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Development and foreign debt:

The stylized facts 1970-2006

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Abstract: The paper uses the data from the incomplete debt cycle for the LDC world from 1970 onwards to tell the typical story of debt. Two debt stories are contrasted: A good debt story: Here countries borrow and invest wisely, so that they grow more. A bad debt story: Here countries borrow when they are in crisis, and the debt grows and generates low growth in the next couple of decades. The analysis concentrates on two relations: (R1) the relation between borrowing and growth, and (R2) the relation between initial debt and growth. Both relations are negative, so essentially the stylized story of debt is a story of bad debt. The paper looks in vain for non-linearities in the two relations, suggesting that the good debt story applies in some part of the range. The result thus confirms that international transfers to governments are an inefficient way to promote development.

Jel: F34, H63, O16
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1 Introduction

During the process of development, many LDCs (less developed countries) accumulate and decumulate debt. In the last 40 years, the world has experienced a period of large scale debt accumulation, followed by a period of debt reduction, which in 10-15 years may bring debt burdens back to the level of 1970. Thus, in a dozen years we may be able to look back upon a completed debt cycle for the LDC world lasting half a century. The paper uses the data for this incomplete cycle to tell the typical story of debt.

A country may change the shape of development over time by financing various expenditures by borrowing abroad. The debt story of each country is different; but they can be classified as *good* or *bad* debt stories based on a welfare assessment of the completed debt cycle. A typical good debt story tells of a country that has borrowed and invested wisely.[1] A typical bad debt story tells of a country in crisis that borrows as a "stop-gap" device, allowing the country *not* to deal with the causes of the crises, so that debt keeps rising.

Section 2 gives an overview of the good debt and the bad debt stories. As we go along looking at the data in the following sections, more and more evidence will appear suggesting that the bad debt story dominates the data. Hence, it is a story of welfare losses. It may be explained by time inconsistency: Debt has a long time horizon, and it is decided by politicians with a short one.

The paper builds on a bulky appendix with a set of 272 regressions (Paldam 2008). Only samples of the material and surveys of regressions are presented, but the reader can download the full documentation.[2] The paper does not present estimates of models, but concentrates on descriptive statistics such as graphs and correlations.

The content of the empirical parts of the paper is organized as follows: Section 3 looks at the orders of magnitudes. Sections 4 and 5 consider the relation (**R1)** between development and borrowing. Section 6 deals with relation (**R2**) between initial debt and development. Section 7 concludes by discussing why it is so difficult to borrow and grow.

The two relations (R1) and (R2) do not cover the full story, but here data are available, and the two relations are important parts of the picture. As is demonstrated in Section 2, the two debt stories give very different predictions about the signs of these relations.

1. The good debt story is the very idea on which the World Bank and the regional development banks are built.
2. The appendix is available from the URL: http://www.martin.paldam.dk.

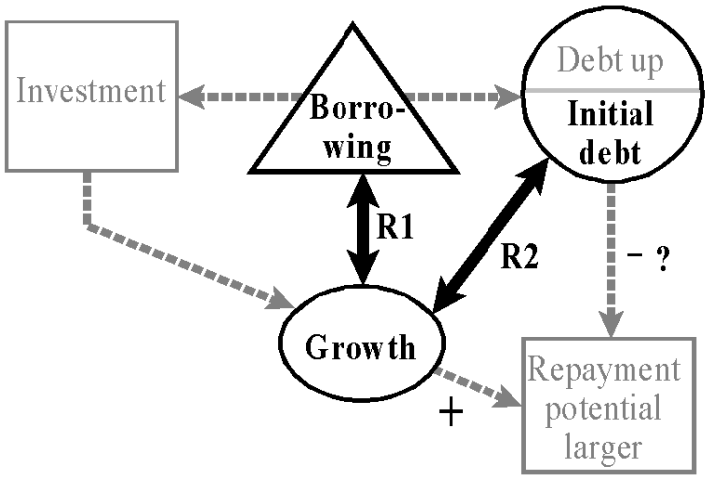
2 The alternative debt stories, definitions and variables

The research strategy of the paper is to examine a few relations only, but to do it carefully. In order to interpret the findings, it is crucial to have a causal structure in mind. Section 2.1 gives the causal structure in the good debt story, while 2.2 considers the bad debt story. Finally, the variables used and the equations estimated are surveyed.

2.1 Causal structure in the good debt story

In the good debt story, countries incur debt to invest wisely and succeed in this endeavor.[3] The structure of causality is as drawn on Figure 1. The figure is drawn in 2 colors: The black parts are the ones analyzed, and the gray parts are not included in the empirical analysis.

Figure 1. The causal structure of the good debt story



As funds borrowed are invested wisely, the growth rate goes up and hence the GDP. Thus, repayment becomes easier. Borrowing also causes debt to rise, but the effect on the debt burden is dubious, as GDP is in the denominator. Some big investments may have a long implementation period, so that debt does rise in the short run. Thus, the "denominator effect" may take some time to appear.

3. The distinction between the purpose of borrowing and the actual success of the policy is illustrated by two countries that both went through a serious debt crisis. The Polish government of Edward Gierek, 1970-80, borrowed to pursue a policy of modernization that failed. At the same time, South Korea borrowed to build a heavy and chemical industry: the HCI-drive, 1973-79. The mixed economic success of that policy has been discussed in a large literature; see World Bank 1973 for references. The case is difficult to discuss as the main reason for the HCI-drive must have been that the US gave up defending South Vietnam in 1973. The HCI-drive certainly gave South Korea a defense industry.

A particularly strong version of the good debt story occurs if the borrowing country is held back in a low level equilibrium trap and the funds borrowed causes the country to break out, see Delas and Galor (1992) for a theoretical model highlighting this possibility. The trap-breaking version may involve a "big push" and hence large scale borrowing.[4]

Both versions of the story should be easy to see in the two relations estimated:

R1: Borrowing causes higher growth, so the borrowing/growth-relation is positive.

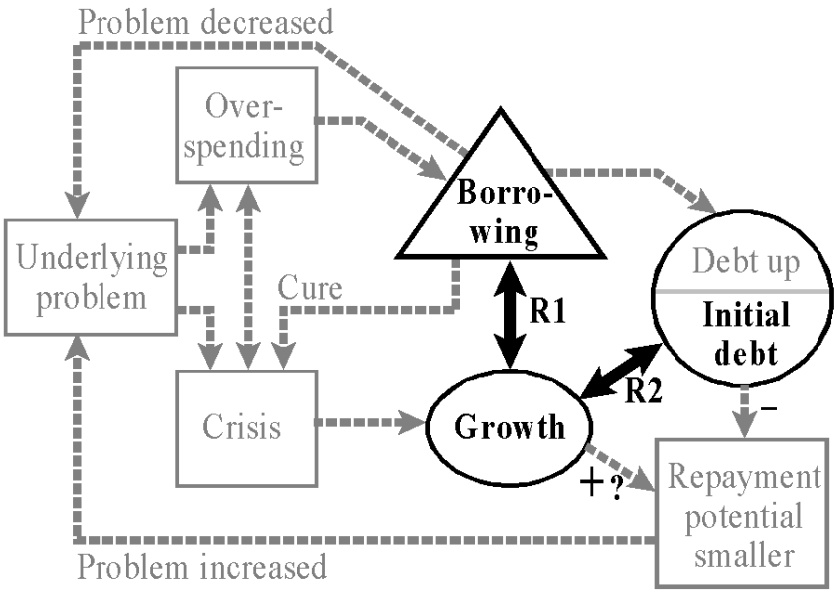
R2: Initial debt is proportional to real capital, so the debt/growth-relation is positive.

2.2 Causal structure in the bad debt story

The bad debt story is more complex as shown on Figure 2. Here countries borrow because they have a short-run crisis. The crisis generates overspending, balance-of-payments deficit and economic crisis. Borrowing allows overspending to continue for a period.

A high frequency of crisis – and thus heavy borrowing – is typically due to an *underlying problem.* It may be (a mixture of) ethnic tensions, weak/unrealistic governments, civil unrest/war, adverse natural conditions, etc. In many cases the underlying problem is of a long-run nature.

Figure 2. The causal structure of the bad debt story



4. It is controversial if this theoretical possibility has a real counterpart. In the analysis below, it should appear as an upward tilt of the curves on Figures 9 and 10 at high levels of borrowing/debt. There may be such tilts, but unfortunately they are based on very few observations making them highly unreliable.

Overspending may prevent the crisis for some time, but overspending and the crisis are often the joint outcomes of the problem. This leads to low growth and borrowing. Low growth may in itself also lead to borrowing. Borrowing accumulates to debt, and this becomes a problem in itself.

Thus, borrowing generates funds that may be used to alleviate the crisis or to reduce the underlying problem,[5] but borrowing also increases debt that adds to the underlying problem. In the short run, borrowing inevitably causes an increase in the debt burden. If the increase soon ceases, and the debt burden starts falling, we conclude that the net effect is a reduction in the underlying problem. However, if the debt burden continues to rise for a long time (as it normally does), we conclude that the net effect of borrowing is to increase the underlying problem.

It is clear how the story should be reflected on the two relations R1 and R2:

R1: Borrowing is associated with crisis, so the borrowing/growth-relation is negative.

R2: Initial debt is proportional to the size of the underlying problem, so the debt/growth-relation is negative.

As mentioned, the bad debt story dominates in the data. This has an important consequence: The growth rate at zero borrowing, and hence zero debt, becomes the growth rate for the well-ruled LDC with few underlying problems. The *debt-free growth rate* is thus an interesting quantity to look for. It will appear that it is approximately 2%.

2.3 Definitions and variables

The paper defines borrowing as a change in the debt burden. This is fairly consistent with the normal use of the term, but the denominator effect causes borrowing to take place when GDP falls. This may or may not be in accordance with intuition.

Table 1 presents the definitions and the relations between the series published in the WDI (references). The debt data used are D_T, D_L, D_G, D_S for all LDCs. The three debt burdens D_T, D_L, and D_G overlap a great deal and produce a very similar picture throughout. They are termed the *long* debt concepts.[6] The *short* debt, D_S, produces a much more flimsy picture. Ratios are always relative to GNI/GDP.

5. A typical case is a country in the Sahel zone in Africa, with a rainy season that is inadequate in x% causing droughts. It may borrow to import food in the x-years, or to build water storage facilities reducing the importance of x. If the country waits till it has a drought, it is forced to use the loan revenue for food import.
6. D_T is dominated by the long run, but it does contain the short-run debt as well.

Table 1. The debt series considered

Debt concepts			Defined as	DSR
D_T	=		Total debt, divided into:	S_T
	D_S		Short-run debt	S_S
	D_{IMF}		Use of IMF credit (not used)	
	D_L	=	Long-run debt, divided into:	S_L
		D_P	private non guaranteed debt (not used)	
		D_G	public or publicly guaranteed debt	S_G

Debt burdens or ratios are relative to GNI/GDP

DSR's (debt service ratios) are relative to GNI/GDP as well

Source: WDI (World Development Indicators)

The data for the real growth rate (per capita) are calculated from the Maddison data set (references), which has been updated from 2003 to 2005 using the WDI. The abbreviation *gdp* (lower-case) is used for GDP per capita. The analysis disregards the size of the country. The data have been divided into: (1) Seven 5-year periods: 1970-75, 75-80, 80-85, 85-90, 90-95, 95-00 and 00-05, and (2) three 10-year periods: 1970-80, 80-90 and 90-00. The term "periods" is reserved for these periods in the paper.

The analysis uses a simple system of variables and equations, which leads to many (descriptive) regressions. For easy reference, the system of regressions is listed in Table 2. All of these regressions, additional figures etc. are presented in the *Appendix.*

Table 2. The regressions done for the period of 5 and 10 years

Variables, where i and t are indices for countries and time, a, b and c are constant, and ε residuals			
g_{it}	Real growth per capita, average for period	ΔD_{it}	$= D_{it+1} - D_{it}$. Borrowing in period
D	$= D_T, D_G, D_L, D_S$, debt, defined in Table 1	$D_{\text{it-1}}$	Initial debt, for year where period starts
Model, brackets give choices, a_t is fixed effects for periods			Choices:
(1)	$g_{it} = a_{1(t)} + b_1\Delta D_{it} + (d_1 z_{it}) + \varepsilon_{it1}$		$z_{it} = \Delta D^2_{it}$, g_{it-1} or a_{1t}
(2)	$g_{it} = a_{2(t)} + c_1 D_{it-1} + (d_1 z_{it}) + \varepsilon_{it2}$		$z_{it} = D^2_{it-1}$, $g_{\text{it-1}}$ or a_{2t}
(3)	$g_{it} = a_{3(t)} + b_2\Delta D_{it} + c_2 D_{it-1} + (d_1 z_{it}) + \varepsilon_{it3}$		$z_{it} = \Delta D^2_{it}$, D^2_{it-1}, $g_{\text{it-1}}$ or a_{3t}

The regressions are run for *all observations* and for the *non-extreme observations* where: $-0.5 < \Delta D < 1.5$ or $D_{-1} < 1.5$, as appropriate. The various data sets contain 1-8% extreme values.

AR^2 is the R^2 adjusted for degrees of freedom. MAR^2(debt) is the change in the AR^2 due to the inclusion of debt variables, calculated by running the regression with and without these variables.

3 Some magnitudes

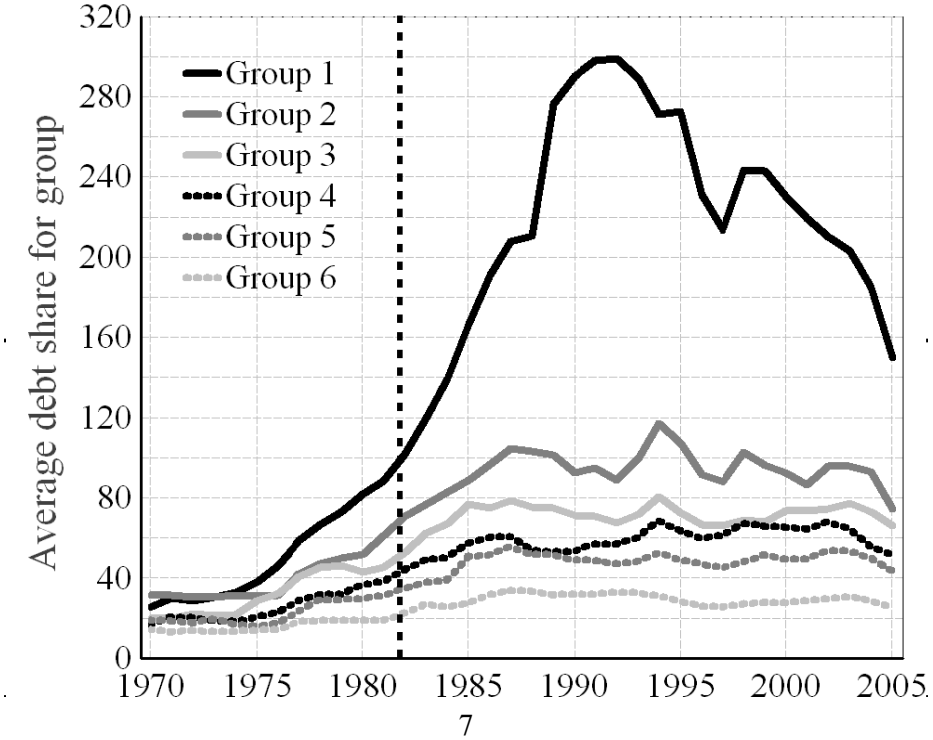
The basic debt data are presented graphically in two ways: First, Section 3.1 considers the debt burdens for total debt, D_T, and then Section 3.2 looks at the distribution of DSRs, debt service ratios, for the public debt, S_{LP}. Finally, Section 3.3 briefly turns to the 15 most extreme cases.

Many attempts have been made to calculate rules of thumb to indicate when debt becomes "dangerous" in some sense. The two most common such rules are that it is dangerous to have a total debt burden of 60% and a public debt service ratio of 5%, where both are in percent of GDP/GNI. Many countries exceed these limits.

Also, 1982 is indicated on the figures. It is the year of the *Debt Crisis*, where a handful of the largest Latin American countries defaulted on their debt, and consequently the US banks by the rules had to reduce their equity capital by their loans to these countries, which made a number of prominent banks technically bankrupt. They were, of course, allowed to continue business, but it caused a major upheaval on the financial market.

The two data presentations supplement each other. Debt burdens tell what has to be paid back eventually, but DSRs tell about the problem right now. A debt restructuring is made to reduce the DSR, but it may increase the debt burdens.

Figure 3. The development in the debt share for 89 countries sorted by debt peak (D_T)



3.1 Looking at Figure 3: Debt burdens for 89 LDCs 1970 to 2005

Complete debt burden series from 1970 to 2005 exist for 69 LDCs, and for another 20 countries so much data are available that the debt story of the country is known. Most missing data are for the first years where debt was low, so the picture shown is representative.

These data are not normally distributed as they have a long upward tail, almost like inflation rates. Consequently, the countries are sorted by the maximum size of the debt burden (debt peak), and then divided into 6 groups of 15 countries, with 14 in the fourth group where the variance is smallest.[7] The graph shows the averages for the six groups.

It is important to note that the debt crisis of 1982 does not stand out as a year when debt peaked in any of the six curves. After the debt crisis broke out, things quickly got worse. Growth rates fell and real interest rates increased. Also, it became more difficult for countries to finance debt servicing with new loans. The debt burdens thus became more oppressive. Nevertheless debt burdens actually continued growing at a faster rate for the next 5 years as a reaction to the debt crisis. When the danger limit of 60% is considered, it is remarkable that the debt burden at some stage exceeded that limit in 81% of the countries. But in 2005 only 41% were above the limit.

The curve for group 1 – the most indebted countries – reaches an average debt of 3 times GDP around 1991-92. This is clearly untenable, and they have received so much debt relief that the debt burden of these countries is now "only" about 150% on average.

Also, it is important that debt relief – though very much discussed – did not substantially reduce debt burdens before 1992. Then it started in the high debt group. But all groups have seen a fall in the last 5 years, mainly due to debt relief. In addition to debt relief, there has been a lot of debt restructuring aiming at reducing debt service payments. This may not appear in the debt burden of Figure 3, but it appears in the debt service ratios.

3.2 Looking at Figure 4: The distribution of the DRS, debt service ratio

Figure 4 shows the distribution of debt service ratios, S_T, for debt, D_T. For easy comparison it is for the same countries and years as on Figure 3.[8]

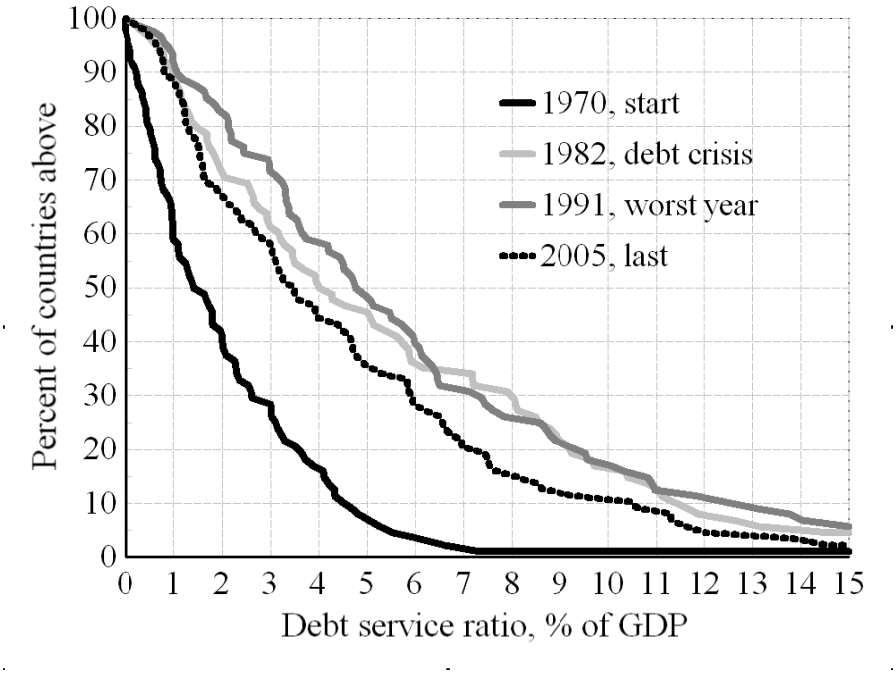
The first curve is for 1970, where data start. Here 58% of the countries had debt burdens giving a DSR, debt service ratio, above 1% of GBP; 26% had a DSR above 3%; and 7% had a DSR above the danger limit of 5%.

7. The countries are listed in Table 1.1 of the Appendix.
8. One country is missing, and for a few countries one missing observation has been assessed. The figure has also been calculated for all available observations, where the pattern is the same, but a little weaker. As many post-communist countries enter for the last observation, the number of countries doubles.

The second curve is for 1982, when the debt crisis broke out. Here 90% of the LDCs covered had a DRS above 1%, and no less than 62% had a DSR above 3%. The DSR of 5% was now exceeded by 46% of the countries.

Debt burdens peaked in 1990-91. Here a full 94% of the LDCs covered had a DRS above 1%, and 72% exceeded 3%. Here no less that 16% even reached a DSR of 10% or more. A level that is clearly impossible to live with.

Figure 4. The distribution of debt service ratios: 1970, 1982, 1991 and 2005 (S_T)



Since the early 1990s, a set of debt relief programs have been implemented. Also, some countries have managed to pay off their debt, but many countries have also acquired new debt. The last curve shows the situation in 2005 after these processes had gone on for 15 years.

The story from Figure 4 corresponds roughly to the one on Figure 3, but it is clear that the DRS's fall more than the debt burdens after 1991 in most of the country groups. This corresponds to the fall in international interest rates that has been passed on to the indebted countries in the form of debt restructuring.

This is illustrated by comparing 1982 and 2005 on the two Figures. On Figure 3 debt burdens of all 6 groups are higher in 2005 than in 1982, but on Figure 4 the DRS's are lower in 2005 than in 1982 throughout the range. Clearly, the LDCs have benefited considerably from the fall in interest rates.

Table 3. The 15 countries of Group 1 with the highest debt peak (D_T)

Nr	Country	Max D_T	Year	2005	Growth	Nr	Country	Max D_T	Year	2005	Growth
1	Nicaragua	1209	89	107	-1.86	9	Sudan	280	95	72	0.60
2	Guyana	825	91	162	0.43	10	Jordan	253	91	59	1.95
3	São Tomé	766	99	496	-0.28	11	Sierra Leone	246	92	145	-0.75
4	Guinea-Bissau	502	98	240	-1.17	12	Cote d'Ivoire	231	94	69	-1.38
5	Congo, Br.	487	95	151	-0.45	13	Mauritania	230	85	119	0.14
6	Zambia	415	86	83	-0.91	14	Burundi	230	03	169	0.03
7	Congo, Ki.	298	00	156	-3.45	15	Jamaica	225	85	73	0.01
8	Somalia	284	90	na	-0.93	Average		432	93	150	-0.53

Notes: Data from 1970-05. The two Congos are identified by the first two letters in the name of their capital city. For São Tomé the D_{LG}-series is used. Debt burden data for Somalia cease in 1990, and then other data gradually stop; the last growth rate is from 2001. For Guyana the gdp data start in 1975.

3.3 The 15 countries of Group 1, with the largest debt peaks

Table 3 gives the 15 largest debt burdens found in the data. Most of the debt peaks are in the 1990s, and all of these pathological cases have led to large scale debt relief. But then, surely, debt amounting to (even) 225% of GDP is outside the possibilities of repayment, and here the behavior of lenders needs to be explained.

10 of the 15 countries have experienced war and civil war in the period, though the debt is not necessarily associated in time with these events. Also, the five worst debt burdens are associated with left-wing regimes that had ambitious plans for social reforms which they tried to implement even if they were unable to finance them with taxes. Several of these countries even resorted to the printing press when they could not borrow anymore.

The average growth of the 15 countries is negative.[9] No less than nine of these countries had negative growth in the period – it is about half of the countries in the world with such a misfortune. Due to the denominator effect, a falling GDP increases the debt problem.

Thus, it can be safely concluded that high debt is associated with adverse economic development. It is hard to imagine that things would have gone worse in these countries if they had been unable to borrow as much as they did. These observations point to the relevance of the *bad debt story* drawn on Figure 2.

Fortunately, the international society reacts to such calamities by reducing the debt of these countries, by an average amount of 3 times GDP. It is hard to imagine any other way out of the mess. And it is also reasonable that reckless lenders take losses.

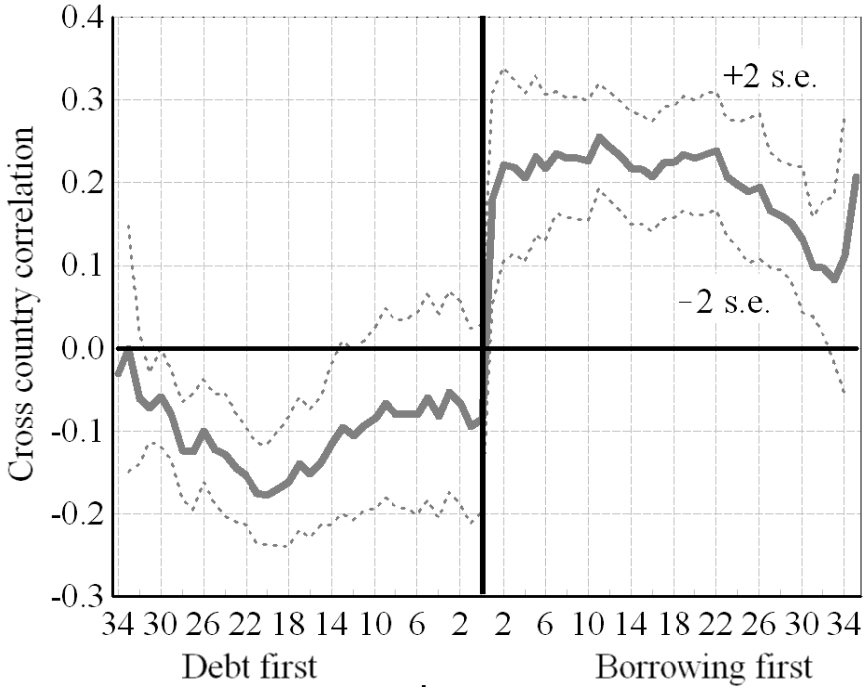
9. The exception is Jordan that grows at 1.95% pa in the period. This corresponds to the debt-free growth rate. Note also that Jordan has the lowest debt burden in 2005 of the 15 countries in Group 1. Perhaps we can conclude that Jordan knew it had wealthy friends, so that it could behave as if it had no debt.

Table 4. The lag structure of the correlogram on Figure 5

	Lag	Correlations, r(ΔD_{Tt}, D_{Tk}) for years t and k	N
Debt first	34 years	r(ΔD_{T2005}, D_{T1970})	1
Debt first	33 years	r(ΔD_{T2004}, D_{T1970}), r(ΔD_{T2005}, D_{T1971})	2
	…		
Debt first	1 year	r(ΔD_{T1972}, D_{T1970}), r(ΔD_{T1973}, D_{T1972}), … , r(ΔD_{T2005}, D_{T2003})	34
Unlagged	0	r(ΔD_{T1971}, D_{T1970}), r(ΔD_{T1972}, D_{T1971}), … , r(ΔD_{T2005}, D_{T2004})	35
Borrowing first	1 year	r(ΔD_{T1971}, D_{T1971}), r(ΔD_{T1972}, D_{T1972}), … , r(ΔD_{T2005}, D_{T2005})	35
	…		
Borrowing first	34 years	r(ΔD_{T1971}, D_{T2004}), r(ΔD_{T1972}, D_{T2005})	2
Borrowing first	35 years	r(ΔD_{T1971}, D_{T2005})	1

Note: The figure shows the average of the N correlations in each line, surrounded by twice their standard error. ΔD_{Tt}, for t = 1971, …, 2005, i.e for 35 years, and D_{Tk}, for k = 1970, …, 2005, i.e. for 36 years. The sum of all N is 1 + 2 +…+ 34 + 35 + 35+ … + 2 + 1 = 35·36 = 1260.

Figure 5. Cross-country correlogram between borrowing and debt (D_T)



3.4 The cross-country correlogram for the relation between initial debt and borrowing

The main body of this paper analyzes two relations: (R1) between growth and borrowing, ΔD, and (R2) between growth and initial debt, D_{-1}. The two variables D_{-1} and ΔD are closely related by definition. Before we look at their relation to growth, it is thus important to know their empirical relation. Also, this relation sheds light on the question posed in Section 2.2: Does borrowing lead to a net reduction in the underlying problem?

Figure 5 presents the average cross-country correlogram of the (*D, ΔD)*-relation.[10] It is calculated from the full (35 *x* 36) pair wise correlation matrix, using all available observations for each pair of years. Table 4 shows how these correlations are ordered, and Figure 5 shows how the cross-country correlogram looks.

It appears from the figure that the correlations between borrowing and debt are rather modest. When countries have debt already, they tend to reduce the debt, but this tendency is barely significant. The relation switches into the positive at zero. Obviously, when countries borrow, they obtain debt. The figure should be fairly symmetrical, and it almost is. Two points are important to note:

(a) The correlations are not so low that relations (R1) and (R2) can be separated.

(b) The effect of borrowing on the debt only starts falling after 22 years, and it is positive all 34 years. Thus, the net effect of borrowing seems to be an increase in the underlying problem of the country for 3 decades or more.

The unlagged correlation (-0.085) is close to zero. What is needed below is the relation between initial debt and the borrowing the next 5 years and 10 years. As the reader can see, it is approximately of the same size and has a positive correlation of a little less than 0.2. This observation will be used below in Section 6.3.

10. Note that the cross-country correlogram is calculated between cross-country data. A "normal" correlogram as the one in Section 4.1 is calculated for the time series of one country.

4 The short-run interaction between borrowing and growth

The short-run interaction between economic growth and borrowing is analyzed by the average correlations for 88 of the 89 countries covered by Figure 3 (one country has too few real gdp data). This correlogram disregards the country level of both series.

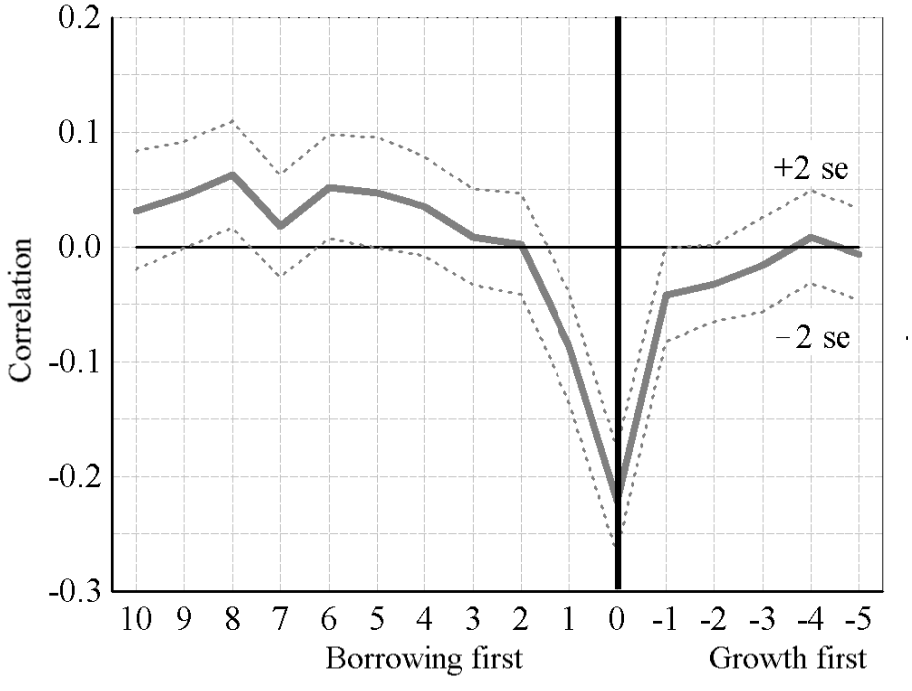
4.1 Correlograms over time: Disregarding the country levels

For each of the 88 countries, the correlogram has been calculated between the real growth rate, g_t and the changes in the initial debt burden D_{T-1} and ΔD_T for so many years between 1970 and 2005 as are available with 16 lags:

$$r(D_{T-1}, \Delta D_{T-10}),\ r(D_{T-1}, \Delta D_{T-9}),\ \ldots,\ r(D_{T-1}, \Delta D_T),\ r(D_{T-2}, \Delta D_T),\ \ldots,\ r(D_{T-5}, \Delta D_T)$$

The 88 correlograms are then averaged – as shown on Figure 6. That is, each of the 16 points depicted on the graph is the average of 88 correlations. Each point is surrounded by 2 standard errors calculated from the 88 correlations. This assumes independence over time and across countries. This is not strictly true, so the significance intervals are a bit too narrow. However, it is difficult to assess how much broader the true intervals would be.

Figure 6. The average correlogram between growth and borrowing, in 88 countries (D_T)



Obviously, the correlograms differ somewhat, but the standard errors show that they differ surprisingly little. Some efforts have been made to study if the correlograms change systematically with the size of the debt burden. The best way to show the stability of the pattern is to look at Table 5.

Table 5. The stability of the correlogram, Figure 6, to the size of the maximum debt (D_T)

	Borrowing first					No	Growth first				
	+5	+4	+3	+2	+1	lags	+1	+2	+3	+4	+5
Avr.	***0.058***	0.044	0.022	-0.006	**-0.080**	**-0.251**	-0.027	-0.047	0.009	0.017	-0.017
t-ratio	(1.8)	(1.5)	(0.8)	(-0.2)	(-2.5)	(-8.2)	(-1.0)	(-1.9)	(0.3)	(0.6)	(-0.6)
Slope	-0.007	-0.006	-0.009	0.005	-0.005	0.019	-0.010	0.011	-0.016	-0.005	0.007
t-ratio	(-0.5)	(-0.4)	(-0.7)	(0.4)	(-0.3)	(1.4)	(-0.8)	(0.9)	(-1.3)	(-0.5)	(0.6)

Note: Each column is a regression: $cor = \alpha + \beta\ debt$, where cor is the correlation and debt is the maximum size of the debt, for $N = 88$ correlations for one point on Figure 6. Coefficients are bolded if their t-ratio is 2 or above. They are in bold and italics if they are in the range from 1.7-1.9. None of the slopes pass this limit. Figure 6 shows the plain averages, with no control for a possible slope.

Table 5 gives a set of tests for the stability of the 11 most central averages depicted on Figure 6. The table confirms the stability of the picture. Only the two points that are more than 2 standard errors from the vertical axis through zero are significant, even when they are allowed to change with the sign of the debt burden. As on Figure 6, there is a small tendency for the debt to generate some positive growth with a lag of 5 years. However, the possibly positive part of the picture is much smaller than the negative section.

4.2 Looking at the raw observations: Borrowing and debt the same year

The negative correlation for the unlagged relation between growth and borrowing suggests crisis-borrowing as in the bad debt story, but logically it may also be due to countries paying off debt when they grow unusually much.

Figure 7 is a simple plot of borrowing and the growth rate in the same year. It is drawn by merging observations from as many LDCs as possible, contrary to what is done on Figure 6. The points are provided with a kernel regression.[11] It fits a moving average – with a fixed bandwidth – through the data. If the bandwidth is too small, the kernel-curve jumps up and down erratically, and if the bandwidth is too large, the kernel-curve becomes horizontal, just

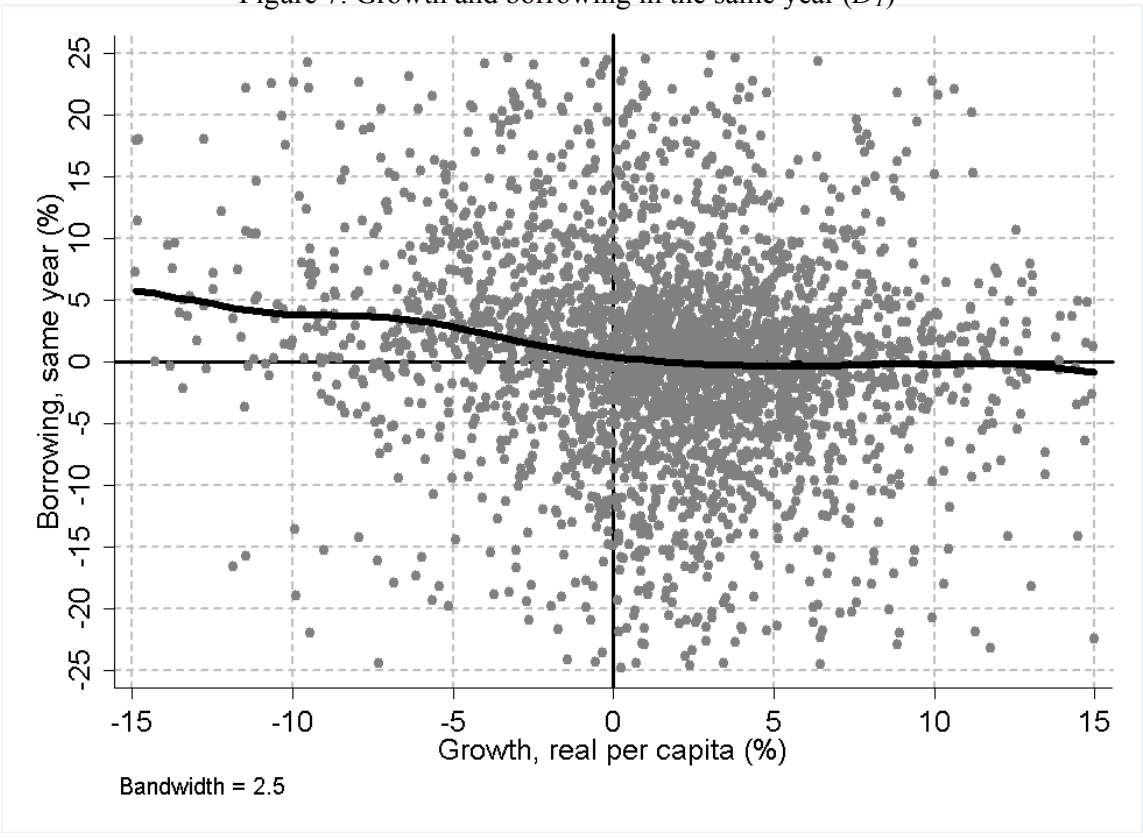
11. The kernel regressions are robust to the kernel formula, so the Epanechnikov kernel is used. Note that all 5 scatter diagrams with kernel regressions have been censored as shown.

showing the average. In-between, the kernel regression gives a robust picture showing if the relation between the variables is linear or has a systematic curvature. Thus, it is a simple graphical test of the form of the relation between two variables.[12]

The data contains some extreme points, so the observations have been censored at ± 25% for borrowing and at ± 15% for the growth rate. It gives (precisely) $N = 3000$ observations. The fist point to note is that the kernel-curve deviates little only from a straight line. It intersects the horizontal axis somewhere between 2 and 5% growth. The line has a modest slope. Thus, the line is close to the horizontal axis in a great deal of its range:

In the range for the growth rate of +1% to about +12%, there is no average tendency to borrow. There may be a small tendency to pay back loans at growth rates above 12%, but here the data are thin. In the low to negative growth range, countries borrow. So countries in economic trouble accumulate debt. The conclusion is that borrowing is associated with crisis.

Figure 7. Growth and borrowing in the same year (D_T)



12. Figure 7 shows how a model explaining borrowing by growth would look. The axes are reversed on Figure 9. The aim is to see if (average) borrowing can explain average growth in a linear way. When the points scatter, as much as they do on Figure 7, the kernel-curve looks very different when the axes are reversed. It actually looks very much like Figure 9a. And like Figure 9a, the kernel-curve intersects the vertical axis, for zero borrowing at 2% growth.

4.3 An interpretation

The correlogram on Figure 6 tells a story of causality: To the left, borrowing precedes growth, so that debt is causal to growth. That is, borrowing causes growth if the left part of the curve is significantly positive, and borrowing causes crisis if the left part of the curve is significantly negative. In the same way, the right part of the curve tells us if growth causes debt. The unlagged part of the curve – that is, at the middle of the vertical axis - needs identifying assumptions to be given a causal interpretation.

The interval of significance shows that the negative peak around zero is significantly different from zero. From Figure 7, we conclude that borrowing is thus associated with low growth in that year and the two adjacent years, i.e. +1, 0 and perhaps –1, on the horizontal axis. Here the correlations on the vertical axis are –0.09, –0.22 and –0.04, respectively. These correlations are not very strong, but the level of significance for the two main ones is high.

It is possible, but not very reasonable, to expect that growth will cause countries to borrow, so at the right part of the diagram (for the values on the vertical axis from –2 to –5) the correlogram is expected to be flat around zero, and it actually is.

If the loans are wisely invested, a positive part of the curve should appear to the left (for the values on the vertical axis from +2 to +10). It does appear, but only for a lag of +4 to +10 years, and it is of dubious significance – especially as the true interval is likely to be slightly broader than the one shown.

However, the years when there is no crisis are years with higher than average growth, so the correlation should be positive between growth in these years and something (like borrowing) that is correlated to the crisis. For a 35-year period, this should be a weak effect, but it may be visible in the average of 88 correlograms. Thus, the positive part of the curve to the left might be an artifact.

4.4 Back to the bad debt story: The underlying problem and the crisis

Figure 6 shows a sharp and negative connection. The correlation is high in a single year and perhaps in the 2 adjacent years. Thus, it suggests a short crisis, and then a loan comes in and everything returns to normal. Thus, the figure may be read as saying that the loan solves the crisis. This brings us back to the bad debt story of Figure 2.

The story argues that the likelihood of a crisis for a country is a function of the underlying problem. In some countries it is high and in others low. If countries have a low

level of such problems, they are hit by fewer shocks and they overcome the resulting crises faster. Thus, there are two levels of "cures"; cures for the crises and cures for the problem. [13]

Figure 6 deals with debt and crises. It does not analyze whether countries manage to reduce the underlying problem. The fact that debt burdens accumulate – sometimes to very large burdens – suggests that borrowing does not reduce the underlying problem very often. This suggestion is further analyzed in the next two sections, which use the cross-country evidence to study if borrowing helps to put countries on a higher growth path.

13. The role of copper in the export of Chile and Zambia was equally high (about 60%) when the price collapsed on the world market as a reaction to the termination of the Vietnam War 1973-75. This caused both countries to borrow heavily in the short run; but then they moved to radically different growth paths: The Zambian economy went into a process of decline that eventually stabilized at an income level of half the previous one. In Chile the copper shock was part of the shocks that led to the reforms making the economy switch to a high growth path.

5. Debt accumulation and growth: The longer run

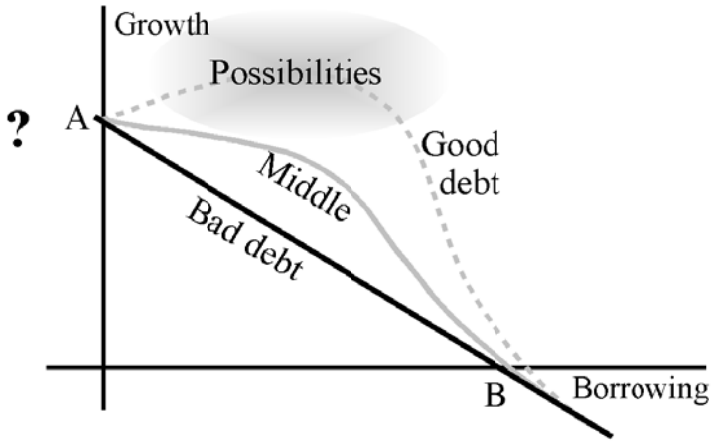
The association between growth and borrowing is also analyzed using the data for the four debt burdens for the seven 5-year periods and the three 10-year periods. Here an important part of the pattern is generated by the cross-country patterns of the variables.

Note that the scatter diagrams of Figure 9 use a different scale and reverse the axis compared to Figure 7 - to distinguish and in accordance with the purposes of the graphs.

5.1 What should the scatter diagrams show?

Section 3.3 showed that high debt was associated with economic misfortune, so the kernel regression line should fall at high debt levels, as indeed it does – high debt is bad debt. If all debt was bad debt, as in the highly indebted countries, a straight line with a negative slope should appear from no borrowing, at point A. Growth should be lower the more the country borrows, as shown by the *bad debt* line on Figure 8, which intersects the borrowing axis in point B. The line looks much as the kernel-line on Figure 9.

Figure 8. Theoretical possibilities used in the discussion



However, if some *possibilities* for good investment exist (shown on Figure 8), and these possibilities cannot be used due to lack of domestic saving, and loans are actually used to finance such investments, then a line for good debt exists, as drawn. It is difficult to be fully successful, so perhaps reality is a mixture of good and bad debt, as shown by the *middle* curve. It has a *good debt convexity* above the bad debt line, as shown.

If these theoretical possibilities are describing something that happens, it should show up as a convex section of the kernel-curve. The technique of kernel regressions is chosen

precisely to reveal a good debt convexity. Bad debt dominates if the kernel-curve is linear from no borrowing till the tragic cases of the high debt countries.

Also, the discussion till now does not say anything about the section to the left of zero borrowing, which is the part of the curve where countries reduce debt.

5.2 Looking at Figures 9a and b: A constant negative slope

The analyses of the 3 long debt burdens D_T, D_L, and D_{LP} give graphs that look very much like Figure 9, and all comments to the figure also apply to the corresponding graphs for the other two long series. However, the two pictures for short-run debt show a rather dull flat curve.

Figure 9a shows a clear linear picture for the part of the range where there are many observations; that is, from -25 to +50. For borrowing rates higher than 50 (that is half of GDP), there are few observations only, and the kernel-line becomes somewhat erratic. However, the dominating impression is a line that falls linearly throughout. Figure 9b has much fewer observations than Figure 9a, but the picture is the same. No signs of a good debt convexity show on either of the two figures.

Both curves intersect the vertical axis at 2% growth, and it is interesting to see that the section to the left of zero, where debt is reduced, continues the linear curve up to 35 on the 5-year data, and up to 15 on the 10-year data. Only then does it bend downward.

Table 6 is a summary of 96 regressions found in the Appendix. They confirm the impressions from the graphs. All coefficients – except for the short debt – are negative, significant and stable. The inclusion of a squared term to catch a curvature gives results that are at best marginal and nearly always just zero.

The table further shows that for long debt it always increases the fit to exclude extreme observations. The results are not due to the extreme observations. Also, the 5-year period always gives larger coefficients than the 10-year period, so the dominant relation is essentially in the short run, as was also seen on Figure 6.

Another observation is that in the perspective used, debt acquisition *explains* 5-7% of the variation in the growth rate, i.e. the $MAR^2(\Delta D, \Delta D^2) \approx$ app 0.06. This does not seem to be much, but with the standard of growth empirics, it is quite large (see Barro and Sala-i-Martin 2004, ch. 11).

The logic of the bad debt story is that borrowing is explained by crisis, and thus not exogenous. Thus, what truly explains the low grow is the underlying problem that causes the debt and the borrowing in some mixture. A total disentangling of the causal structure is, as always, very difficult.

Figure 9a. Graphs for growth and borrowing 5 years averages (D_T)

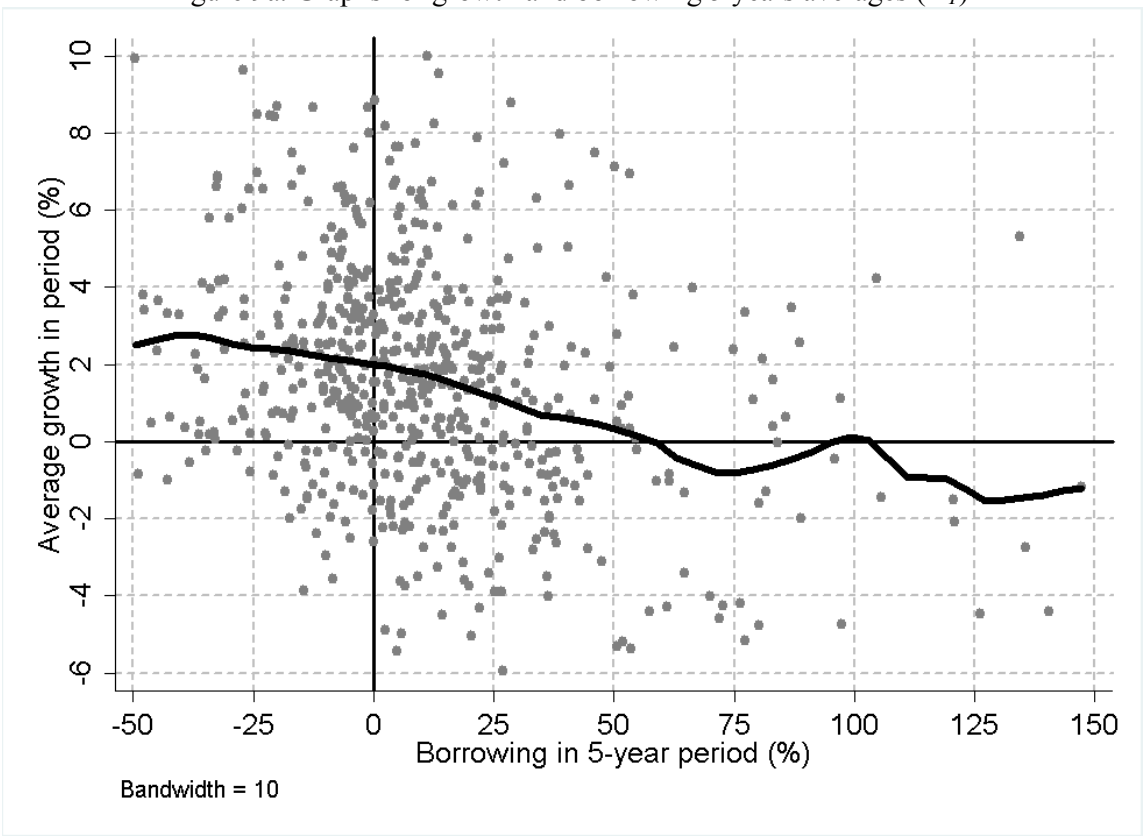
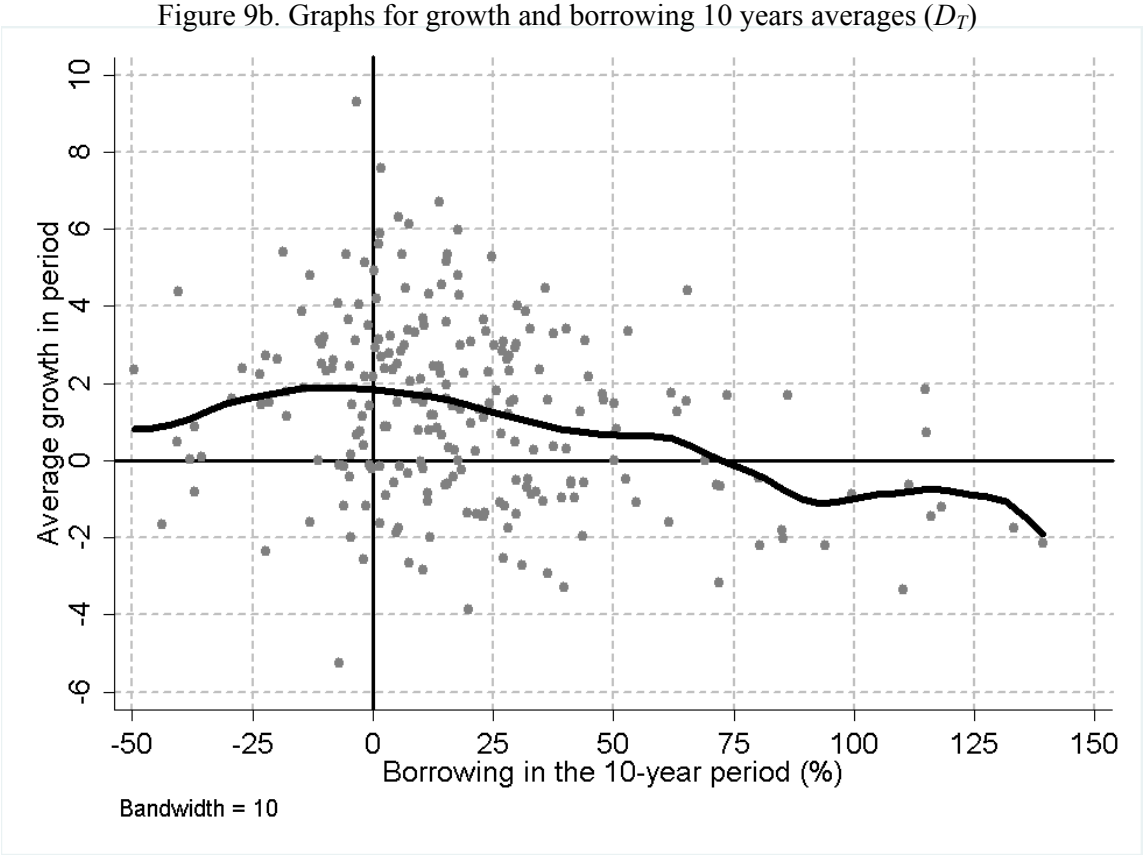


Figure 9b. Graphs for growth and borrowing 10 years averages (D_T)



Also the effect of debt is substantial. The coefficient -2.67 to 1 gives the effect of an increase in the debt of 100% of GDP. A country in such trouble that total debt increases with 100% of GDP over a 5-year period also suffers a loss of 2.67 pp (percentage points) growth per year in the period. This is a substantial growth loss, but then an increase in the debt burden of 100% over 5 years is a sign of a severe crisis.

Table 6. The effect of borrowing on growth (D_T)

	ΔD_T, total		ΔD_G, public		ΔD_L, long run		ΔD_S, short run	
Time period	5 years	10 years	5 years	10 years	5 years	10 years	5 years	10 years
				All observations				
Coefficient	**-1.20**	**-0.65**	**-1.58**	**-0.75**	**-1.46**	**-0.79**	-0.08	**-1.84**
Avr t-ratio	6.0	4.2	6.4	4.4	6.0	4.2	0.6	2.5
Rob t-ratio	10.1	16.1	10.9	13.5	9.8	14.6	1.2	-32.4
$MAR^2(\Delta D)$	0.049	0.084	0.059	0.088	0.052	0.086	-0.003	0.047
$MAR^2(\Delta D^2)$	0.000	-0.000	-0.000	-0.000	-0.001	0.006	-0.002	-0.000
N [a]	644	258	683	257	683	257	682	257
				Non-extreme observations				
Coefficient	**-2.67**	**-1.59**	**-3.83**	**-1.98**	**-2.89**	**-1.87**	**-2.99**	**-4.54**
Avr t-ratio	5.0	2.7	6.5	3.0	5.0	2.9	2.3	2.8
Rob t-ratio	6.6	3.2	10.1	6.8	6.0	9.9	3.6	5.6
$MAR^2(\Delta D)$ [b]	0.050	0.060	0.074	0.042	0.052	0.047	0.010	0.035
$MAR^2(D^2)$	-0.001	-0.002	-0.001	-0.000	0.003	0.014	-0.003	0.002
N	629	237	647	237	644	245	675	255

Note: Debt is rescaled by division by 100. Run for 6 combinations of the controls from Table 2, as given in the Appendix. See Table 2 for definitions. The *rob t-ratio* measures robustness as the stability across regressions. Significant and stable coefficients are in bold. (a) In the regressions with lagged growth, about 10 observations are lost.

5.3 What has been explained?

As discussed, borrowing explains app 6% or the variation in the growth rate. Thus, Figure 9 and Table 5 can be interpreted as follows:

(a) *Well run* countries with *few problems* do not borrow. Thus, the intersection of the kernel-curve with the vertical axis for $\Delta D_T = 0$ is a measure of the debt-free growth rate. It is 2% pa.

(b) Countries borrow due to problems, and this has a cost in growth. The average growth rate in our sample of LDCs is 1.6%. Thus, the problems and the resulting borrowing cost the average country 0.4% percentage points of growth.

Item (a) is straightforward, but (b) is more difficult to discuss as the paper does not consider the nature of the underlying problem. It may be due to exogenous factors that are difficult to handle or to long-run consequences of bad politics.

When the cases of extreme debt in Section 3.3 are once again considered, it is easy to point to clear cases of mismanagement such as the three top cases in Table 3, but even in these cases there are additional exogenous problems.

6. Initial debt and growth

The final part of the analysis looks at the relation between initial debt and growth in the following 5 and 10 years. Figures 10a and b are constructed precisely as Figures 9a and b.

A number of papers and reports from aid agencies and NGOs have shown that high initial debt causes low growth,[14] which is confirmed by Figures 10a and b. However, if we had not read this literature, it would not be obvious what to expect.

6.1 What to expect?

If the debt were a sign of a correspondingly large real capital, it should be associated with high growth. From Section 5 we know that debt mainly finances crisis. Given that debt is acquired as a reaction to crisis and has generated little investments, a high debt is a problem that is roughly proportional to the debt.

However, even if a country starts out with high debt, ceteris paribus, it is not obvious that this should cause lower growth. It should be sunk cost, and thus irrelevant for future behavior. The micro parallel of a business is clear: There seems to be no reason that you should work less hard and strive less to develop your business if it has a large debt than a small one. It might even be the reverse: You will work harder when in debt, and you may get more complaisant with a well consolidated business. Section 6.3 returns to this argument.

6.2 Looking at Figures 10a and b

The first impression from Figure 10 is that it looks like a weak version of Figure 9. The slopes on the kernel regressions are negative on Figure 10, but less so than on Figure 9. This is also confirmed by the regressions as seen in Table 7. The effects are smaller, both in size and significance throughout the table when the individual cells are compared to those of Table 6.

It looks as if the curve is flat (virtually horizontal) from zero to about 50. The tests of nonlinearity do find some significant coefficients to the squared term, but the signs are always positive. This indicates that they pick up the small upward bend at the high end – an upward bend that will be discussed in a moment. However, for the non-extreme observations the significance of the squared term vanishes.

14. See Chowdhury (2001) for a recent analysis and a survey of the literature.

Figure 10a. Graphs for initial debt and growth, 5 years averages (D_T)

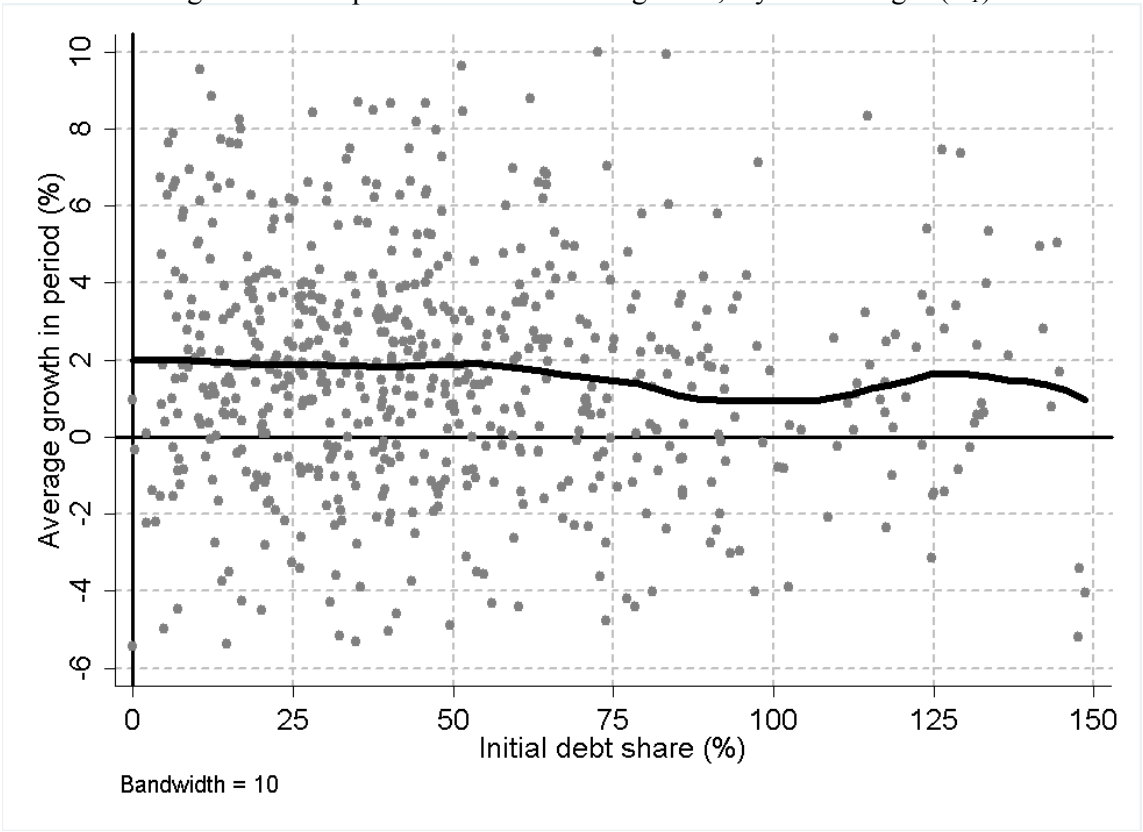


Figure 10b. Graphs for initial debt and growth, 10 years averages (D_T)

Table 7. The effect of initial debt on the growth rate (D_T)

	D_{T-1}, total		D_{LG-1}, public		D_{L-1}, long run		D_{S-1}, short run	
Time period	5 years	10 years	5 years	10 years	5 years	10 years	5 years	10 years
				All observations				
Coefficient	**-0.69**	-0.26	**-0.92**	-0.12	**-0.89**	-0.36	-0.02	-1.04
Avr t-ratio	2.8	0.6	2.9	0.2	2.8	0.6	0.2	0.6
Rob t-ratio	2.4	0.9	2.1	-0.5	2.0	0.09	-0.8	-0.8
$MAR^2(D_{-1})$	0.017	0.026	0.017	0.029	0.011	0.029	0.003	0.017
$MAR^2(D^2_{-1})$	0.004	0.008	0.008	-0.001	0.003	-0.001	0.005	-0.002
N	644	258	683	257	683	257	682	257
				Non-extreme observations				
Coefficient	**-1.90**	**-1.86**	**-2.23**	-1.38	**-2.15**	**-2.38**	-3.41	-5.38
Avr t-ratio	2.6	2.0	3.2	1.5	3.1	2.4	1.6	1.2
Rob t-ratio	2.9	4.4	-5.5	1.9	3.9	3.8	-2.3	-1.1
$MAR^2(D_{-1})$	0.023	0.031	0.030	0.016	0.032	0.035	0.003	-0.001
$MAR^2(D^2_{-1})$	-0.001	-0.001	-0.001	0.001	-0.003	-0.004	-0.002	0.007
N	629	237	647	237	644	245	675	255

Note: See Table 6. Debt is rescaled by dividing by 100.

Table 7 shows that for the three long debt variables, initial debt explains about 3% of the variation or about half as much as does the borrowing. This confirms the impression from the graphs. The crisis that causes debt is more important for growth than the resulting debt.

The two kernel-curves intersect the vertical axis at 2% just as in Section 5. The second estimate of the debt-free growth rate is thus the same as the first.

However, it is somewhat strange that the two kernel-curves for D_{T-1} (and the 4 parallel ones for D_{LG-1} and D_{L-1}) all turn up again for very high debt burdens. These "upturns" do not look very convincing on the data points, but they give the impression that countries with extreme initial debt care relatively little about the debt. They probably know that they cannot and will not ever have to repay their debt.

6.3 Models including both borrowing and initial debt

Sections 4 and 5 of the Appendix show what happens when both borrowing and initial debt are included at the same time. The main results are surveyed in Table 8. The analysis of Figure 5 in Section 3.4 showed that the two debt variables have a small positive correlation, so when the growth-borrowing relation is controlled for initial debt, the effect of borrowing should be clearer, and when the growth-debt relation is controlled for borrowing, the effect of initial debt should be clearer as well. This is precisely what happens.

Table 8. The effect on growth of borrowing and initial debt: previous and mixed models

		Total		Public		Long		Short	
		Alone	Both	Alone	Both	Alone	Both	Alone	Both
All 5-years	Borrowing	**-1.10**	**-1.97**	**-1.47**	**-2.84**	**-1.34**	**-2.58**	-0.07	-1.63
	Initial debt	**-0.70**	**-0.84**	**-0.91**	**-1.14**	**-0.90**	**-1.16**	-0.02	-1.78
Non-extreme 5-years	Borrowing	**-2.27**	**-2.85**	**-3.61**	**-4.33**	**-2.55**	**-3.45**	-1.92	**-3.17**
	Initial debt	**-2.31**	**-2.55**	**-2.32**	**-2.68**	**-2.48**	**-2.77**	-3.20	-3.82
All 10-years	Borrowing	**-0.61**	**-1.48**	**-0.71**	**-1.74**	**-0.75**	**-1.70**	**-1.85**	**-4.58**
	Initial debt	-0.10	-0.23	0.04	-0.19	-0.21	-0.37	0.24	-1.91
Non-extreme 10-years	Borrowing	**-1.68**	**-1.95**	**-2.07**	**-2.24**	**-1.73**	**-2.29**	**-5.07**	**-4.94**
	Initial debt	-1.35	-1.17	-0.48	-0.33	-1.83	-1.67	-2.73	-4.12

Note: Debt is scaled as in Table 6 and 7. Each coefficient is the averages of models with and without controls for second order effects. Bold if average t-ratio is above 2.

The pattern for the short debt is unclear as usual, but for the three long debt series the following two observations are very robust in Table 8:

(a) The coefficient to borrowing is larger than the coefficient to initial debt in all cases (except 1) when they are alone, and in all cases when they are both in.
(b) Both coefficients rise more (i.e. they become more negative) when they are in together than when they are alone in all significant cases.

Observation (a) confirms the argument till now, but observation (b) is important in the sense that it shows that two effects are separate effects. Borrowing has to do with crisis, and initial debt is bad in itself.

This also means that the contribution to the explanation by the two variables is additive. That is: $MAR^2(\Delta D) + MAR^2(D_{-1}) \approx MAR^2(\Delta D, D_{-1})$. The two debt variables thus explain 7 to 10% of the variation in the growth rate, as the reader can ascertain from the Appendix.

7. Why is it so difficult to borrow and grow?

The stylized story that dominates the data is *the bad debt story*, where borrowing is a consequence of crises. It causes debt to accumulate, and it generates low growth in the longer run.

Consequently, the empirics presented show that the average country does not borrow and invest wisely. Two concluding comments will be added to this sad observation: The first is that it fits into a picture of the poor effects of transfers to governments from abroad, and the second deals with the political economy of the decisions involved.

7.1 The effects of transfers from abroad

The bad loans story corresponds to other stories of *transfers* from abroad where the growth effect has been rather unsatisfactory. Table 9 lists a handful of the main categories of transfers, where types A and B overlap some. Only types A, B and C will be discussed as they mainly go to governments. Loan (A) has already been discussed.

Table 9. Main categories of transfers into the economy

	Type of flow	Conditions of use
A	Loans (subject of paper) all loans but not gifts	Fairly free to use and fungible
B	Development aid: concessional loans and gifts	Normally tied to use, but fungible
C	Resource rent	Typically flow to government – free to use
D	FDI: foreign direct investments	Tied to private investment, typically little fungibility
E	Remittances from workers abroad	Free to use by private recipients

Great efforts have been made to find a robust link from development aid (B) to development. The result is disappointing. It appears that aid has essentially no effect on development.[15]

Resource export typically contains resource rent (C). Economic theory predicts that the government of the exporting country can appropriate most of the rent, and it actually happens. So, from a balance of payments perspective, resource rent is a transfer to the government from the rest of the world. It has often been shown that this gives an initial jump in income, but a low and erratic growth later on (see e.g. Sachs and Warner, 1995). [16]

15. The author has recently participated in a major quantitative survey of the 100 papers analyzing development aid effectiveness (see Doucouliagos and Paldam, 2006, 2008a and 2008b).
16. Half a century ago Venezuela's great oil wealth caused the country to have almost the same income level as the USA. Since then Venezuela has had zero economic growth, even though the inflow of oil revenue continues.

Thus, (A), (B) and (C) all deal with inflows of foreign funds to the government that for various reasons give disappointing effects on development. One explanation is that it appears that the marginal effect of all three flows is almost exclusively public consumption, which has a dubious effect on development.

However, a more general explanation is available. It is the classical theory of international transfers, which today is mainly known as the theory of Dutch Disease.[17] It essentially shows that international transfers lead to a real revaluation simply because the transfer increases the supply of foreign currency, and consequently the price of foreign currency goes down; i.e. the new equilibrium has a revalued domestic currency. How this process works through the economy depends upon the exchange rate regime, the behavior of governments, trade unions, firms etc. It may take some time in a fixed rate regime, but it inevitably happens.

Hence, the public sector that receives the inflow of resource rent, development aid or non-concessional loans becomes the booming sector, and it replaces the tradables sector. This causes lower growth in the future. So the development is far less rosy than the inhabitants expected, when the transfer happens/starts.

7.2 The political economy of foreign borrowing

One may also ask the simple question: Why does a country borrow when it has a crisis? Is it to adjust quicker to the crisis or to be able to finance non-adjustment? Our results certainly suggest that the latter possibility dominates the picture.

The analysis has showed that debt accumulation is normally associated with some underlying problem leading to economic crises. Somehow things are going badly, and the political system is unable to handle the crisis. A foreign loan provides some wiggle room, and this is surely used to solve the most pressing problem. The reader may then ask what decision makers are most likely to take this problem to be. Think of the choice between a political stabilization and a balance-of-payments stabilization.

A political stabilization means that the popularity/support of the government is increased. This can be done either by satisfying the demands of the voters or by paying off some pressure group, such as the military, the unions etc. In both cases it costs money. Here the foreign loan comes in handy. It appears that such solutions are of a short-run character.

A balance-of-payments stabilization inevitably means that domestic absorption has to be reduced. It is obvious that this is painful and likely to cost the government some support,

17. Paldam (2007) gives a survey of the theory of Dutch Disease.

thus it is almost the reverse of a political stabilization. Hence, it is likely that the government may fully or partly shy away from solving the balance-of-payments crisis.

Thus, it is possible that the underlying problem that led to the crisis may be reduced temporarily, but it often appears that it is not. Also, it might be that the problem has long and strong roots, such as a guerilla war with no solution in sight. Here anything buying time is a great relief. But if such relief is brought about with foreign borrowing, it generates a long-run problem of a high debt burden.

All of this appears to tally well with the general finding that governments and voters have a short time horizon; i.e. that the political decision process is *myopic*. The political myopia result has been found both in the literature on vote and popularity functions and in the literature on political business cycles.[18] Thus, political decision making is problematic in a field with a long time horizon such as international borrowing.

18. See the surveys by Nannestad and Paldam (1994) and Paldam (1997) covering the two bodies of literature.

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