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Macroeconomic Effects of Private Sector Participation in Latin America's Infrastructure

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Abstract

Trujillo, Martín, Estache, and Campos provide empirical evidence on the impact that private participation in infrastructure has had on key macroeconomic variables in a sample of 21 Latin American countries from 1985–98. Specifically, they look at the effects on GDP per capita, current public expenditures, public investment, and private investment, controlling for country effects and institutional factors. The authors also investigate the relevance of the specific contractual form of private participation contracts on these variables and show differentiated effects according to contract types.

The results suggest that:

- Private sector involvement in utilities and transport have some, but not impressive, positive effects on GDP per capita.
- There is some degree of crowding-out of private investment resulting from greenfield projects in utilities, and delayed crowding-in from concessions in transport.
- There is crowding-in of public investment by private participation in utilities, while there is crowding-out by increased private investment in transport.
- Private participation in utilities decreases recurrent expenditures, while in transport it results in an increase.

The net effect on the public sector account is uncertain, but this uncertainty is a major risk. The revelation of this risk may be the main contribution of this paper since it is inconsistent with the fiscal gains expected by many policymakers as they engage in infrastructure privatization programs.

This paper—a joint product of the Governance, Regulation, and Finance Division, World Bank Institute, and Finance, Private Sector, and Infrastructure Unit, Latin America and the Caribbean Region—is part of a larger effort in the Bank to increase understanding of infrastructure regulation. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Gabriela Chenet-Smith, room J3-304, telephone 202-473-6370, fax 202-676-9874, email address gchenet@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. Antonio Estache may be contacted at aestache@worldbank.org. October 2002. (26 pages)

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1. Introduction

The relevance of the design of institutions for the effectiveness of policies is now well recognized by policymakers from all boards (see The World Bank, 2002 for a recent survey of the debate and of the evidence). This design becomes particularly important where reforms have significantly changes the types and roles of players. The restructuring of the infrastructure sector with a view to increase competition and private sector participation in Latin America over the last decade provides a clear example of such an institutional change. Since the late 1980s, many Latin American countries have indeed progressively opened their infrastructure sectors to private operators, seeking a remedy to structural deficits and hoping to foster investment and growth.

The literature on the impact of these reforms can be classified into three broad types. The first group focuses mostly on the macroeconomic effects of a macroeconomic view of the reforms – the "macro-macro" group –; the second, on the sector-specific effects of sector-specific reforms – the "micro-micro" group, and the third on the macroeconomic effects of sector specific reforms – the "micro-macro" group. The "macro-macro" category is by a wide margin the most populated. It has generally been supported by fairly detailed econometric analyses of the relatively good macroeconomic databases available (see McGillivray and Morrissey, 1999, for a relatively recent survey). The "micro-micro" group has generated fewer analytically strong studies partially because detailed relevant data is not easy to obtain. Most of the published papers have focused on Argentina and Chile, where enough time has gone by to generate reasonable time series (for a recent overview, see Guasch, 2001). A much more modest literature has focused the micro-macro group and looked at the macroeconomic effects of sector-specific reforms, even if these sectoral reforms have been key components of the overall macroeconomic restructuring agenda. Exceptions include the literature on the general equilibrium effects of reform or the literature on convergence (see De la Fuente, 2000, or Estache, Foster and Wodon, 2002).

This paper contributes to the "micro-macro" literature by offering a first empirical assessment of the macroeconomic effects of the increased private sector participation in the

management and financing of the infrastructure sectors (PPI).[1] Its main purpose is to provide empirical evidence for Latin America of the effects on several key macroeconomic variables of the increased role of "privatization", defined as the decision to rely on the private sector to implement projects.[2] In this analysis, we also isolate some institutional factors and control by country effects, recognizing that each country in the region may face different sources of risks.

In view of these objectives, the paper suffers from at least two major drawbacks. First, the quality of the data available is a significantly restrictive factor and will force us to further limit the hope placed on being able to draw very strong policy conclusions. This drawback is however also a source of strength since it forces to highlight the main direction for additional work through the analysis. Second, it lacks an explicit theoretical model to justify the "micro-macro" effects of increased PPI.[3] However, our goal here is not to test any specific theory but rather to provide – if possible – statistically significant evidence on the sign and size of the effects of PPI on the most common macroeconomic indicators. We specify very general empirical relationships between each of our macroeconomic variables and different subsets of instruments that summarize when and how private participation was introduced in each country and under which institutional environment. Our results, therefore, do not look for causal liaisons; they represent correlations that may hint what the macroeconomic impact of "privatization" (if any) has been so far in Latin America.

In spite of these limitations, we manage to obtain useful results, relying on standard econometric technique. We, first, estimate pooled-data models ignoring country specific effects. These models provide both initial values for the "micro-macro" effects and a benchmark for comparisons. However, if unobserved individual heterogeneity (*i.e.*, country-specific effects) is relevant in our statistical relationships, its omission yields biased estimates. To overcome this problem, we also estimate panel data models that allow for an explicit testing of individual

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[1] Siniscalco *et al.* (2001) provide a recent similar study for OECD countries.

[2] The recent literature on regulation theory explicitly acknowledges that the term "private participation" is much more general that "privatization". The former encompasses many different forms that include divestures, concessions, management contracts, leases, etc. (see Laffont and Tirole, 1998).

[3] The new growth theory literature is the most likely place to find such a model (see Aghion *et al.*, 1999, for example). On addition, political economy models may help explain under what circumstances privatization policies can be a success or a failure (see Alesina and Perotti, 1996).

heterogeneity.[4] The differentiation between these two types of model specifications yields evidence on the effects of the "privatization" policies for the region as a whole as well as for average country specific effects.

The remaining sections of the paper are organized as follows. Section 2 discusses the methodology followed to draw a minimum set of robust policy implications on the effects of PPI. Section 3 describes the sample and defines the most relevant variables used. Section 4 summarizes the main results on the impact of private participation policies on each macroeconomic variable. Finally, Section 5 concludes with a quick summary of the main empirical implications.

2. Testing the macroeconomic effects of PPI

There is no simple way of anticipating the overall macroeconomic effects of a policy opening infrastructure to the private sector in a particular country because many tradeoffs are at stake. The best we can do with the kind of data available is to focus on "reduced" forms which net out more structural positive and negative effects of the reforms on the key macroeconomic variables because we do not have enough data to separate them. From the viewpoint of private investment, for instance, many privatization policies are usually expected to bring about positive results on the medium or long run if the overall efficiency of the economy is improved as a result of the policy changes. However, the long run payoffs may be preceded by short-run costs, if increased competition reduces margins and profits, hampering the investment capabilities of private investors. Since we can only look at the sectors at a very aggregate level and sector specific reforms are difficult to pick up, we can only see the accumulated effects of the policy changes year after year, as new investments results from all prior reforms and cannot be assigned to any specific policy change. This is why we focus on a very limited concern which has not been studied so far. We focus on identifying the sign of the effects that can be genuinely attributed to the net effects of private sector participation in infrastructure projects. The size of the effects is also computed but are for now less interesting since it probably represents a large number of effects with opposite signs.

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[4] See Chamberlain (1984) for a survey and examples on the use of macroeconomic panel data.

With these limitations in mind, the paper proposes a formal test of the consequences of infrastructure "privatization" as defined specifically later on four selected macroeconomic variables: total gross domestic product (GDP) per capita, private investment, public investment and current public expenditures. The first dependent variable is measured in levels. By focusing on per capita figures, we also get a chance at a modest look at the impact on poverty though income levels. The other four are calculated as a percentage of the GDP. Within infrastructure, we will additionally distinguish between *utilities* (electricity, gas, water and sanitation and telecommunications) and *transportation* (which include airports, ports, railways and roads) to test for possible differences.[5] Since the timing of the changes and the policy environment varies significantly across countries, we simultaneously control for a time trend and variables that represent the institutional framework. In addition, we specifically take into account and test the possible existence of (unobservable) country-effects.[6]

Formally, we handle the data in two separate ways. First, we use all available data, pooling together the whole information set into a single sample. In this *pooled-data case*, where each country and year is treated as separate observation (denoted by subscript *i*) and no individual heterogeneity is allowed, we specified and estimated the following linear relationship for each one of our five macroeconomic variables:[7]

$$y_i = \alpha + d_i'\beta + x_i'\gamma + \xi_i \,. \qquad (2.1)$$

The term y_i represents the dependent variable, α is the intercept, d'_i is a vector of dummies that account for private participation and its starting year, and x'_i is a vector of control variables that include a time trend and others that characterize the country's institutional framework; finally, ξ_i is a normally distributed error term, uncorrelated with the regressors, and α, β, γ the (vectors of) parameters to estimate.

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[5] For a review on how different types of infrastructures affect macroeconomic fundamentals, see for example Munnell (1992) or Gillen (1996).

[6] As usual, a strong misspecification risk is always present in this sort of *ad hoc* models. However, since our idea is to isolate partial correlations among the privatization variables and the macroeconomic one, the use of the time trend and the institutional variables is the easiest way of minimizing that risk in this kind of heterogeneous sample. A lagged dependent variable (tried at preliminary stages of the work) would have done something similar, but at the costs one degree of freedom and lower significance levels.

[7] Non-linear specifications were also discarded in preliminary estimations.

The variables included in x reflect the political and governance situation taking into account the degree of political stability of the country (approximated by the degree of internal conflict) and the strength of the governance structure of the country. According to the specification of x'_i it is possible to derive a separate models from expression (2.1). In the first one (*Model 1*), the macroeconomic variables are explained by two dummy variables that reflect the existence or not of some form of privatization in utilities and in transport (they will be labeled *DU*, *DT* respectively). The second model (*Model 2*) tests, in addition, for the effect of investment associated with a specific form of private sector participation on each one of the macroeconomic variables. We will distinguish three types of "privatizations" associated with private investment: divestures or sale of the assets (*DIV*), concessions (*CONC*) and greenfield projects (*GP*). Each of these variables is defined as the share of total investment from privatization associated with each contract type.

The expected sign on these explanatory variables varies with the macroeconomic variable explained. If we are to believe the predictions of the advocates of privatization, for GDP per capita and for domestic investment as percentage of GDP, we should expect a net positive effect of infrastructure privatization, since these are some of the core macroeconomic promises of privatization. For the share of public investment in GDP and for the share of current expenditures, the *a priori* expectation would be a negative sign since we expect infrastructure privatization to reduce the overall size of the public sector. In addition, we also expect stronger institutions to generate better macroeconomic performances.

The second model we test makes use of the panel characteristics of our sample, where a number of individuals (21 countries, denoted by subscript j) are repeatedly observed through time (t=1985,...,1994). In the *panel data case* we can now specifically study whether there are country-specific effects not included in expression (2.1). For each of our five macroeconomic variables the linear relationship that we test becomes

$$y_{jt} = \alpha + d'_{jt}\beta + x'_{jt}\gamma + \eta_j + \xi_{jt}. \qquad (2.2)$$

Both dependent and independent variable have time-variability, but that a *Model 1* and a *Model 2* could be estimated again, using the same definitions of x provided above. The most significant difference between (2.2) and the *pooled-data case* is that a country-specific effect (labeled η_j) is

explicitly accounted for, whereas the error term ξ_{jt} is again normally distributed and uncorrelated with the regressors.

It is precisely the nonappearance of the country-specific term that may bias the estimates in the pooled-data case due to a standard "omitted-variable" problem (Amemiya, 1985). Panel data models allow for a method to correct this problem, either using a "fixed-effects" or a "random-effects" approach. In the first case, the (unobserved) individual heterogeneity is represented as a parametric shift in expression (2.2). It is "as if" a new intercept, $\alpha_j = \alpha + \eta_j$, time-invariant and particular to each country, were defined and the estimation by ordinary least squares (OLS) would explicitly consider it. In the random effects case, the individual heterogeneity term is assumed to be part of the error term, $u_{jt} = \eta_j + \xi_{jt}$. The model becomes heteroskedastic and must be estimated by Generalized Least Squares (GLS).

Unfortunately, both approaches do not always yield the same result, as observed by Hausman (1978). However, if the effects of omitted variables can be appropriately summarized by a random variable and the (unobserved) individual effects may also represent the ignorance of the investigator, it does not seem unreasonable to treat in one case the source of ignorance as fixed (α_j) and in the other case as random (u_{jt}). It appears that one way to encompass the fixed-effects and the random-effects models is to assume from the outset that the effects are random and use GLS to estimate them. The immediate check, summarized in the so-called Hausman test, would be then to contrast whether the heteroskedasticity of the model allows a fixed-effect approach or not.[8] An Hausman test is used when there are two estimators of the parameter vector β (*e.g.* β_{GLS} and β_{OLS}). Under the null hypothesis (H_0) individual effects are not correlated with the regressors, β_{GLS} is consistent and efficient, but β_{OLS} is inconsistent. Under the alternative H_1, both estimators are consistent, but β_{GLS} is inefficient. This allows a routinely performed comparison between fixed-effects and random-effects estimates.

A final important question regarding model specification is related to potential dynamic effects in our estimated relationships. In general, unless the economies behave in a hyper-rational

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[8] This argument has been widely discussed in the panel data literature. For example, Arellano (1993) insists on the fact that in the fixed-effects model investigators make inferences conditional on the effects that are in the sample, whereas in the random-effects inferences are based on the population. But there is really no distinction in the nature of the effect: it is up to the investigator to decide whether to make one type of inferences or the other.

way and manage to internalize instantaneously the effects of reform policies, the optimal lag for the dummies included in vector *d* should be different from zero. It is natural to expect that privatization may not bring its full (positive or negative) consequences immediately. Instead, based on a simple look at the facts in the region, a reasonable lag of one or two years should be considered. We investigate these dynamic effects by estimating, for each of our dependent variables, for each data case (pooled vs. panel), and for each of our models (*Model 1* and *2*) slightly different variations on (2.1) and (2.2) where the dummies have been lagged one and two periods. The results of all these estimations, reported in Section 4 below, allow us to analyze the macroeconomic effects of privatizations, by type of process, considering the existence of country-specific effects, and taking into account short rum versus medium-run impacts.

3. The variables, the data and their limitations

We have collected a sample that covers 21 Latin American countries, all from Mexico to Chile, excluding Caribbean states, Belize, Surinam and French Guyana. In principle, this geographical dispersion offers enough variety of infrastructure reform experiences and of income levels to yield useful policy conclusions. The time period covered stops in 1998, just before the effects of the Asian crisis started to have a major impact in the financing of Latin America's infrastructure.

The specific sample size for each macroeconomic variable considered in this study varies across the models estimated. This is driven by the fact that we could not obtain comparable data for all variables for all countries. The largest samples cover all of the 21 countries. The smallest focuses only on 16 countries. Since the overall sample tracks the changes in the role of the private sector in infrastructure for 14 years (from 1985 to 1998), the econometrics can make use of panel of data approaches as described above. Since there are several variables for which no information was available for some years, our panel is unbalanced.[9]

The macroeconomic dependent variables – GDP per capita, total public investment, total private investment, total gross domestic investment and current public expenditures, and public

[9] However, this can easily be handled in the econometrics (Greene, 1995).

deficit – are from the World Development Indicators produced by The World Bank (1999), and are all expressed in 1995 US$ constant prices.[10]

Table 1: Main macroeconomic variables: levels and ranking

Country	GDP		Public Investment		GDI		Current expenditure		Fiscal deficit	
	Ranking	Value (1)	Ranking	Value (2)	Ranking	Value (2)	Ranking	Value (2)	Ranking	Value (2)
Argentina	1	7065.76	20	1.49	14	19.04	17	8.29	10	-1.25
Bolivia	17	863.76	4	7.86	18	15.36	10	12.34	7	-1.53
Brazil	3	4269.94	19	2.32	11	21.38	5	16.00	1	-9.33
Chile	7	3444.01	7	5.02	6	23.87	14	10.44	16	1.19
Colombia	11	2182.56	5	7.82	10	21.61	9	12.56	8	-1.36
Costa Rica	9	2471.03	8	4.95	3	26.58	4	16.49	6	-2.25
Ecuador	14	1518.33	9	4.64	13	20.54	13	10.45	14	0.48
El Salvador	15	1488.07	13	3.65	17	15.56	12	10.79	–	–
Guatemala	16	1398.81	17	2.67	19	14.29	21	6.38	–	–
Guyana	19	671.65	1	15.91	1	29.64	2	19.00	–	–
Haiti	21	440.21	10	4.59	21	10.45	20	7.84	4	-2.63
Honduras	18	697.03	6	7.61	4	25.43	11	11.81	–	–
Jamaica	13	1567.49	–	–	2	29.23	7	14.85	–	–
Mexico	5	4102.54	16	3.23	7	22.70	15	9.51	3	-3.47
Nicaragua	20	476.69	2	12.40	5	23.97	1	24.01	2	-9.09
Panama	8	2847.40	15	3.54	9	21.94	3	17.66	13	0.44
Paraguay	12	1793.86	11	4.49	8	22.26	19	7.86	15	0.81
Peru	10	2391.83	14	3.62	12	21.31	18	8.23	5	-2.33
Trinidad and Tobago	4	4247.32	18	2.51	16	17.72	6	15.22	12	0.22
Uruguay	2	4989.11	12	3.76	20	12.97	8	13.43	11	-1.08
Venezuela	6	3510.81	3	9.60	15	18.67	16	8.63	9	-1.29

Notes: (1) in US$ per capita. (2) In percentage of GDP.
Source: World Development Indicators (1999) and own elaboration.

[10] Although initially tried, we ended up rejecting the models on the effects on the public deficit because we did not feel the variable to be reliable enough. For the interested reader, PPI in utilities, tends to be associated with an immediate increase the deficit while PPI in transport is associated with a delayed increase in the deficit.

Table 1 summarizes the ranking of the countries covered by the sample, for the sample time average and for each one of the macroeconomic variables. At first glance, the table shows the lack of consistency of countries in ranking, suggesting that there are enough differences in behavior across variables to justify a separate analysis of each macroeconomic variable individually. The table also shows the mains sources of imbalances in our data panel. The fiscal deficit is the least complete variable since values for El Salvador, Guatemala, Guyana, Honduras and Jamaica are missing.

The data quality issues already referred to start here. Indeed, there may be a measurement problem in the definition of several of these macroeconomic variables in relation to the concerns addressed here. According to the World Development Indicators database, public deficit, public expenditure and public investment all refer to the central government alone. However, much of the infrastructure-related activities are usually developed by public enterprises that may finance themselves outside the central government's budget. Even if most Latin American public enterprises get financed through government transfers and decline in infrastructures financial needs but be matched by a corresponding decline in the government budget, our data could produce some imprecise results. For example, they fail to capture much of the impact on deficits and public investment of utilities privatization if the current and/or capital expenditures on utilities prior to privatization used to be made by public firms rather than the government. Furthermore, this effect may be different for different types of infrastructures (*e.g.*, telecoms and power usually belonged to public enterprises, while roads and ports were typically under the central government). Fortunately, there is not a similar problem in the case of activities financed by regional government in Latin America. With the major exception of Brazil (in the case of roads, for example), the most relevant privatization transactions in the region always involved the central government.

The second matter of concern with the variables is the specific definition of "privatization". We rely on a set of "*infrastructure privatization dummies*" (*d* in the econometric model), constructed from The World Bank PPI database on private participation in infrastructure projects as follows:

- ***DU***: takes a value of 1 starting on the first year there is a private utility project in a specific country (e.g. a private power generator or a private cellular operator).

- ***DT***: takes a value of 1 starting on the first year there is a (significant) private operator of transport infrastructure in a specific country. Table 2 shows the first year in which each dummy takes the value of 1.

Table 2: Starting year for private participation in utilities and transport

Country	Utilities	Transport	Country	Utilities	Transport
Argentina	1990	1991	Honduras	1994	–
Bolivia	1987	1996	Jamaica	1990	–
Brazil	1985	1985	Mexico	1991	1991
Chile	1987	1995	Nicaragua	1993	–
Colombia	1991	1994	Panama	1996	1994
Costa Rica	1989	–	Paraguay	1992	–
Ecuador	1985	1985	Peru	1985	1985
El Salvador	1995	–	Trinidad and Tobago	1991	-
Guatemala	1994	1997	Uruguay	1992	1993
Guyana	1991	–	Venezuela	1985	1985
Haiti	1995	–			

Notes: (1) Average. Dummies *DU* and *DT* take value 1 from the starting year onwards.

Source: The World Bank, International Country Risk Guide and own elaboration

The main problem with this variable is that it reflects the start of the reliance on some form of project finance scheme rather than a major effort to restructure the sector and to rely systematically on private finance and operation for most of the sector. The correlation between the variable constructed this way and a variable that would focus on major policy changes is strong but far from perfect. We decided to stick to this approach because project finance data is more closely related to actual investment levels expected to influence the levels of macroeconomic indicators, in particular for the public sector.

In addition, we also have tried to distinguish between contract types associated with each project. To do so, we constructed the following variables associated with the three types of infrastructure "privatization":

- ***DIV***: is the number of divestitures or asset sales contracts in each year due to infrastructure privatizations for each of the two broad subsectors for each country.

- *GP*: is the number of greenfield projects contracts in each year due to infrastructure privatizations for each of the two broad subsectors for each country.

- *CONC*: is the number of concessions contracts in the database in each of the two subsectors.

Each contract type variable is multiplied by the relevant dummy to ensure that the contract type only kicks into the regression after the first privatization in utilities and transport has started. This is recognized by a *DT* and *DU* suffix attached below to each contract type in the tables summarizing the results.

Table 3: Average value of the institutional variables between 1985 and 1998

Country	Political Stability	Corruption		Country	Political Stability	Corruption
Argentina	9.9	3.4		Honduras	5.8	2.1
Bolivia	5.9	2.1		Jamaica	9.1	2.6
Brazil	8.9	3.6		Mexico	9.4	3.1
Chile	7.4	3.2		Nicaragua	5.3	4.7
Colombia	5.4	2.7		Panama	8.0	2.1
Costa Rica	9.3	4.9		Paraguay	9.4	1.2
Ecuador	9.8	3.1		Peru	5.1	3.0
El Salvador	4.7	2.5		Trinidad and Tobago	8.8	2.8
Guatemala	6.3	2.5		Uruguay	8.3	3.0
Guyana	7.7	1.7		Venezuela	10.4	3.0
Haiti	4.7	1.4				

Notes: (1) Political stability is measured from 1 (low) to 12 (high). Corruption goes from 1 (bad) to 6 (clean).
Source: International Country Risk Guide.

Table 3 shows the institutional explanatory variables used as regressors in the model specifications (2.1) and (2.2) above are the following. Two institutional variables (labeled by x in the model) have been obtained from the International Country Risk Guide (ICRG). The index of political stability (**D**) is approximated by the inverse of the degree of violence and its impact on the ability of the government to govern. The countries are ranked on a scale of 1 to 12 with the lowest rating is allocated to the most unstable countries (*e.g.* countries during a civil war) and the highest rating does to the stable countries. The quality of the political system of the country (***F***) is

also approximated by a ranking on a scale of 1 to 6. A ranking of 1 is allocated to the most corrupt countries. A value of 6 is allocated when a country is perceived to be corruption-free.[11]

4. The results

We relied on the *LIMDEP v.7.0* econometric software to obtain OLS and GLS estimates of the linear specifications (2.1) and (2.2) described above. For each dependent variable (GDP per capita, GDI, public investment, public expenditure and public deficit) we first provide a table for *Model 1* (where privatization dummies are separated into transportation and utilities) and then a second table for *Model 2* (where contract types for transportation and utilities are separately identified). Each table is divided into two main columns that allow an explicit comparison between the pooled data case (i.e., not taking into account the presence of country-specific effects) and the panel data case. Finally, each column presents the results distinguishing whether the privatization dummies are simultaneous (zero lag) or are lagged one or two periods in order to identify delays or adjustments in the "macro-micro" effects. All estimated coefficients are accompanied by the standard goodness of fit statistics (t-coefficients at a 95% of confidence, adjusted R^2 values and the corresponding log-likelihood ratios).[12] In general, panel data results (which specifically account for the presence of individual heterogeneity) correspond to the random-effects specification, except when the result of the Hausman test suggests that fixed-effects could be more appropriate.

Finally, the ultimate comparison between pooled-data estimates and panel data estimates (*i.e.*, whether country-specific effects are relevant or not) can be carried out through a general specification test on the heteroskedasticity properties of the panel residuals. There are different tests for this purpose in the literature. We have chosen the standard LM-test proposed by Breusch and Pagan (1979) because its calculation is simpler. The LM statistics, whose null hypothesis in this case implies that individual effects are not relevant, are showed Tests are carried out in the final rows of each table.

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[11] This modeling strategy has been used before. See Fosu (2001), for example.

[12] Goodness of fit measures in GLS models are usually controversial since R^2 measures losses effectiveness under heteroskedasticity. All the existing alternatives must be carefully interpreted, since they cannot be reliably used to compare models.

4.1. Effects of private participation in infrastructure (PPI) on GDP per capita

Table 4 summarizes the estimates of *Model 1* using GDP per capita as the dependent variable, both for the pooled data case and the panel data case. Since the comparison tests show that panel data estimates (using the fixed effects approach) are preferred to pooled data estimates, the results to consider are those in the final columns. Moreover, and even though the goodness of fit measures are to be taken cautiously in panel estimations, the values of the adjusted R^2 are relatively high. Overall, the preferred regression suggests that the trend matters strongly and that the institutional variables are highly significant with the expected sign, even when lagged dummies are considered into the regression.

Table 4. Effects of PPI on GDP per capita (Model 1)

	POOLED DATA CASE						PANEL DATA CASE (Fixed-effects)					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	158.661	0.52042	174.878	0.51919	205.508	0.54850						
TIME	-43.922	-1.641	-52.253	-1.74169	-58.1843	-1.71985	18.7264	3.36999	17.9955	3.01499	21.3374	3.18398
D	242.708	6.94567	252.367	6.73199	257.547	6.42126	28.3979	3.18444	25.2048	2.78471	23.7823	2.50583
F	264.676	3.20049	249.947	2.83498	236.825	2.47938	-106.00	-3.8653	-82.446	-3.00623	-67.1605	-2.31178
DU	-641.87	-2.5325					-29.439	-0.5787				
DT	1433.55	6.90419					489.852	8.40341				
DU-1			-591.80	-2.25789					3.21975	0.6350		
DT-1			1453.3	6.51564					504.02	8.31114		
DU-2					-530.48	-1.95242					30.2842	0.57773
DT-2					1465.98	6.04391					480.864	7.00114
Adj. R^2	0.3273		0.31729		0.3025		0.98041		0.9821		0.9823	
Log Lr	-2546.68		-2368.4		-2190.09		-2016.3		-1860.7		-1715.89	

Comparison tests

	Unlagged			Lag =1			Lag =2		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.	LM test	d.f.	Prob.
	492.75	1	.0000	432.92	1	.0000	386.69	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	10.99	5	.05167	18	5	.0029	21.34	5	.0006

Note: Dependent variable is GDP per capita. t-ratios are calculated at 95% level of confidence.

As for the main focus of this paper, the coefficients on the PPI dummies, **DU** and **DT**, suggest that only PPI in transport infrastructure seems to have a positive (and significant) effect on GDP per capita, both when considered unlagged and when a lag of 1 or 2 periods is included.

These results are somewhat surprising, but imply that the effect of PPI on growth varies across infrastructure types in Latin America. The lagged dummies do not alter the signs or size of these effects very much, suggesting that the impact of PPI in transport may be distributed over time. Table 5 summarizes the results for *Model 2*, in which the dummies are separated by type of PPI (divestures, *DIV*, greenfield projects, *GP*, and concessions, *CONC*). The estimation methodology is very consistent with Table 4, since Hausman test suggests that fixed effects are preferable and the LM test does not allow to discard the existence of country-specific effects.

Table 5. Effects of PPI on GDP per capita (Model 2)

	POOLED DATA CASE						PANEL DATA CASE (Fixed-effects)					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	523.698	1.8647	678.623	2.23009	841.8	2.52653						
TIME	-109.31	-4.8668	-118.527	-4.67099	-128.067	-4.41238	16.954	3.34287	18.8212	3.41408	23.0818	3.76959
D	225.598	7.08405	229.748	6.7498	228.998	6.27975	23.5891	2.57865	20.6748	2.19548	17.6267	1.82271
F	260.585	3.44418	235.477	2.94337	220.828	2.56155	-73.6671	-2.47859	-61.1194	-2.05414	-58.2651	-1.94686
DIVDU	128.391	4.99402					12.9868	2.22143				
GPDU	99.394	2.51293					38.75	4.03708				
CONCDU	209.51	1.43128					21.8197	0.77787				
DIVDT	-836.1	-0.5994					722.373	2.6597				
GPDT	476.72	0.43957					-9.805	-0.04648				
CONCDT	165.07	1.07172					25.503	0.85045				
DIVDU-1			106.818	3.41141					13.1279	1.8994		
GPDU-1			98.48	2.49363					36.4376	3.86373		
CONCDU-1			183.028	1.21337					17.097	0.61229		
DIVDT-1			-867.062	-0.61826					672.495	2.54702		
GPDT-1			-2125.38	-0.90207					-178.181	-0.3913		
CONCDT-1			404.275	1.50967					29.2965	0.54961		
DIVDU-2					118.364	3.95182					18.0522	2.77911
GPDU-2					102.304	2.54982					31.2365	3.34042
CONCDU-2					128.024	0.80218					29.884	1.04156
DIVDT-2					-841.789	-0.5937					663.142	2.55595
GPDT-2					-1522.47	-0.61293					83.771	0.18168
CONCDT-2					323.96	1.13581					-6.28027	-0.1131
Adj. R^2	0.4159		0.4169		0.4111		0.9795		0.9811		0.9821	
Log Lr	-2523.87		-2344.90		-2166.67		-2020.16		-1866.01		-1715.32	

Comparison tests									
	Unlagged			Lag =1			Lag =2		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.	LM test	d.f.	Prob.
	566.59	1	.0000	493.99	1	.0000	419.37	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	16.95	9	.0495	17.36	9	.043	14.89	9	.0939

Note: Dependent variable is GDP per capita. t-ratios are calculated at 95% level of confidence.

The institutional variables in the panel data estimations are, respectively, positive and negative for **D** and **F**, with the same interpretation as above. However, the disaggregated effects of PPI types shows several new results. First, divestitures and greenfield projects have significant and positive effects for utilities (even when lagged one and two periods). Concessions, on the other hand, do not yield significant coefficients. For transport, only divestitures seem to have a relevant impact on GDP per capita. Divestitures are sometimes viewed as the strongest form of commitment to let the private sector take care of the delivery of the services. What this suggests, at least in a first analysis, is that only the strongest commitments to a private sector role have an impact on GDP per capita.

4.2. Effects of infrastructure PPIs on private investment

Table 6 shows the results from *Model 1* using private investment (as directly reported by the World Development Indicators database) as the dependent variable. We added an interest rate variable, LR (the lending rate listed in the IMF statistics) to ensure a better specification of the model. Both for the pooled data case and the panel data case.

As in Table 4 above, country-specific effects are very relevant, according to Breusch and Pagan's LR test, but now the Hausman tests suggests that random effects, instead of fixed ones are the preferable way to specify η_i. In general, it seems that this is not as good a model to explain what happens to private investment.

Table 6. Effects of PPI on Private Investment (Model 1)

	POOLED DATA CASE						PANEL DATA CASE (Random effects)					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	11.861	8.02367	12.0409	6.98812	0.36487	2.20199	14.9078	8.81839	14.7674	8.14323	0.47517	3.80217
TIME	0.29529	2.41093	0.32733	2.28893	0.4425	2.02643	0.36130	3.68471	0.43668	3.961	0.29703	1.58399
D	0.67260	3.95373	0.54518	2.80695	0.86932	1.55013	0.45569	2.9258	0.43663	2.50088	-0.40788	-0.64676
F	0.60011	1.37261	0.82739	1.67031	-0.00188	-2.16141	-0.61882	-1.23564	-0.44978	-0.80148	0.00069	1.07466
LR	-0.0007	-2.62139	-0.00126	-2.48127	-0.58515	-0.50375	0.00014	0.67633	0.00022	0.58817	0.1647	0.17563
DU	0.74026	0.66619					0.69279	0.81816				
DT	-2.7784	-3.15398					0.48218	0.51042				
DU-1			-0.70641	-0.62162					-0.13708	-0.14876		
DT-1			0.01114	0.19090					-0.01072	-0.2771		
DU-2					0.04304	0.71746					0.01851	0.47977
DT-2					12.3933	6.27925					15.5332	7.94757
Adj. R^2	0.2131		0.15799		0.1311		0.6789		0.66016		0.6741	
Log Lr	-703.43		-647.51		-585.539		-590.903		-543.15		-484.37	

Comparison tests

	Unlagged			Lag =1			Lag =2		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.	LM test	d.f.	Prob.
	337.56	1	.0000	353.10	1	.0000	344.24	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	9.86	6	0.13	9.34	6	0.1553	6.58	6	0.361

Note: Dependent variable is private investment. t-ratios are calculated at 95% level of confidence.

The trend continues to be a significant factor as is the degree of political stability. The measure of corruption used does not perform well as it does not appear to have a statically significant effect. Most interesting from our viewpoint is the fact that the PPI dummies (except for DT when lagged two periods) are never significant.

Table 7 tells us a very similar story. Again, panel data (with random effects) are preferable to pooled data, but the overall significance of the model is lower than for GDP per capita. As for our variable of concern, the emerging story is interesting. It suggests that greenfield projects can make a difference but do so with a negative sign, implying some crowding out of other private investment projects. The results also shows, somewhat expectedly, that concession contracts in transport have a positive lagged effect on private investment. As well known by the specialists of investment promotion programs, good transport services are crucial to attract investment. These results confirm their experience.

Table 7. Effects of PPI on private investment (Model 2)

	POOLED DATA CASE				PANEL DATA CASE (Random)			
	Unlagged		Lag =1		Unlagged		Lag =1	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	11.8566	7.89852	12.1531	7.17573	15.0516	8.14836	15.1976	7.9948
TIME	0.28293	2.42325	0.32373	2.36962	0.48999	5.68235	0.53941	5.47164
D	0.57704	3.49916	0.52336	2.80214	0.54424	3.45748	0.55977	3.23
F	0.78758	1.76644	0.77469	1.54584	-0.96090	-1.79418	-1.12983	-1.89907
LR	-0.0007	-2.57747	-0.00123	-2.41655	0.00016	0.77739	0.00037	1.00481
DIVDU	-0.0347	-0.28951			0.05864	0.48231		
GPDU	0.05293	0.27260			-0.30279	-1.91108		
CONCDU	-0.1222	-0.19009			0.10868	0.25257		
DIVDT	2.06112	0.34429			1.75513	0.45052		
GPDT	6.08447	1.2658			1.52561	0.49100		
CONCDT	-0.9697	-1.27965			0.12912	0.23612		
DIVDU-1			-0.04318	-0.28148			-0.04177	-0.26587
GPDU-1			-0.07583	-0.36051			-0.50265	-2.8282
CONCDU-1			-0.25176	-0.34985			-0.35248	-0.71361
DIVDT-1			3.20066	0.51858			1.59119	0.39855
GPDT-1			0.14229	0.01056			-18.8736	-1.99786
CONCDT-1			-0.13469	-0.0807			2.77924	2.22362
Adj. R^2	0.1757		0.1453		0.6785		0.6787	
Log Lr	-706.64		-646.96		-588.73		-535.99	

Comparison tests

	Unlagged			Lag =1		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.
	376.60	1	.0000	364.74	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	7.73	10	.655	11.67	10	.3079

Note: Dependent variable is private investment. t-ratios are calculated at 95% level of confidence.

Since we had some concern on the quality of the dependent variable used, we also ran the models by redefining private investment as the difference between total investment and public investment. This analysis is carried out in Table 8, where *Model 1* (and *Model 2* but not reported here) has been re-estimated using this new definition of the dependent variable. The estimates – once more, panel data ones – score slightly better, particularly the institutional variables (same signs that in Tables 4 and 5) and the utilities PPI dummy, but again the overall significance of the model is not as good as we had hoped. They do suggest however that there is a lagged crowding

out taking place during the 1980-1990s as a result of the increased presence of private sector participation in utilities.

Table 8. Effects of PPI on private investment (defined as Gross Domestic Investment-public) (Model 1)

	POOLED DATA CASE						PANEL DATA CASE (Random)					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	8.52524	5.90699	12.0482	7.60141	8.56549	4.64182	11.9965	7.70941	8.18617	5.11725	12.717	7.2551
TIME	0.38858	3.33634	0.38012	4.13288	0.42191	2.74017	0.33188	3.94077	0.42688	3.25328	0.36512	3.4953
D	0.48252	2.88952	0.41659	2.91702	0.38643	1.88699	0.37075	2.77623	0.46902	2.59491	0.31643	2.0644
F	0.35229	0.83851	-1.06257	-2.25479	0.37264	0.71691	-1.07941	-2.46355	0.43905	0.96630	-1.1380	-2.104
LR	-0.0006	-2.26562	6.109e-05	0.19924	-0.0015	-2.01302	0.00010	0.55941	-0.0010	-2.34242	0.0004	0.8560
DU	-2.3802	-2.24367					-0.56833	-0.78091				
DT	-0.05089	-0.05994					1.0974	1.35159				
DU-1			-1.13005	-1.4864					-2.7763	-2.67919		
DT-1			-0.00707	-0.22991					0.03528	0.67958		
DU-2					-2.1426	-2.02563					-0.130	-0.167
DT-2					0.0391	0.72729					-0.002	-0.084
Adj. R^2	0.1353		0.1322		0.1008		0.720		0.720		0.7365	
Log Lr	-624.24		-574.47		-522.14		-497.00		-456.39		-407.24	

Comparison tests

	Unlagged			Lag =1			Lag =2		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.	LM test	d.f.	Prob.
	411.83	1	.0000	372.38	1	.0000	341.30	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	8.14	6	.22	10.14	6	.1188	6.79	6	.3402

Note: Dependent variable is private investment defined as GDI – Public Investment.

4.3. Effects of infrastructure PPIs on public investment

The estimates in Table 9 summarize the effects of PPI policies on public investment. The overall statistical results are similar to those of previous tables (particularly, again panel data is preferred and political stability is the strongest institutional explanatory variable).

Table 9. Effects of PPI on public investment (Model 1)

	POOLED DATA CASE						PANEL DATA CASE (Random effects)					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	3.66962	3.94788	3.9936	3.75475	4.06308	3.38307	4.44897	4.20102	4.83884	4.1948	5.20166	4.32134
TIME	-0.07364	-0.98179	-0.0624	-0.7266	-0.0049	-0.05000	-0.05740	-1.38683	-0.0541	-1.24162	-0.0266	-0.60620
D	0.02823	0.26252	-0.01665	-0.13596	-0.11209	-0.8315	0.14989	2.27065	0.10937	1.61114	0.06459	1.01417
F	0.44421	1.64164	0.44173	1.44382	0.61026	1.77114	0.01922	0.08736	0.02644	0.11457	0.11744	0.49584
DU	2.28888	3.35006					0.97727	2.75014				
DT	-1.50248	-2.74791					-0.75619	-1.85432				
DU-1			2.23534	3.14047					0.85183	2.41344		
DT-1			-1.28836	-2.14511					-0.65454	-1.57607		
DU-2					1.73967	2.40797					0.31974	0.98976
DT-2					-0.95966	-1.45039					-0.55866	-1.33359
Adj. R^2	0.079		0.0603		0.0393		0.8314		0.8560		0.8888	
Log Lr	-533.17		-486.19		-435.03		-347.08		-300.381		-244.885	

Comparison tests

	Unlagged			Lag =1			Lag =2		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.	Likelihood Ratio Test	d.f.	Prob.
	479.3	1	.0000	395.18	1	.0000	341.15	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	3.33	6	.7664	3.20	6	.7838	4.15	6	.6563

Note: Dependent variable is public investment. t-ratios are calculated at 95% level of confidence.

The coefficients of the policy variables reveal several notable differences. First, the unlagged PPI dummies are significant and have the strongest statistical significance but the impact of PPI is still strong with a one year lag as well. Second, and much more interestingly, the PPI in utilities and transport infrastructures has a different sign (positive and negative, respectively). PPI in utilities complement or crowd-in public investments, while PPI in transport substitutes for or crowds –out public investment. What this may reflect is the fact that reforms in the utilities sector are used by governments to raise matching resources from private operators for the sector where as for transports, private investments allow governments to reduce its commitments to the sector in terms of expansion at least. These results hold however at the very aggregate level because we are not able to draw similar, albeit more subtle, conclusions from a dis-aggregation of contract types.

Table 10, where *Model 2* estimates are presented, suggests that disaggregating the PPI dummies by contract type (*DIV, CONC, GP*) does not only reduces the overall significance of the panel data model, but also eliminates the validity of individual coefficients in all cases.

Table 10. Effects of PPI on public investment (Model 2)

	POOLED DATA CASE				PANEL DATA CASE (Random)			
	Unlagged		Lag =1		Unlagged		Lag =1	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	3.00518	3.17881	3.05074	2.83953	4.38753	3.86902	4.81907	3.85598
TIME	0.070658	0.972953	0.086508	1.02017	-0.00185	-0.04831	0.004202	0.102901
D	0.084315	0.833599	0.049902	0.435871	0.177649	2.61672	0.159847	2.28561
F	0.579541	2.12111	0.579349	1.88307	-0.00192	-0.00797	-0.08577	-0.33593
DIVDU	-0.10843	-1.40861			-0.00826	-0.15074		
GPDU	-0.03527	-0.29531			-0.05281	-0.76188		
CONCDU	-0.30248	-0.78691			0.008682	0.046816		
DIVDT	-0.41943	-0.11882			-0.34932	-0.21648		
GPDT	-1.08498	-0.38211			-0.1971	-0.15255		
CONCDT	-0.40700	-0.90236			-0.14526	-0.62068		
DIVDU-1			-0.08516	-0.91265			-0.03976	-0.54395
GPDU-1			0.011500	0.091964			-0.07574	-1.06111
CONCDU-1			-0.15569	-0.30543			-0.01017	-0.04515
DIVDT-1			-0.50780	-0.14025			-0.24170	-0.15809
GPDT-1			6.09788	0.769687			-1.61612	-0.44201
CONCDT-1			-1.18086	-1.19824			0.091974	0.186214
Adj.R^2	0.0525		0.03386		0.5199		0.5475	
Log Lr	-534.039		-486.68		-352.592		-303.393	

Comparison tests

	Unlagged			lag=1		
Panel vs. Pooled	LM test	d.f.	Prob.	LM test	d.f.	Prob.
	490.14	1	.0000	413.20	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	5.12	10	.8829	4.34	10	.9306

Note: Dependent variable is public investment. t-ratios are calculated at 95% level of confidence.

4.4. Effects of infrastructure PPIs on recurrent public expenditures

The effects of PPI on recurrent public expenditures summarized in Tables 11 and 12 follow a particularly interesting pattern, in particular when contrasted with the pattern seen for the effect

of PPI on public investment. From an overall statistical viewpoint, the unlagged panel case with fixed effects provides the best results according to the values of the comparison tests and as usual by now, political stability matters. The time trend has been eliminated as there was a multicollinearity problem with the institutional variable.

Table 11. Effects of PPI on public expenditures (Model 1)

	POOLED DATA CASE						PANEL DATA CASE (Fixed-effects)					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	11.3039	10.7462	10.9635	9.89115	10.3882	9.28352						
D	-0.1788	-1.34699	-0.21252	-1.53208	-0.21873	-1.58207	-0.53505	-4.72158	-0.60036	-5.10504	-0.55101	-4.79349
F	1.76807	5.82027	1.69406	5.34853	1.67279	5.18957	0.37483	1.02608	0.46611	1.23573	0.55759	1.48251
DU	-2.3251	-2.88953					-1.90985	-3.45204				
DT	-0.4033	-0.49698					1.60745	1.91227				
DU-1			-1.5276	-1.84674					-1.03453	-1.78406		
DT-1			-0.33347	-0.39110					1.7084	1.86185		
DU-2					-1.04329	-1.27273					-0.60165	-1.03656
DT-2					-0.11565	-0.1333					2.22884	2.32731
Adj.R^2	0.128		0.1040		0.0933		0.676		0.6648		0.6687	
Log Lr	-886.74		-821.45		-746.58		-731.53		-677.59		-610.06	

Comparison tests

	Unlagged			Lag =1			Lag =2		
Panel vs. Pooled	LM Test	d.f.	Prob.	LM Test	d.f.	Prob.	LM Test	d.f.	Prob.
	492.75	1	.0000	432.92	1	.0000	386.69	1	.0000
Fixed vs. Random	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
	22.12	5	.0004	19	5	.0019	16.48	5	.0055

Note: Dependent variable is public expenditure. t-ratios are calculated at 95% level of confidence.

The coefficients of the policy variables reveal several new elements. First, the PPI dummies for utilities has a declining impact over time (as seen in the declining t ratios for the lagged variables) while it is increasing for the transport dummies. are significant and have the strongest statistical significance but the impact of PPI is still strong with a one year lag as well. Second, the PPI in utilities and transport infrastructures has a different sign (negative and positive, respectively). PPI in utilities reduces recurrent public expenditures while PPI in transport seem to increase these recurrent expenditures. For transport, this reflects the common wisdom among practitioners that investments in the sector are only viable when the operation of the services allowed by the investment are subsidized. For utilities, it may reflect the fact that PPI

often lead to significant cost reductions and that subsidy levels tend to decline once private operators take over operations. Table 12 however suggests that this result does not hold for divestitures in the utilities sector since it seems that when PPI takes place with type of contract, recurrent expenditures increase.

Table 12. Effects of PPI on public expenditures (Model 2)

	POOLED DATA CASE						PANEL DATA CASE					
	Unlagged		Lag =1		Lag = 2		Unlagged		Lag =1		Lag =2	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
One	11.8751	11.0155	11.5392	10.3069	10.8341	9.75749					13.4454	7.97494
D	-0.3618	-2.879	-0.33320	-2.56723	-0.29091	-2.27076	-0.69229	-6.24888	-0.70928	-6.18977	-0.55700	-5.19081
F	1.59759	5.24564	1.58883	5.06543	1.64259	5.21548	0.31248	0.84395	0.56458	1.48095	0.62041	1.75473
DIVDU	0.10125	0.95671					0.16150	2.10343				
GPDU	0.02751	0.18406					0.04272	0.36408				
CONCDU	-0.0648	-0.11170					0.44645	1.24778				
DIVDT	-2.8262	-0.51358					-1.82768	-0.53024				
GPDT	4.98035	1.16415					-1.97114	-0.7388				
CONCDT	0.16325	0.2677					0.32307	0.84723				
DIVDU-1			0.03432	0.27820					0.18662	2.02477		
GPDU-1			0.03225	0.22135					0.10929	0.92870		
CONCDU-1			-0.24189	-0.4143					0.44321	1.22012		
DIVDT-1			-3.16602	-0.58592					-2.00054	-0.5856		
GPDT-1			-0.31654	-0.03476					2.97191	0.50511		
CONCDT-1			1.00619	0.96937					0.52354	0.945324		
DIVDU-2					-0.04841	-0.43473					0.10595	1.25544
GPDU-2					0.03067	0.22158					0.15917	1.48609
CONCDU-2					-0.37117	-0.64509					0.32673	0.90769
DIVDT-2					-3.90711	-0.76645					-1.82049	-0.56524
GPDT-2					-10.1595	-1.13554					-3.7521	-0.6523
CONCDT-2					2.32176	2.25521					0.78765	1.14032
Adj. R^2	0.091		0.0895		0.1064		0.672		0.6683		0.6724	
Log Lr	-890.77		-821.57		-742.71		-731.29		-673.94		-606.39	

Comparison tests

	Unlagged			Lag =1			Lag =2		
	LM Test	d.f.	Prob.	LM Test	d.f.	Prob.	LM Test	d.f.	Prob.
Panel vs. Pooled	566.59	1	.0000	493.99	1	.0000	419.37	1	.0000
	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.	Hausman test	d.f.	Prob.
Fixed vs. Random	21.30	9	.0113	18.96	9	.0255	12.7	9	.1767

Note: Dependent variable is public expenditure. t-ratios are calculated at 95% level of confidence.

5. Conclusions

This paper provides empirical evidence on the impact that private participation in infrastructure has had on key macroeconomic variables in a sample of 21 Latin American countries during the 1985-1998 period. Specifically, we look at the effects on GDP per capita, current public expenditures, public investment and private investment, controlling for country effects and institutional factors. The most interesting initial conclusions focus on the sign of these effects of the average macro effects of these micro reforms as estimated from model 1. Table 13 summarizes the main results with respect to the statistically significant signs we have been able to identify.

Table 13: Summary of signs of average macro effects of PPI

	PPI in utilities	PPI in transport
GDP/capita	Not significant	+
Private Investment	-	Not significant
Public Investment	+	-
Recurrent Public Expenditures	-	+

The first obvious fact to emerge from Table 13 is that transport and utilities "privatization" should not be expected to have the same macroeconomic effects. Transport has a significant positive effect on per capita income, utilities has none observable. Second., PPI, at best, leaves private investment constant but in the case of utilities tends to crowd it out, which is the opposite of the effect it has on public investment. Indeed, the third result to emerge is from a public sector perspective. Utilities lead to increases in public investments but reduce recurrent expenditures. The opposite holds for transport. In other words, there is crowding-in of public investment for PPI in utilities and crowding-out for transport. Also, while private transport investments require a matching commitment to operational subsidies, the arrival of private utilities operators reduces the burden of these operational subsidies.

The results generated by model 2 are in general less interesting. Indeed, the disaggregation of PPI per contract type yielded few statistically significant results. The most interesting ones are that Divestitures, the strongest form of commitment to private sector has clear positive effects on GDP per capita. The second interesting result is that concession contracts

and Greenfield projects in transport have significant payoffs in terms of future investments. Finally, divestitures in utilities and transport concessions tend to increase recurrent expenditures.

These results, however limited, provide a first set of econometric evidence on the macro effects of micro reforms for the region in which PPI policies have been the most active. Much better data is needed to draw more specific and more robust policy conclusions. Much more ambitious econometric analysis is also needed. In particular, causality has not been tested and an optimal lag structure has not been identified because of data limitations. As the PPI experience progresses and more and better data becomes available, we should be able to refine these results. But for now, these results provide already enough reasons to be concerned about a good assessment of the macro and in particular the fiscal effects of private participation in infrastructure. The fact that the effects on GDP/capita at neutral at worse and most probably positive is good news but it comes at a risk with respect to its effects on the public sector accounts. The revelation of this risk may be the main contribution of this paper since it is inconsistent with the fiscal gains expected by many policymakers as they engage in infrastructure privatization programs.

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