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Public Investment in Infrastructure in Latin America: Is Debt the Culprit?

by

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Abstract[1]

Panel data for seven Latin American countries are used to assess the influence of public indebtedness on public investment in infrastructure in the period 1987-2001. Debt increases are associated with higher public infrastructure investment, an effect that is robust to the inclusion of many other fiscal and macroeconomic variables. This paper also finds some evidence of complementarity between public and private investment and of the negative effect of IMF adjustment loans on infrastructure expenditures. No evidence is found that debt defaults affect public investment in infrastructure.

Keywords: Public investment, Public infrastructure, Public debt, Fiscal policies, Default, Latin America.

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1. Introduction

Since public infrastructure projects are typically large, lumpy and long-lived, they are usually financed with debt. In the case of Latin America, the legacy of past fiscal problems and exposure to major domestic and external economic shocks have made public debt restrictions a common phenomenon in the region, with potentially deleterious effects on the levels and costs of public infrastructure investment. Overindebtedness may thus create a vicious circle where the inability to finance new investment projects curtails the possibility of generating economic growth and servicing debt. This issue is of the utmost relevance in Latin America, where public debt ratios in the 1990s were on average around 40 percent of GDP and public investment in infrastructure was just 1 percent of GDP. Although the private sector invested nearly 1.1 percent of GDP in infrastructure during the 1990s, as Figure 1 shows, that still leaves a gap with respect to the requirements of investment, which have been estimated at about 4.4 percent of GDP (Fay and Morrison, 2005), not to mention the standards of fast-growing countries such as China, where investment in infrastructure averaged 6.7 percent of GDP in the 1990s and 9 percent of GDP in the period 1998-2002 (Naughton, 2004).

Though a growing body of literature provides some support for these arguments, as will be discussed below, a central piece of this line of reasoning remains largely untested, namely the presumption that exogenous increases (or decreases) in the stock of debt translate into decreases (or increases) in public infrastructure investment. (In this context, "exogenous" means debt changes that are not the result of public infrastructure investment decisions). If this presumption holds true, several important implications follow. First, it implies that public infrastructure investment (henceforth PII), is crowded out by non-infrastructure uses of public finance. Second, it implies that PII may be sensitive to other factors that may affect the value of the existing debt, such as exchange rate changes, debt relief or debt repudiation.

But the presumption that exogenous public debt increases translate into lower PII is not necessarily true. The presumption may be valid if the public sector as a whole faces a single financial constraint, there is no important feedback from non-infrastructure expenditures into government revenues, and infrastructure expenditures operate as an adjustment variable to accommodate fiscal restrictions. When state-owned enterprises are in charge of infrastructure services, they may face financial constraints that may be largely (though not always) independent of those of the central government. But even if they face the same financial constraints, non-

infrastructure public expenditures financed with debt may be revenue enhancing (through their effect on growth or, more directly, by improving the ability of the government to collect revenues) and therefore need not crowd out PII. Finally, if fiscal adjustment is unavoidable, it is far from evident that PII is the best candidate for cuts: delays in public investment projects are extremely expensive and may be ruinous not only financially but also politically.

This paper attempts to shed light on these issues by assessing how public debt affects public infrastructure investment with econometric evidence for seven Latin American countries since 1987. The main conclusion is that exogenous debt increases do not reduce PII. On the contrary, the further a country goes into debt, the more PII increases, even after controlling for the contemporaneous effect of primary expenditure increases on PII. But this also implies that during periods of fiscal retrenchment, PII suffers the double whammy of expenditure cuts and reductions in the stock of debt. The central conclusion of this paper is consistent with the finding in Lora and Olivera (2007) that public social expenditures are inversely associated with public debt. The present paper also finds that IMF lending does reduce PII, as is often said, although it does not alter the composition of primary expenditures. No evidence is found in support of the view that debt defaults may help increase PII.

The rest of this paper is organized in four short sections. Following this introduction, a brief literature review is intended to put the research questions in context. Then, the econometric approach and data used are presented. The main section of the paper is the discussion of the econometric results, and a final section summarizes the conclusions and implications.

2. A Brief Literature Review

Since the 1980s, concerns about the implications of fiscal adjustments have motivated several studies of interest. Hicks and Kubisch (1984) noted that capital expenditures were the type of expenditure most exposed to cuts during periods of fiscal retrenchment over the period 1972-80, and Hicks (1989) confirmed this finding with a sample of 11 “high debt” countries during 1978-84. With data for a larger number of developing countries over the period 1975-86, Heller and Diamond (1990) concluded that shifts in the composition of government expenditures tended to be most pronounced against fixed assets and capital transfers. Consistent with these studies, Calderón, Easterly and Servén (2003) have calculated that in five of the largest Latin American

countries, infrastructure investment cuts contributed half or more of the total fiscal adjustment during the 1980s and 1990s.

While all the evidence points towards greater exposure of capital expenditures to fiscal retrenchment measures, these studies leave unclear whether this is a response to changes in debt ratios and/or the debt burden. Calderon, Easterly and Servén (2003) argue that the debt crisis of the 1980s caused a collapse in infrastructure investment in Latin America and the Caribbean, but no econometric test is provided to support this assertion.

The potential effects of debt on capital investment and growth have been studied in a recent paper by Pattillo et al. (2004). They applied a growth-accounting framework to a group of 61 developing countries over 1969-98 and found that doubling their average external debt level reduces growth of both per capita physical capital and total factor productivity by almost 1 percentage point. In other words, large debt stocks negatively affect growth by dampening both physical capital accumulation and total factor productivity growth. While very illustrative, these simulations do not constitute evidence of the actual impact of debt on infrastructure investment expenditures.

One of the few papers where the issue has been addressed econometrically is Mahdavi (2004), which finds support for the adverse effect of the debt burden on capital expenditure in a sample of 47 developing countries for 1972-2001. However, the effect is not significant for the Latin American sub-sample. Also, it is important to keep in mind that Mahdavi only tested for the effects of the debt burden, not for the possible direct influence that the levels of debt may have on public investment.

A few studies on the determinants of public investment in low-income countries have attempted to isolate the influence of indebtedness on public capital expenditures. Using data for 1970-99 for 55 low-income countries classified as eligible for the IMF's Poverty Reduction and Growth Facility, Clements et al. (2003) estimated equations to identify the key determinants of public investment. Among the variables considered were the stock of external debt and the debt service. They concluded that the stock of external debt has no significant effect on public investment, as public investment seems to be driven more by the current fiscal position and the availability of resources than by factors that affect fiscal sustainability over the longer term. However, their results support the hypothesis that higher debt service (as opposed to the stock of external debt) crowds out public investment in a non-linear fashion, with the crowding-out effect

intensifying as the ratio of debt service to GDP rises. According to their estimates, on average, for every percentage point of GDP increase in debt service, public investment declines by about 0.2 percentage point of GDP. As they conclude, "the modest magnitude of this decline is surprising, indicating that large debt burdens have not seriously hampered public investment in low-income countries… [and that] debt relief by itself cannot be expected to lead to large increases in public investment." This conclusion is consistent with the review of studies on the debt-overhang hypothesis by Dijkstra and Hermes (2001), which found the empirical evidence on this issue to be inconclusive.

In synthesis, while the evidence clearly indicates that capital expenditures are sensitive to fiscal adjustment, there is not much empirical basis to the presumed inverse link between debt or even the debt burden and capital expenditures. Furthermore, no study has focused on public infrastructure investment, PII, our main variable of interest. This is a serious deficiency, because capital expenditures by the central or the consolidated government as measured by the International Monetary Fund's *Government Finance Statistics* (the source in some of the papers surveyed; see Mahdavi, 2004) are a very poor measure of actual PII, which in many countries is mostly undertaken by state-owned enterprises or local governments whose operations are not well captured by this source.

In a paper closely related to the present one, Lora and Olivera (2007) have assessed the effects of public debt on *social* expenditure worldwide.[2] Besides sharing most of its data and econometric methods with the present paper (see next section), that paper is worth mentioning because some of its findings may help to explain how PII may be affected by debt. The central finding of the paper is that higher public debt ratios *reduce* both the level and the share of social expenditures in primary expenditures (that is, excluding interest payments, and even after controlling for them). This finding indicates that debt displaces social expenditures not so much because it raises the debt burden, but rather because it crowds out social expenditure in favor of *other* expenditures (besides reducing room for further indebtedness).

The present paper attempts to answer many of the same questions, namely:

- Is public infrastructure investment (PII, as a share of GDP and as a share of public primary expenditure) affected by changes in public debt ratios (over GDP), and in what direction?

[2] Our definition of social expenditures comprises only public health and public education expenditures.

- Is this effect related to the changes that occur in interest debt payments (as a share of GDP) when debt changes, or does the stock of debt have an effect of its own?
- Does it make any difference if the lender is a multilateral organization, such as the International Monetary Fund, or one of the multilateral development banks?
- Does a debt default lead to an increase or to a reduction in PII?
- And, finally, what are the policy implications of all of the above?

3. Data and Econometric Approach

Our main variable of interest, public investment in infrastructure, PII (measured as GDP-ratios) in the seven largest Latin American countries, has been constructed by Calderón and Servén (2004). They have also gathered data on private infrastructure investment, which will be of use for us as a control variable. Both public and private investment in infrastructure cover four types of capital goods: power, land transportation, water and telecommunications. As Calderón and Servén note, a narrow definition of PII is needed to assure comparability across countries.

Given our dependent variable, our dataset is a panel of yearly data from 1987 to 2001 for seven Latin American countries.[3] Due to time sample limitations of some of the explanatory variables described below, the panel is unbalanced. After taking first differences in order to apply an Arellano and Bond estimator (see below), only a maximum of 47 observations[4] are left, which limits the precision of the estimates and narrows the scope for robustness exercises. With these caveats in mind, following is a short description of the remaining variables and the econometric approach.

Data for debt stocks, our main explanatory variable, comes from Jaimovich and Panizza (2006). This dataset uses information from the IMF's *International Financial Statistics* (IFS), complemented with data from the IMF's *World Economic Outlook* and ECLAC. One important feature of the data for debt stocks is that they cover both external and domestic debt issued by central governments (but not by other levels of government, or by state-owned enterprises). Debt data are expressed as shares of GDP in nominal values (to do so, debts denominated in foreign

[3] Argentina, Bolivia, Brazil, Chile, Colombia, Mexico and Peru.
[4] Distributed as follows: Argentina 7, Bolivia 6, Brazil 1, Chile 9, Colombia 3, Mexico 14, and Peru 7.

currencies are converted into domestic currency values using market exchange rates). Interest debt payments and other fiscal variables come from the IMF's *Government Finance Statistics*, except for privatization proceeds, which come from World Bank (2005). Since all these data come in nominal values, they are converted into GDP ratios using the nominal GDP values reported by the IMF's IFS. This is also the source for other macroeconomic variables, such as the exchange rate and the inflation rate. Finally, the default variable (a dummy taking the value of 1 in the years that the country is in arrears) comes from Standard & Poor's data processed by Borensztein and Panizza (2006).

Table 1 provides summary statistics for the main variables used in the econometric analysis and Table 2 reports pairwise correlations.

The main concern that needs to be addressed in the estimation method is the endogeneity bias that would result from regressing PII directly on public debt (and other fiscal variables). The most convenient method for dealing with endogeneity problems in panel data is the Arellano and Bond estimator, which uses lagged values of the explanatory variables (in first differences) as instruments for those same variables. The validity of the method rests on the assumption that the instruments are correlated with the explanatory variables but not with the dependent variable. The Sargan test (which is reported in the tables) suggests no reason to suspect the validity of the method. However, in the first set of regressions, I also present standard ordinary least squares estimates that, although necessarily biased, point towards the same basic results as the Arellano and Bond estimator. Since the dependent variable is also converted into first differences, the Arellano and Bond estimator also deals with the non-stationarity problem that arises when the variables exhibit time trends that may lead to spurious correlations between the dependent and the explanatory variables. Although the Arellano and Bond estimator may still be inadequate when the series exhibit non-stationarity after first differentiation, the main tests (reported in Table 1) indicate that this is not the case with most of our dataset.

4. Econometric Results

The first set of results is presented in Table 3. All regressions control for GDP and its square (in logs). We start with two ordinary least-squares regressions with country-fixed effects, which show a striking result that will be the center of attention throughout this section, namely that PII *increases* in response to a rise of the debt-ratio. The coefficient of these first two regressions

indicate that PII increases around 1.3 percent points of GDP when the debt ratio (lagged one year) goes from 0 to 100 percent of GDP. The result is significant at 10 percent and is robust to the inclusion of the fiscal balance, which is not significant. Regressions 3 and 4, using the Arellano and Bond estimator, confirm that PII is positively associated with increases in the debt ratio. The inclusion of the fiscal balance reduces the value of the (short-run) coefficient from 1.6 to 1.1 percent and lowers its significance. Taking into account the effect of the lagged dependent variable, the long-run coefficients become 2.9 and 1.4 percent, respectively. According to Regression 4, there is a highly significant negative association between the fiscal balance and PII, implying that PII tends to decline during periods of fiscal adjustment, as found in previous studies. Regressions 5 and 6 attempt to identify the channels through which this effect takes place. In Regression 5 the fiscal balance is broken down into primary balance and debt interest payments, and in Regression 6 the primary balance is broken down into primary expenditures and primary revenues. Surprisingly, PII seems to *increase* when interest payments rise, which is due to the effect that debt increases have on both variables. PII also responds directly to changes in total primary expenditures, confirming that PII is susceptible to expenditure cuts (though not to changes in fiscal revenues).

In Table 4, which attempts to test whether PIIs behave like other primary expenditures, the dependent variable is the ratio of PII to total primary expenditures. The results clearly indicate that PIIs behave differently, since their relative importance increases significantly when debt increases or during periods of fiscal relaxation. Thus, Regressions 1 and 2 indicate that an increase of the stock of debt equivalent to 1 percent of GDP leads to a short-run *increase* of 0.18-0.15 percent points in the share of PII in primary expenditures (or 0.3 and 0.22, respectively, in the long run). The second, and lower, of these coefficients comes from the regression that includes the fiscal balance, suggesting that part of the increase of PII comes from the relaxation of fiscal discipline associated with periods of debt expansion. Thus, as implied by Regression 2, when the fiscal balance is loosened by 1 percent of GDP, the share of PII in total primary expenditures increases 0.26 percent in the short run (or 0.39 in the long run). Therefore, while in periods of fiscal relaxation PII increases both because there is more expenditure and more indebtedness, in periods of fiscal restraint PII is subject to the "double whammy" of expenditure cuts and debt consolidation. Regressions 3 and 4 indicate that this double effect is strongly associated with the behavior of interest payments, not with the rest of the fiscal balance. Thus,

the share of primary expenditures devoted to PII tends to increase around 0.5 percent in the short run (or 0.66 in the long run) when debt interest payments increase by 1 percent of GDP, but that share does not change significantly when the primary balance weakens (or when primary expenditures fall or fiscal revenues increase). Of course, this pattern of behavior of PII must have its counterpart in some other expenditure that behaves in the opposite fashion. The results of Lora and Olivera (2007) suggest that public social expenditures (PSEs), play that role. In that paper we estimate that PSEs in Latin America *decline* around 0.04 percent points for each 1 percent point increase of the debt-to-GDP ratio, with most of that decline coming from the negative effect of debt interest payments on PSEs. As a share of primary expenditures, PSEs fall in a significant way when interest payments increase in Latin America: about 0.89 percent for each 1 percent increase in interest payments as a share of GDP.

Our results point towards a symbiotic relationship between PII and public debt that may operate in the following way. Like other primary expenditures, PII increase when fiscal resources grow. However, when public debt is on the rise, PII is at an advantage vis-à-vis other primary expenditures, possibly because infrastructure is considered a more productive type of expenditure than, say, social expenditure, especially in the short to medium run, and possibly because there are legal and institutional constraints that tie debt to physical investment projects. In periods of fiscal consolidation, PII is adversely impacted through the decline in expenditures and the reduced use of (or access to) credit.

Table 5 presents additional regressions to test the robustness of the basic results. Regression 1 is the same Regression 4 of Table 3. Regressions 2 through 6 include as additional regressors the value of privatizations (as share of GDP) of existing infrastructure state-owned enterprises (Regression 2), the real exchange rate (Regression 3), the inflation rate (measured as loss of domestic purchasing power of the currency, Regression 4), the value of private infrastructure investment (as share of GDP, Regression 5), and all these additional regressors together (Regression 6). Only the last of these additional variables has some significance. The positive sign indicates that private and public investment are (contemporaneously) complementary (with a significance of 10 percent). Except for one regression, the influence of public debt on PII is positive and significant. The association between the fiscal balance and PII is always inverse, but it is only significant in three of the five new regressions.

A topic of heated debate among Latin American policymakers and international financial institutions such as the IMF, the Inter-American Development Bank and the World Bank is the influence that the loans of these institutions have on the level and the composition of public expenditures. If governments have access to international capital markets, multilateral lending does not necessarily increase public expenditure or alter its composition, though it may of course improve its quality and its economic and social impact. When access to external finance is limited, two opposing effects may operate: on the one hand, multilateral loans may finance projects that could not take place otherwise, but on the other hand, governments may be forced to adopt fiscal adjustment measures that they would not take otherwise. As recently argued by representatives of several Latin American governments, the adjustment measures usually promoted by the IMF may be behind the decline of PII. According to some, PII should be considered "below the line" when used to calculate the fiscal balance targeted in the IMF-supported adjustment programs, because PII leads to the generation of further fiscal revenues (for a summary of this debate see Agénor and Moreno-Dodson, 2006).

The set of regressions in Table 6 may shed some light on this debate. Regression 1 shows that official lending, as a whole, has a minor and negative—though not significant—effect on PII. However, when official lending is broken down by type of lender, as in Regression 2, it becomes clear that IMF lending may indeed be associated (with a 10 percent significance) with lower PII, as the critics claim, while other multilateral lending may be supportive of PII, though the latter effect is not significant. Regressions 3 and 4 replicate the two previous regressions, but with PII as share of primary expenditures as the dependent variable. The only additional conclusion to take from these regressions is that the negative influence that the IMF may have on PII is shared by other expenditures; in other words, the IMF does not create a bias against (or in favor of) infrastructure vis-à-vis other expenditures.

Another contentious topic in Latin America is the effect of debt defaults and renegotiations. Pro-defaulters argue that defaults release resources that can be reallocated to attend to needs that are more pressing than debt service. Opponents of default, however, argue that such potential benefits are easily overridden by the costs of reduced investment and production, and the loss of access to finance. In Lora and Olivera (2007), we have shown that defaults do help increase social expenditures in the short run, but the benefit is offset rapidly if that decision leads to a loss of credit access. However, as shown in Lora (2007), in Latin

America defaults are associated with larger social expenditures only in cases of very high indebtedness; otherwise they lead to lower social expenditures. Table 7 assesses whether debt defaults have any effect on PII. The relevant explanatory variables are a dummy (that takes the value of one when the government declares default)[5] and interaction terms between that dummy and the amounts of total public debt or total official debt (as ratios to GDP). The answer seems to be negative: defaults do not seem to have any effect on PII (a conclusion necessarily tentative, given the limitations of our dataset). This conclusion holds both when the dependent variable is the ratio of PII to GDP (Regressions 1 and 2) or when it is the ratio of PII to primary expenditures (Regressions 3 and 4).

5. Conclusion

The central conclusion of this paper is that (exogenous) debt increases (or declines) are associated with *increases* (or declines) in public infrastructure investment in seven Latin American countries, which runs contrary to conventional wisdom. Our estimates indicate that each additional dollar of debt leads to an increase of 1 cent in PII in the following year and around 1.4 cents in the long run. Though the effect is small, it is robust to the inclusion of the current fiscal balance and of many other macroeconomic variables. However, it is not robust to the breakdown of the fiscal balance between primary balance and interest payments because PII is strongly and *positively* associated with debt interest payments (which are, of course, influenced by debt levels). PII is also strongly and positively associated with total primary expenditures.

Surprising as they may look, these findings are largely consistent with previous literature. While no previous paper has found any direct effect of public debt on public investment or capital expenditures in general, the sensitivity of these variables to periods of fiscal retrenchment is a well-documented fact. The findings of the present paper are also consistent with the fact that public indebtedness has a deleterious effect on social expenditures. With respect to the influence of the debt service on public investment, our results contrast with previous findings.

This paper has also found some evidence of complementarity between public and private investment in infrastructure and of the negative effect of IMF adjustment loans on infrastructure expenditures. Finally, no evidence was found that debt defaults affect PII.

[5] This is so because the variable in the regression is the *change* in the default dummy variable.

The positive effect of public debt on PII found in this paper may stem from a combination of economic, political and institutional factors that deserve greater attention before any policy recommendations can be advanced. Economic considerations may justify giving infrastructure expenditure higher priority than other types, such as social expenditure, in the face of rising debt stocks, because PII may generate higher economic and fiscal returns (at least in the short to medium run) and because delays in infrastructure projects often carry heavy costs. Politically, public infrastructure projects are more visible and more easily accepted as an adequate use of finance, and this bias is even enshrined in the legal system of many countries, where debt issuance is restricted to physical investment projects. These factors create a dynamic whereby PII increases like any other expenditure during periods when no debt is incurred but tends to increase even further when expenditure increases lead to indebtedness. This is consistent with the observed vulnerability of PII during periods of fiscal retrenchment with debt reduction.

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Table 1. Summary Statistics and Unit Root Tests

Variable	Obs.	Mean	Std. Dev.	Min	Max	Unit Root Test (Dickey Fuller) - t statistics						
						Argentina	Bolivia	Brazil	Chile	Colombia	Mexico	Peru
Total Investment in Infrastructure	47	0.035	0.022	0.009	0.083	-2.59*	-3.25**	-3.59**	-4.49***	-3.68**	-4.10***	-2.27*
Public Investment in Infrastructure	47	0.014	0.011	0.002	0.043	-2.74*	-5.34***	-3.87***	-3.82***	-4.71***	-3.81***	-4.22***
Private Investment in Infrastructure	47	0.021	0.014	0.000	0.051	-2.19	-2.05	-4.68***	-3.68**	-2.07	-4.15***	-1.73
Log GDP per capita	47	8.8	0.5	7.7	9.5	-2.63*	-4.12***	-3.32**	-3.09**	-3.28**	-4.00***	-2.77*
Public Debt	47	0.378	0.164	0.125	0.724	-2.00	-3.13**	-1.95	-1.99	-0.24	-4.23***	-2.59
Fiscal Balance	46	-0.019	0.034	-0.142	0.042	-4.70***	-34.12***	-2.17	-3.27**	-5.23***	-3.12**	-5.68***
Debt Service	47	0.030	0.034	0.003	0.184	-3.29**	-2.88*	-3.18**	-4.69***	-2.72*	-3.06**	-7.76***
Primary Expenditure	46	0.167	0.054	0.091	0.297	-5.08***	-2.33	-3.46**	-1.92	-1.85	-3.19**	-4.36***
Total Revenues	46	0.177	0.043	0.121	0.259	-25.29***	-4.42***	-4.92***	-2.84*	-3.35**	-5.41***	-5.92***
Primary Balance	47	0.009	0.027	-0.053	0.059	-3.23**	-4.94***	-3.16**	-3.59**	-4.05***	-2.54	-3.65**
Official Debt	47	0.227	0.291	0.030	1.060	-5.53***	-3.89***	-3.03**	-3.21**	-2.63*	-4.20***	-5.45***
Multilateral Debt	47	0.118	0.173	0.012	0.593	-5.08***	-2.41	-2.58*	-3.26**	-2.65*	-4.24***	-4.88***
IMF Debt	47	0.018	0.014	0.000	0.055	-4.23***	-7.12***	-3.05**	-2.95**	.	-3.93***	-5.32***
Bilateral Debt	47	0.109	0.136	0.011	0.468	-4.99***	-4.21***	-3.12**	-3.76***	-2.62*	-4.35***	-5.13***
Default	47	0.234	0.428	0.000	1.000	-2.46	-3.60**	-3.87***	-3.87***	.	-3.87***	-3.87***
Privatizations	47	0.011	0.011	-0.002	0.049	-2.87*	-8.65***	-2.50	-5.57***	-4.43***	-6.80***	-6.18***
Real Exchange Rate	47	104.0	31.7	65.7	267.3	-6.63***	-40.09***	-4.51***	-2.96**	-3.54**	-4.47***	-6.97***
Inflation	47	14.6	24.8	-1.2	131.8	-3.53**	-2240.7***	-4.46***	-3.94***	-3.99***	-3.40**	-4.34***

Note: All variables, except log GDP per capita, real exchange rate, inflation and default dummy are shares of GDP.

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

Unit root tests on first difference of each series.

Table 2. Pairwise Correlations

	Total Investment in Infrastructure	Public Investment in Infrastructure	Private Investment in Infrastructure	Log GDP per capita	Public Debt	Fiscal Balance	Debt Service	Primary Expenditure	Total Revenues	Primary Balance	Official Debt	Multilateral Debt	IMF Debt	Bilateral Debt	Default	Privatizations	Real Exchange Rate
Total Investment in Infrastructure	1																
Public Investment in Infrastructure	0.866	1															
Private Investment in Infrastructure	0.910	0.580	1														
Log GDP per capita	-0.631	-0.570	-0.555	1													
Public Debt	0.092	0.184	-0.002	-0.625	1												
Fiscal Balance	-0.174	-0.407	0.054	0.238	-0.380	1											
Debt Service	-0.269	0.129	-0.545	0.092	0.413	-0.650	1										
Primary Expenditure	0.780	0.467	0.882	-0.672	0.193	-0.107	-0.449	1									
Total Revenues	0.663	0.393	0.754	-0.565	0.196	-0.012	-0.267	0.897	1								
Primary Balance	-0.445	-0.325	-0.454	0.322	0.117	0.272	0.415	-0.494	-0.125	1							
Official Debt	0.595	0.445	0.600	-0.922	0.718	-0.213	-0.162	0.718	0.578	-0.322	1						
Multilateral Debt	0.676	0.540	0.652	-0.858	0.666	-0.278	-0.135	0.755	0.622	-0.309	0.954	1					
IMF Debt	-0.095	-0.042	-0.120	-0.334	0.738	-0.171	0.290	-0.019	0.002	0.319	0.451	0.458	1				
Bilateral Debt	0.413	0.265	0.453	-0.881	0.688	-0.101	-0.176	0.574	0.444	-0.296	0.924	0.768	0.382	1			
Default	-0.030	0.133	-0.159	-0.231	0.578	-0.247	0.526	-0.126	0.030	0.382	0.226	0.139	0.411	0.307	1		
Privatizations	0.257	0.117	0.321	-0.313	0.074	0.042	-0.196	0.327	0.307	-0.202	0.291	0.172	-0.069	0.404	0.223	1	
Real Exchange Rate	-0.277	-0.022	-0.433	0.106	0.290	-0.452	0.732	-0.366	-0.261	0.358	-0.152	-0.094	0.330	-0.204	0.260	-0.371	1
Inflation	-0.139	0.216	-0.406	0.050	0.322	-0.524	0.872	-0.372	-0.193	0.424	-0.160	-0.123	0.315	-0.187	0.416	-0.173	0.759

Note: All variables, except log GDP per capita, real exchange rate, inflation and default dummy are shares of GDP.

Table 3. Public Investment in Infrastructure, Share of GDP

Public Investment in Infrastructure (share of GDP)	OLS fixed effects		Arellano Bond			
	1	2	3	4	5	6
Public Investment in Infrastructure (share of GDP, lagged)	0.045	-0.009	0.4445 ***	0.2391 **	0.2443 **	0.2173 *
	(0.299)	(0.061)	(4.349)	(2.282)	(2.028)	(1.906)
Public Debt (share of GDP, lagged)	0.0138 *	0.0133 *	0.0163 ***	0.0108 *	0.0041	0.0064
	(1.946)	(1.946)	(2.654)	(1.909)	(0.570)	(0.854)
Fiscal balance (share of GDP)		-0.0278		-0.0449 ***		
		(1.101)		(3.422)		
Debt service (share of GDP)					0.0691 ***	0.0595 **
					(2.890)	(2.533)
Primary expenditure (share of GDP)						0.0653 *
						(1.649)
Total Revenues (share of GDP)						-0.0316
						(0.627)
Primary balance (share of GDP)					-0.0233	
					(0.999)	
Constant	-0.0005	-0.0006	-0.0009 ***	-0.0011 ***	-0.0009 ***	-0.0011 ***
	(0.401)	(0.514)	(4.255)	(5.504)	(4.052)	(4.578)
Observations	47	46	47	46	47	45
Number of countries	7	7	7	7	7	7
Sargan test (prob > chi^2)			57.97	53.55	54.37	48.76
			1.00	1.00	1.00	1.00

Absolute value of t statistics in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include as controls logarithms of GDP (per capita) and GDP per capita squared.
All estimators are in first differences.

Table 4. Public Investment in Infrastructure, Share of Primary Expenditure

Public Investment in Infrastructure (share of primary expenditure)	1	2	3	4
Public Investment in Infrastructure (share of primary expenditure, lagged)	0.394	0.3252	0.2401	0.2419
	(3.814) ***	(3.157) ***	(2.040) **	(2.126) **
Public Debt (share of GDP, lagged)	0.1832	0.1526	0.0924	0.0875
	(3.691) ***	(3.097) ***	(1.625)	(1.496)
Fiscal Balance (share of GDP)		-0.2626		
		(2.721) ***		
Debt service (share of GDP)			0.5048	0.5376
			(2.964) ***	(3.123) ***
Primary expenditure (share of GDP)				-0.2371
				(0.723)
Total Revenues (share of GDP)				-0.459
				(1.142)
Primary balance (share of GDP)			0.0682	
			(0.362)	
Constant	-0.0096	-0.0095	-0.0081	-0.0081
	(5.192) ***	(5.321) ***	(4.365) ***	(4.269) ***
Observations	43	43	43	43
Number of countries	6	6	6	6
Sargan test (prob > chi^2)	42.52	38.11	36.69	37.00
	1.00	1.00	1.00	1.00

Absolute value of z statistics in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include as controls logarithms of GDP (per capita) and GDP per capita squared.
All estimators are Arellando Bond in first differences.

Table 5. Public Investment in Infrastructure, Control Variables

Public Investment in Infrastructure (share of GDP)	1	2	3	4	5	6
Public Investment in Infrastructure (share of GDP, lagged)	0.2391	0.2391	0.2417	0.2429	0.155	0.1413
	(2.2821) **	(2.2555) **	(2.2536) **	(2.3058) **	(1.3794)	(1.1406)
Public Debt (share of GDP, lagged)	0.0108	0.0107	0.0128	0.0093	0.0169	0.0208
	(1.9087) *	(1.8846) *	(2.1496) **	(1.4530)	(2.6085) ***	(2.4219) **
Fiscal Balance (share of GDP)	-0.0449	-0.045	-0.0232	-0.0386	-0.0524	-0.0339
	(3.4217) ***	(3.2902) ***	(1.1148)	(2.0941) **	(3.8969) ***	(1.3745)
Privatizations (share of GDP)		0.0015				-0.0195
		(0.0445)				(0.5002)
Real exchange rate			0.000028			0.000028
			(1.3691)			(1.2786)
Inflation				0.000016		-0.0000092
				(0.4844)		(0.2514)
Private investment in infrastructure (share of GDP)					0.1457	0.1688
					(1.7826) *	(1.7389) *
Constant	-0.0011	-0.0011	-0.0011	-0.0011	-0.0012	-0.0012
	(5.5040) ***	(5.1722) ***	(5.2318) ***	(4.7661) ***	(5.8317) ***	(4.8332) ***
Observations	46	46	46	46	46	46
Number of countries	7	7	7	7	7	7
Sargan test (prob > chi^2)	53.55	52.29	49.25	53.03	53.32	44.59
	1.00	1.00	1.00	1.00	1.00	1.00

Absolute value of t statistics in parentheses.

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

All regressions include as controls logarithms of GDP (per capita) and GDP per capita squared.

All estimators are Arellando Bond in first differences.

Table 6. Public Investment in Infrastructure and Multilateral Debt

Public Investment in Infrastructure	Share of GDP		Share of primary expenditure	
	1	2	3	4
Public Investment in Infrastructure (share of GDP, lagged)	0.2159	0.186		
	(2.0247) **	(1.6673) *		
Public Investment in Infrastructure (share of primary expenditure, lagged)			0.2983	0.2642
			(2.7860) ***	(2.3469) **
Fiscal balance (share of GDP)	-0.0385	-0.0418	-0.2228	-0.2322
	(2.6740) ***	(2.7688) ***	(2.0650) **	(2.0538) **
Public Debt (share of GDP, lagged)	0.0126	0.0129	0.1688	0.171
	(2.1465) **	(2.0236) **	(3.1995) ***	(3.0690) ***
Official Debt (share of GDP, lagged)	-0.0161		-0.0987	
	(1.0680)		(0.7724)	
Multilateral debt (share of GDP, lagged)		0.0305		0.2701
		(1.0258)		(1.1348)
IMF debt (share of GDP, lagged)		-0.1004		-0.5949
		(1.7271) *		(1.2696)
Bilateral debt (share of GDP, lagged)		-0.0086		-0.093
		(0.4661)		(0.5808)
Constant	-0.0012	-0.0013	-0.0099	-0.0111
	(5.6229) ***	(5.3771) ***	(5.4272) ***	(5.3758) ***
Observations	46	46	43	43
Number of countries	7	7	6	6
Sargan test (prob > chi^2)	52.79	44.53	36.86	32.27
	1.00	1.00	1.00	1.00

Absolute value of t statistics in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include as controls logarithms of GDP (per capita) and GDP per capita squared.
All estimators are Arellando Bond in first differences.

Table 7. Public Investment in Infrastructure and Defaults

Public Investment in Infrastructure	Share of GDP		Share of primary expenditure	
	1	2	3	4
Public Investment in Infrastructure (share of GDP, lagged)	0.2464	0.2355		
	(2.2496) **	(2.1192) **		
Public Investment in Infrastructure (share of primary expenditure, lagged)			0.3246	0.3246
			(3.1067) ***	(3.0592) ***
Fiscal balance (share of GDP)	-0.0429	-0.0518	-0.2684	-0.269
	(3.0614) ***	(3.1908) ***	(2.6855) ***	(2.3102) **
Public Debt (share of GDP, lagged)	0.0119	0.0181	0.136	0.1365
	(1.7614) *	(2.0610) **	(2.1930) **	(1.7908) *
Default	0.0029	0.009	-0.021	-0.0206
	(0.6420)	(1.2691)	(0.5348)	(0.3466)
Default*Public debt	-0.0053	-0.0138	0.0413	0.0407
	(0.5999)	(1.1787)	(0.5325)	(0.4086)
Default*Offiicial debt		0.0053		0.0004
		(1.1223)		(0.0108)
Constant	-0.0011	-0.0011	-0.0096	-0.0096
	(4.9626) ***	(5.0263) ***	(5.0963) ***	(5.0078) ***
Observations	46	46	43	43
Number of countries	7	7	6	6
Sargan test (prob > chi^2)	49.28	46.95	36.84	35.76
	1.00	1.00	1.00	1.00

Absolute value of t statistics in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions include as controls logarithms of GDP (per capita) and GDP per capita squared.
All estimators are Arellando Bond in first differences.