Initial education	296	4.48	2.12	0.49	9.84
Foreign direct investment[a]	534	0.03	0.05	-0.20	0.63
Institutional quality	362	4.67	1.51	0.78	9.14
Log(1+Inflation)	469	0.21	0.42	-0.04	3.06
Budget balance[a]	376	-0.12	1.69	-32.84	0.10

[a] Expressed in percentage of GDP

Appendix F shows the pairwise correlation coefficients of the variables included in the analysis. The correlation between the present value of debt relief and the market value of debt relief is not particularly high, verifying that the measures capture different aspects of debt relief. Moreover, the correlation between the debt relief variables and the aid variable is not very high. This supports the approach to study the effect of debt relief separately. The debt relief variables are positively correlated with the debt stock variable, indicating that countries with a higher debt burden receive more debt relief. Both measures of debt relief are negatively, but weakly, correlated with GDP growth and the investment ratio. A first review of the data does not lend support to a positive growth effect of debt relief.

5.2 Regression analysis

The relationship between debt relief and the dependent variables is estimated for three different specifications. In the base model, the relationship is treated as linear. However, as noted above, there are theoretical reasons suggesting that a linear relation between debt relief and investment or growth might be inadequate. Since the debt overhang hypothesis states that the effect of debt relief via the incentive mechanism depends on the level of the debt burden an interaction term between debt relief and the debt ratio is included in the second specification. Moreover, following the aid literature, potential diminishing returns of debt relief is assessed by including debt relief squared. The Arellano-Bond test for autocorrelation of second order and the Hansen J test are presented in the regression tables.[22] Both tests support the validity of the model in all the regressions. Moreover, to avoid the results to be driven by the choice of the cut-offs of the time periods, all models are estimated with an alternative choice of division into time periods. This means that all regressions are estimated using two different sub-samples.[23]

Turning to the estimation results, Table 5.1 presents the effect of debt relief on the investment ratio. Results correspond to the two alternative divisions of the sample into four periods. The main message is that no clear relation emerges neither through the incentive mechanism, measured by the present value of debt relief (pvdr), nor the resource mechanism, measured as the market value of debt relief (mvdr). The base model is presented in columns [1] and [4]. Although a positive and significant coefficient turns out for the market value of debt relief in column [1], the relation is not robust to the choice of sub-period division. Adding an interaction term, as done in columns [2] and [5], a positive effect via the incentive mechanism emerges. The negative coefficient of the interaction term is interpreted as the marginal effect of more debt relief on the investment ratio is decreasing with a higher debt burden. This suggests that more debt relief has the least impact where it is most needed, i.e. in high debt countries. However, the significance of the coefficients is not robust to the alternative specifications. In columns [3] and [6], debt relief squared is included to assess potential diminishing returns of debt relief. The coefficients of debt relief are in most cases insignificant, indicating that this is not the case. Taken together, debt relief does not seem to significantly influence the volume of investment neither through the incentive nor the resource mechanism. Hence, the importance of the investment channel, emphasised both in the debt overhang literature and the crowding-out theory, is not supported by the data.

[22] The validity of the use of the system GMM estimator depends on the validity of the instruments and on the assumption that the error term is not serially correlated. The Arellano-Bond test for autocorrelation determines whether the differenced error-term has second-order, or higher, serial correlation. Since the test uses the differenced error term, by construction AR(1) is expected. The Hansen J statistic is a test of over-identifying restrictions, which tests the overall validity of the instruments.

[23] In sub-sample 1, the periods are 1989-1992, 1993-1996, 1997-2000, and 2001-2003. In sub-sample 2, the periods are 1989-1991, 1992-1995, 1996-1999, and 2000-2003.

Table 5.1 Investment regressions

Dependent variable	Investment ratio					
	[1]	[2]	[3]	[4]	[5]	[6]
Debt relief ratio (pvdr)	-0.011	0.198	0.194	0.061	0.220***	0.359
	[0.814]	[0.209]	[0.269]	[0.185]	[0.001]	[0.109]
Debt relief ratio (mvdr)	0.922**	0.53	0.406	0.173	-0.186	-0.603
	[0.025]	[0.161]	[0.629]	[0.540]	[0.422]	[0.417]
Debt relief ratio (pvdr)*Debt ratio		-0.042			-0.060***	
		[0.127]			[0.005]	
Debt relief ratio (pvdr)^2			-0.078			-0.220*
			[0.165]			[0.099]
Debt relief ratio (mvdr)^2			-3.127			1.992
			[0.530]			[0.434]
Initial debt ratio (gdp)	-0.007	0.005	0.011	-0.001	0.036*	-0.005
	[0.801]	[0.865]	[0.714]	[0.969]	[0.096]	[0.762]
Aid	0.031	-0.351	-0.38	-0.661	-0.977*	-0.639
	[0.949]	[0.508]	[0.494]	[0.200]	[0.071]	[0.219]
Aid^2	-1.137	-0.366	-0.266	1.539	2.257	1.202
	[0.482]	[0.821]	[0.878]	[0.334]	[0.179]	[0.469]
Log(Initial GDP per capita)	0.016	0.018*	0.022**	0.036***	0.033***	0.038***
	[0.172]	[0.096]	[0.026]	[0.000]	[0.002]	[0.000]
GDP growth	1.301**	1.251**	1.013*	0.887*	0.858*	0.765
	[0.017]	[0.022]	[0.064]	[0.079]	[0.095]	[0.127]
Initial education	-0.01	-0.014	-0.018	-0.026**	-0.024**	-0.028**
	[0.389]	[0.265]	[0.125]	[0.012]	[0.025]	[0.013]
Foreign direct investment	0.553	0.57	0.526	0.701**	0.558*	0.721**
	[0.230]	[0.197]	[0.237]	[0.045]	[0.084]	[0.048]
Institutional quality	0.024***	0.024***	0.025***	0.017**	0.020***	0.018**
	[0.002]	[0.002]	[0.001]	[0.010]	[0.005]	[0.010]
Log(1+Inflation)	0.017	0.004	-0.007	-0.042	-0.052**	-0.045*
	[0.632]	[0.892]	[0.783]	[0.116]	[0.046]	[0.085]
Budget balance	-0.412	-0.537	-0.497	-0.79	-0.834	-0.754
	[0.322]	[0.221]	[0.211]	[0.118]	[0.108]	[0.143]
Observations	201	201	201	199	199	199
Number of countries	60	60	60	60	60	60
Number of instruments	46	50	54	46	50	54
Hansen J-test [p-value]	0.606	0.649	0.623	0.727	0.863	0.779
Serial correlation [p-value]	0.769	0.889	0.972	0.349	0.425	0.256

Notes:

* significant at 10%; ** significant at 5%; *** significant at 1%

Robust one-step estimates of the standard errors are used.

Robust p-values are presented in brackets.

Column 1-3 refers to the sub-sample where the periods are 1989-1992, 1993-1996, 1997-2000, and 2001-2003.

Column 4-6 refers to the sub-sample where the periods are 1989-1991, 1992-1995, 1996-1999, and 2000-2003.

The collapse option for the instrument matrix is used to avoid the bias that arises as the number of instruments climbs toward the number of observations.

The investment ratio, debt relief ratios, aid, initial debt ratio, foreign direct investment, and budget balance are expressed in percentage of GDP.

Moving on to the direct growth effect, debt relief does not seem to have influenced growth rates in developing countries. Table 5.2 presents the growth equations, using the same specifications as for the investment equations. When potential diminishing returns of debt relief is taken into account, a negative growth effect is found through the resource mechanism. However, the effect is not robust to the alternative division into periods. The conclusion drawn is that no effect of debt relief on growth is found. Hence, neither a direct growth effect nor an effect through the investment channel is evident. One aspect, emphasised in the literature, involves that neither the incentive mechanism nor the resource mechanism is relevant in low-income countries. Since dysfunctional economic institutions dampen investment and debt relief is expected not to increase net resource transfers to the recipient countries, a growth effect is not expected in these countries (Arslanalp and Henry 2004, Bird and Milne 2003). To test this line of the argument, debt relief is allowed to have a different effect in low- and middle-income countries. This is tested by including an interaction term between debt relief and a dummy variable for low-income countries in equation (4.1). Table 5.3 shows the results for the debt relief coefficients.[24] Column [1] and [2] show no robust effect of debt relief neither in low- or middle-income countries via the investment channel. The same conclusion can be drawn for the growth effect in columns [3] and [4]. Taken together, no significant effect of debt relief is evident in low- or middle-income countries.[25]

Contrary to hypothesis 1, a debt overhang effect is not found in the data. One explanation could be that debt relief does not really reduce the debt burden of the recipient country. Previous studies show that debt relief is correlated with new borrowing, indicating that debt relief does not ease the debt burden (Easterly 2002). Moreover, statistics show that debt relief does not consist of a one shot flow; instead each country on average receives debt relief 5 times between 1989 and 2003. This indicates that debt relief does not, once and for all, reduce the debt burden of the recipient countries. Also, it indicates that debt relief increases, rather than reduces, uncertainty about the debt situation in the countries. Deficient economic institutions and the signalling effect of debt relief, in line with hypothesis 3, could also explain the result. Contrary to hypothesis 2, debt relief does not turn out to enhance investment or growth through the resource mechanism. This suggests that debt relief did not release important amounts of resources or that the released resources were not used for productive investments.

[24] The additional variables and test statistics correspond to the results in Table 5.1 and 5.2.

[25] The same conclusion can be drawn when the effect of debt relief is allowed to be different for HIPCs and non-HIPCs by including an interaction term between debt relief and a dummy variable for HIPCs in equation (4.1). Output tables can be provided from the author upon request.

Table 5.2 Growth regressions

Dependent variable	Growth					
	[1]	[2]	[3]	[4]	[5]	[6]
Debt relief ratio (pvdr)	-0.011	0.041	0.071	0.008	0.028	0.091
	[0.605]	[0.423]	[0.164]	[0.695]	[0.347]	[0.181]
Debt relief ratio (mvdr)	-0.057	-0.191	-0.688***	-0.108	-0.17	-0.364
	[0.653]	[0.198]	[0.008]	[0.385]	[0.202]	[0.211]
Debt relief ratio (pvdr)*Debt ratio		-0.011			-0.008	
		[0.258]			[0.516]	
Debt relief ratio (pvdr)^2			-0.024			-0.061
			[0.172]			[0.146]
Debt relief ratio (mvdr)^2			3.876***			1.182
			[0.006]			[0.262]
Initial debt ratio (gdp)	0.013	0.017	0	0.002	0.006	0
	[0.342]	[0.226]	[0.970]	[0.806]	[0.637]	[0.988]
Aid	-0.454**	-0.578***	-0.219	-0.125	-0.143	-0.219
	[0.014]	[0.005]	[0.270]	[0.502]	[0.495]	[0.265]
Aid^2	1.438**	1.772***	0.709	0.505	0.544	0.645
	[0.032]	[0.004]	[0.264]	[0.393]	[0.393]	[0.290]
Log(Initial GDP per capita)	-0.002	0	0	-0.007	-0.008*	-0.005
	[0.715]	[0.936]	[0.918]	[0.101]	[0.056]	[0.338]
Investment ratio	0.152**	0.146**	0.116**	0.171**	0.176**	0.154**
	[0.018]	[0.027]	[0.037]	[0.022]	[0.014]	[0.049]
Initial education	0	-0.002	0.001	0.006	0.006	0.004
	[0.965]	[0.685]	[0.818]	[0.162]	[0.139]	[0.363]
Foreign direct investment	0.1	0.138	-0.043	-0.045	-0.057	0.093
	[0.601]	[0.455]	[0.800]	[0.797]	[0.749]	[0.573]
Institutional quality	0.001	0.001	0.001	0.002	0.002	0.001
	[0.590]	[0.578]	[0.549]	[0.340]	[0.307]	[0.556]
Log(1+Inflation)	-0.006	-0.013	-0.012	-0.009	-0.009	-0.003
	[0.596]	[0.287]	[0.318]	[0.552]	[0.541]	[0.798]
Budget balance	0.251**	0.196*	0.199*	0.22	0.217	0.305**
	[0.045]	[0.072]	[0.063]	[0.137]	[0.121]	[0.030]
Observations	201	201	201	199	199	199
Number of countries	60	60	60	60	60	60
Number of instruments	46	50	54	46	50	54
Hansen J-test [p-value]	0.327	0.28	0.183	0.427	0.388	0.469
Serial correlation [p-value]	0.86	0.86	0.698	0.78	0.828	0.954

Notes:

* significant at 10%; ** significant at 5%; *** significant at 1%

Robust one-step estimates of the standard errors are used.

Robust p-values are presented in brackets.

Column 1-3 refers to the sub-sample where the periods are 1989-1992, 1993-1996, 1997-2000, and 2001-2003.

Column 4-6 refers to the sub-sample where the periods are 1989-1991, 1992-1995, 1996-1999, and 2000-2003.

The collapse option for the instrument matrix is used to avoid the bias that arises as the number of instruments climbs toward the number of observations.

The debt relief ratios, aid, initial debt ratio, foreign direct investment, and budget balance are expressed in percentage of GDP.

Table 5.3 Debt relief coefficients for low- and middle-income countries

Dependent variable	Investment		Growth	
	[1]	[2]	[3]	[4]
Effect of debt relief for middle-income countries (pvdr)	-0.074	0.14	0.066	0.032
	[0.589]	[0.186]	[0.180]	[0.431]
Effect of debt relief for middle-income countries (mvdr)	0.743*	0.241	0.081	-0.094
	[0.075]	[0.421]	[0.578]	[0.448]
Effect of debt relief for low-income countries (pvdr)	-0.026	0.059	0.004	0.004
	[0.565]	[0.243]	[0.847]	[0.831]
Effect of debt relief for low-income countries (mvdr)	0.82	0.245	-0.131	-0.131
	[0.179]	[0.695]	[0.597]	[0.679]

Notes:

The coefficient for middle-income countries refers to the term β_{dr} when equation (4.1) is estimated including an interaction term between debt relief and low-income countries.

The coefficient for low-income countries refers to the term β_{dr} plus the coefficient of the interaction term when equation (4.1) is estimated including an interaction term between debt relief and low-income countries.

* significant at 10%; ** significant at 5%; *** significant at 1%

Robust one-step estimates of the standard errors are used.

Robust p-values are presented in brackets.

Column 1 and 3 refers to the sub-sample where the periods are 1989-1992, 1993-1996, 1997-2000, and 2001-2003.

Column 2 and 4 refers to the sub-sample where the periods are 1989-1991, 1992-1995, 1996-1999, and 2000-2003.

The collapse option for the instrument matrix is used to avoid the bias that arises as the number of instruments climbs toward the number of observations.

Turning to the additional variables, the initial stock of debt is not found to influence neither the investment ratio nor the growth rate. Contrary to previous studies, support is not given for an effect of aid on the investment ratio (Hansen and Tarp 2001). Moreover, in the growth equations, the response of aid is negative, conditioned on a fixed investment ratio. However, the negative relation is not robust to the different specifications. The estimated influence on growth and investment of the control variables is essentially in accordance with other studies. An environment with higher institutional quality seems to be beneficial for investment. In the growth equations, the coefficient of the investment ratio is positive and significant, as well as the budget balance.

6 Concluding remarks

The Multilateral Debt Relief Initiative took off in 2006, promising additional amounts of debt relief to heavily indebted poor countries. However, the empirical analysis in this paper shows disappointing results regarding the growth effect of debt relief. Between 1989 and 2003, debt relief does not seem to have influenced investment or growth trough neither the resource mechanism nor the incentive mechanism. When the implication of debt relief is assumed to be different in low- and middle-income countries, the analysis nonetheless invalidates a growth and an investment effect of debt relief. The failure to find a positive growth effect of debt relief in low-income countries corresponds to previous studies (Depetris and Kraay 2005, Hepp 2005). The results implicate that, although a high debt is assumed to dampen growth, a reduction in the debt stock by debt relief does not necessarily enhance growth in the recipient country. This suggests that predictions of the form that halving the debt of highly indebted poor countries, from the levels in year 2000, would raise per capita growth by about one percentage point (Pattillo et al. 2002) should be considered with care.

The failure to find a positive effect of debt relief on growth should be viewed in light of the small value of debt relief compared to other forms of development aid or tax revenues (Depetris and Kraay 2005). Also, the question of additionality of debt relief in relation to other forms of development aid needs attention. Powell (2003) found no significant impact of debt relief on resource transfers, suggesting that debt relief is provided as a substitute of aid instead as a supplement. The rationale for replacing other forms of aid with debt relief rests on the assumption that debt relief turns out as a more effective form of assistance. Discouraging, the empirical analysis of this paper fails to support a significant growth effect of both debt relief and aid. Further research is needed to analyse the effects of different forms of development assistance and the interaction between them.

Both aid and debt relief are seen as important policy tools by the development community to spur growth and reduce poverty in developing countries. Especially debt relief has got increased attention in the last decade. However, Easterly (2001) describes debt relief as "the feel-good economic policy of the new millennium". Announcements of debt relief have been claimed to be an effective way for donor countries to appear generous at little real economic or political cost (Bird and Milne 2003). This study concludes that debt relief does not seem to be the panacea to spur growth and attain the international development targets. Although, there might be other reasons for debt relief, the main message is that a growth enhancing effect of debt relief could not be taken for granted.

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Appendix

A. Debt situation statistics

Composition of outstanding long-term external debt of developing countries

Percent

	1980	1990	1997	1998	1999	2000	2001	2002	2003
Divided by creditor									
Official creditors	**36.8**	**50.1**	**44.0**	**41.7**	**41.7**	**41.0**	**40.3**	**40.6**	**40.4**
Bilateral debt	69.1	63.1	61.3	59.8	58.8	57.3	55.0	54.0	53.8
of which concessional	69.2	59.5	51.9	55.0	57.4	56.0	57.5	61.3	65.7
Multilateral debt	30.9	36.9	38.7	40.2	41.2	42.7	45.0	46.0	46.2
of which concessional	38.9	33.7	40.2	39.2	38.9	38.8	38.7	41.2	43.8
Private creditors	**63.2**	**49.9**	**56.0**	**58.3**	**58.3**	**59.0**	**59.7**	**59.4**	**59.6**
Bonds	5.0	19.1	40.4	37.9	39.0	41.6	42.1	43.1	44.0
Commercial bank loans	73.9	56.3	49.0	54.4	53.6	52.1	52.0	51.6	51.5
Other private creditors	21.1	24.6	10.6	7.6	7.4	6.3	5.9	5.3	4.5
Divided by debtor									
Public sector debt	**81.6**	**94.2**	**78.4**	**73.2**	**72.0**	**71.1**	**70.8**	**71.3**	**70.5**
Private sector debt	**18.5**	**5.8**	**21.6**	**26.8**	**28.0**	**28.9**	**29.2**	**28.7**	**29.5**
of which publicly guaranteed	9.3	5.3	1.6	1.7	1.7	1.3	1.1	1.3	1.3
Memorandum item									
Long-term debt outstanding (US$ billions)	**407**	**1 099**	**1 663**	**1 894**	**1 940**	**1 907**	**1 863**	**1 920**	**2 045**

Source: Global Development Finance 2005

Composition of outstanding long-term external debt of HIPCs

Percent

	1980	1990	1997	1998	1999	2000	2001	2002	2003
Divided by creditor									
Official creditors	**62.2**	**84.0**	**88.3**	**89.1**	**89.3**	**88.7**	**88.8**	**89.8**	**90.3**
Bilateral debt	71.2	64.5	55.6	55.0	52.2	51.3	48.4	46.7	44.6
of which concessional	70.2	61.5	66.3	67.4	67.4	67.0	67.4	71.9	72.6
Multilateral debt	28.8	35.5	44.4	45.0	47.8	48.7	51.6	53.3	55.4
of which concessional	57.3	71.0	82.9	84.5	86.0	87.6	89.3	90.8	91.4
Private creditors	**37.8**	**16.0**	**11.7**	**10.9**	**10.7**	**11.3**	**11.2**	**10.2**	**9.7**
Bonds	0.7	0.2	17.8	17.8	18.9	18.0	19.3	19.5	16.9
Commercial bank loans	51.7	64.2	61.9	61.2	64.3	67.9	67.4	68.0	71.1
Other private creditors	47.5	35.5	20.4	21.1	16.9	14.1	13.3	12.5	12.0
Divided by debtor									
Public sector debt	**91.9**	**96.5**	**95.7**	**95.9**	**95.2**	**95.0**	**95.5**	**96.1**	**96.2**
Private sector debt	**8.1**	**3.5**	**4.3**	**4.1**	**4.8**	**5.0**	**4.5**	**3.9**	**3.8**
Memorandum item									
Long-term debt outstanding (US$ millions)	**43 330**	**119 784**	**133 941**	**139 794**	**131 326**	**127 524**	**120 945**	**130 181**	**141 989**

Source: Global Development Finance 2005

Indicators of the burden of external debt of developing countries

Percent

	1980	1990	1997	1998	1999	2000	2001	2002	2003
Short-term debt/Total debt	16	13	14	13	13	13	13	13	14
Total debt/Exports	154	382	301	303	274	246	241	252	250
Debt service/Exports	16	19	14	15	16	15	15	15	15
Reserves/Total debt	56	29	38	36	37	39	41	40	43
Total debt/GNI	45	101	80	87	88	85	82	85	86
Concessional debt/Total debt	37	44	43	43	43	43	43	44	45

Source: Global Development Finance 2005

Indicators of the burden of external debt of Highly Indebted Poor Countries (HIPC)

Percent

	1980	1990	1997	1998	1999	2000	2001	2002	2003
Short-term debt/Total debt	11	9	9	9	10	10	9	9	8
Total debt/Exports	220	812	867	845	729	615	579	619	612
Debt service/Exports	16	24	17	18	17	17	16	12	13
Reserves/Total debt	14	7	10	9	10	11	12	13	14
Total debt/GNI	63	170	167	178	174	167	157	157	157
Concessional debt/Total debt	47	58	66	67	68	68	69	71	73

Source: Global Development Finance 2005

Composition of change in total external debt stock in developing countries

Percent

	1990	1996	1997	1998	1999	2000	2001	2002	2003
Net flows on debt	56.7	169.1	165.3	25.7	64.9	9.7	15.7	11.2	27.5
Cross-currency valuation	47.0	-92.6	-120.3	13.6	-77.6	82.9	186.1	93.6	40.1
Debt forgiveness or reduction	-34.7	-16.8	-18.7	-0.7	-31.1	39.8	31.1	-8.7	-1.3
Net change in interest arrears	15.7	-7.5	-13.8	2.8	17.6	11.3	-11.7	1.7	5.1
Interest rescheduled	5.9	9.9	14.0	0.7	29.4	-21.8	-5.0	5.2	0.4
Residual	9.4	37.9	73.6	57.9	96.8	-21.9	-116.2	-2.9	28.2
Memorandum item									
Change in total debt stock ($billions)	99.1	73.1	64.7	213.3	23.7	-64.1	-22.0	76.0	217.7

Source: Global Development Finance 2005

Composition of change in external debt in Highly Indebted Poor Countries (HIPC)

Percent

	1990	1996	1997	1998	1999	2000	2001	2002	2003
Net flows on debt	40.3	-73.7	-121.2	17.0	-22.9	-21.1	-22.7	43.3	7.8
Cross-currency valuation	36.7	145.9	227.5	-17.2	58.5	116.5	47.2	96.7	82.3
Debt forgiveness or reduction	-17.2	71.5	98.9	-11.5	60.3	20.7	61.3	-55.0	-21.7
Net change in interest arrears	9.4	15.7	36.3	16.7	7.8	-7.2	1.9	-25.3	13.7
Interest rescheduled	11.1	-14.2	-42.4	7.7	-6.4	-7.0	-4.7	19.4	1.6
Residual	19.7	-45.2	-99.1	87.2	2.7	-1.8	17.0	21.0	16.4
Memorandum item									
Change in total debt stock ($millions)	15 330	-6 122	-5 058	6 358	-9 041	-4 959	-8 013	8 249	11 964

Source: Global Development Finance 2005

B. Debt relief statistics

Frequencies of receiving debt relief per country, 1989–2003

	Freq.	Percent	Cum.
0	23	16.9	16.9
1	17	12.5	29.4
2	17	12.5	41.9
3	10	7.4	49.3
4	10	7.4	56.6
5	7	5.2	61.8
6	5	3.7	65.4
7	3	2.2	67.7
8	4	2.9	70.6
9	3	2.2	72.8
10	3	2.2	75.0
11	11	8.1	83.1
12	4	2.9	86.0
13	7	5.2	91.2
14	6	4.4	95.6
15	6	4.4	100.0
Total	136	100	

Source: Own calculations based on the GDF 2005

C. Countries included in the empirical analysis

Algeria	Guyana*	Philippines
Argentina	Haiti**	Poland
Bangladesh**	Honduras*	Senegal*(**)
Bolivia*	Hungary	Sierra Leone*(**)
Botswana	India**	South Africa
Brazil	Indonesia	Sri Lanka
Cameroon*(**)	Iran, Islamic Rep.	Sudan*(**)
Chile	Jamaica	Syrian Arab Republic
China	Jordan	Tanzania*(**)
Colombia	Kenya**	Thailand
Congo, Dem. Rep.*(**)	Malawi*(**)	Togo*(**)
Congo, Rep.*(**)	Malaysia	Trinidad and Tobago
Costa Rica	Mali*(**)	Tunisia
Dominican Republic	Mexico	Turkey
Egypt, Arab Rep.	Nicaragua*(**)	Uganda*(**)
El Salvador	Pakistan**	Uruguay
Gambia, The*(**)	Panama	Venezuela, RB
Ghana*(**)	Papua New Guinea**	Yemen, Rep.**
Guatemala	Paraguay	Zambia*(**)
Guinea-Bissau*(**)	Peru	Zimbabwe**

* HIPC

** Low-income country

D. Data and variables

Variable	*Explanation*	*Source*
GDP growth	Natural logarithm of GPD per capita growth in constant 2000 U.S. dollars	WDI 2005
Investment	Gross capital formation (% of GDP)	WDI 2005
Debt relief ratio (pvdr)	Present value of debt relief (% of GDP) See description in Appendix E	GDF 2005, Dikhanov 2006
Debt relief ratio (mvdr)	Market value of debt relief (% of GDP) See description in Appendix E	GDF 2005, Cohen 2000
Present value of debt	Public and publicly guaranteed long-term external debt (% of GDP)	Dikhanov 2006
Aid	Effective Development Assistance (% of GDP) Data is available for 1975-1995. Extrapolated to 2003 by a regression of ODA on EDA.	Chang et. al 1998
Initial GDP	GDP per capita in constant 2000 U.S. dollars	WDI 2005
Initial education	Average years of schooling of the population aged 15 and above	Barro and Lee 2001
Foreign direct investment	Foreign direct investment, net inflows (% of GDP)	WDI 2005
Instituional quality	Average of corruption, bureaucratic quality, and rule of law	ICRG
Inflation	The natural logarithm of (1 + the consumer price inflation)	WDI 2005
Budget balance	The local currency budget surplus (% of GDP)	IFS 2006, WDI 2005
HIPC	Countries classified as HIPC 2005	GDF 2005
Low-income countries	Countries classified as Low-income countries 2005	GDF 2005

E. Measures of debt relief

Present value of debt relief (pvdr)

To calculate the present value of debt relief, the method of Depetris and Kraay (2005) is applied. It is assumed that the concessionality rate of the debt forgiven equals the concessionality rate of the outstanding debt stock of the country. To calculate the concessionality rate the present value calculations conducted by Dikhanov (2006) and the nominal values of external debt in the GDF database are used.[26] The present value of the debt forgiven is calculated by multiplying the estimated concessionality rate with the nominal value of debt relief available in the GDF database. [27]

As with debt forgiveness, the concessionality rate of the amount rescheduled is assumed to equal the concessionality rate of the outstanding debt stock of the country.[28] The rescheduling, however, will only generate a decrease in the present value of debt if the terms of the rescheduled debt are more concessional than the original debt. For countries with a Paris Club agreement, it is assumed that half of the amount rescheduled was done on non-concessional terms, i.e. the change in the present value is zero. The other half is assumed to be made on the terms of the latest Paris Club deal, e.g. if a country's debt was treated under the London terms the concessionality rate of the debt restructured is assumed to be 50 percent. The table provides a summary of the concessionality rates of debts reschedulings within the Paris Club.

Summary of the concessionality rate of debt reschedulings within the Paris Club

Paris Club deal	Concessionality rate
Classical terms	0
1956 -	
Houston terms	0
1990 -	
Toronto terms	0.33
1988-1991	
London terms	0.5
1991-1994	
Naples terms	0.67
1994 -	
Lyon terms	0.8
1996 -	
Cologne terms	0.9
1999 -	

Source: Standard terms of treatment, Paris Club (2006)

For countries without a Paris Club agreement the total rescheduling is assumed to be non-concessional. The present value change of the debt forgiven and the rescheduled debt is added:

[26] Since Dikhanov (2006) calculates the present value for long-term external public debt, the variable *Public and publicly guaranteed long-term debt* from the GDF database is used.
[27] The nominal value of debt relief consists of the variables *Debt forgiveness and reduction* and *Interest forgiven.*
[28] Depetris and Kraay (2005) use unpublished GDF data on *Rescheduling commitments*; however, since it is not publicly available the variable *Total amount of debt rescheduled* from the published GDF is used.

$$pvdr = drf * conc + dre * conc * (0.5 * pct)$$

where *pvdr* is the present value of debt relief, *drf* is the debt reduction, *conc* is the concessionality rate, *dre* is the debt rescheduled and the *pct* is the Paris Club terms.

The present value of debt relief is discounted to the beginning of each four-year period used in the empirical analysis. The discount rate used is the average value of the OECD's Commercial Interest Reference Rate for long-maturity US-dollar denominated liabilities (OECD 2006).[29] In the analysis, the measure is expressed as a percentage of GDP prior to the beginning of each period.

Market value of debt relief (mvdr)

Following Cohen (2000), a market value of debt relief is calculated, which takes account of the risk of non-payment. By using information on the secondary market prices, the debt stock, arrears and rescheduling commitments of middle-income debtors during the 1980s, the market value of the debt stock is estimated. The estimated value is then used to calculate the market value of debt relief. The method relies on two critical assumptions. First, the causal link between the explanatory variables and the market price is assumed to be the same for middle-income debtors in the 1980s and the countries in this study. Second, forgiven or rescheduled debt is assumed to have the same relation between the market value and nominal value as the debt stock on average.

By using data on the debt ratio, arrears as a share of the debt and reschedulings performed as a percentage of the debt stock, the market value of the countries debt can be estimated as

$$log(p) = \underset{}{5.06} - \underset{(0.152)}{0.653}\, Log(d/x) - \underset{(0.603)}{2.231}\, a/d - \underset{(0.373)}{1.016}\, r/d$$

where p is the price of the debt on the secondary market with respect to its nominal value, d is the debt stock, x is exports, a is arrears and r is reschedulings. Standard errors are provided in parenthesis. By using the market value of the debt stock, the market value of debt relief is calculated as

$$mvdr = \frac{\exp(log(p))}{100} * dr$$

where *mvdr* is the market value of debt relief, p is the price of the debt on the secondary market with respect to its nominal value and *dr* is debt relief in nominal terms. Debt relief in nominal terms is calculated as the sum of *Principal forgiven*, *Interest forgiven*, *Principal rescheduled* and *Interest rescheduled* from the GDF database. In the analysis, the measure is expressed as a percentage of GDP and is calculated as the average for each four-year period.

[29] The average value over the sample period, 1989–2003, is about 7 percent, which is used throughout.

F. Correlation coefficients

	GDP growth	Investment ratio	Debt relief ratio (pvdr)	Debt relief ratio (mvdr)	Initial debt ratio	Aid	Initial GDP per capita
GDP growth	1						
Investment ratio	0.24	1					
Debt relief ratio (pvdr)	0.00	-0.03	1				
Debt relief ratio (mvdr)	-0.09	-0.07	0.50	1			
Initial debt ratio	0.03	0.03	0.52	0.39	1		
Aid	-0.11	0.03	0.24	0.21	0.50	1	
Initial GDP per capita	0.03	0.08	-0.14	-0.17	-0.24	-0.40	1
Initial education	0.17	0.17	-0.13	-0.09	-0.23	-0.54	0.71
Foreign direct investment	0.34	0.52	0.02	-0.05	0.11	-0.06	0.10
Institutional quality	0.16	0.31	-0.09	-0.21	-0.29	-0.36	0.42
Log(1+Inflation)	-0.28	-0.12	0.06	0.09	0.17	0.02	-0.05
Budget balance	-0.02	0.01	0.01	0.02	-0.01	-0.04	0.04
HIPCs	-0.16	-0.27	0.29	0.27	0.43	0.53	-0.45
Low-income countries	-0.15	-0.16	0.16	0.14	0.30	0.45	-0.61

	Initial education	Foreign direct investment	Institutional quality	Log (1+Inflation)	Budget balance	HIPCs	Low-income countries
Initial education	1						
Foreign direct investment	0.17	1					
Institutional quality	0.51	0.13	1				
Log(1+Inflation)	-0.07	-0.12	-0.12	1			
Budget balance	0.07	0.00	0.11	0.02	1		
HIPCs	-0.59	-0.08	-0.39	-0.01	0.03	1	
Low-income countries	-0.76	-0.03	-0.40	0.00	-0.07	0.62	1