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**Working Paper****Author(s):**

Atukeren, Erdal

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Erdal Atukeren

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# Politico-Economic Determinants of the Crowding-in Effects of Public Investments in Developing Countries

Erdal Atukeren

Swiss Institute for Business Cycle Research  
Swiss Federal Institute of Technology - Zurich  
(KOF / ETH Zurich), WEH - ETH Zentrum,  
CH - 8092, Zurich – Switzerland

E-mail: atukeren@kof.ethz.ch

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## Abstract

*This study investigates the politico-economic determinants of the crowding-in effects of public investments in a cross-section of 25 developing countries for the 1975-2000 period using multivariate probit analysis. The estimation results show that public fixed capital investments may crowd in private investments, but this still depends on the developments in the economic, political, and legal environment of business in individual countries. As such, our findings capture the essence of the mixed results found in this literature well and shed further light on the conditions under which public investments are more likely (not) to crowd in private investments in developing countries.*

**Keywords:** Public investment, crowding-in effects, environment of private business, institutions, rule of law, property rights

**JEL Codes:** E62, H54, O11

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## I. INTRODUCTION

The relationship between government expenditures and economic performance is a subject of continuing discussion in economics and public policy making. On the one hand, increased government involvement in the economy might distort the economic and political environment of business and discourage or crowd out private sector investments. On the other hand, the government might help lay the ground for the development of private sector through the provision of legal infrastructure that ensures the protection of physical and intellectual property rights and by undertaking investments that deepen the physical and human capital infrastructure in the country. The latter, for example, may include investments in public works, education, and health care facilities, the amount of which might be otherwise (that is, when left to market forces alone) socially sub-optimal. As a result, the provision of protective and productive investments in physical, legal, and human capital infrastructure by the state might crowd in, rather than crowd out, private sector investments.<sup>1</sup> This argument is especially valid in a developing country framework. In addition, governments may use fiscal policy that involve increased spending in infrastructure projects as an aggregate demand management tool. If such policies turn out to be successful, decreased macroeconomic volatility and a more stable level of aggregate demand may provide stimulus for private businesses. Nevertheless, not all government expenditures are productive in nature and not all aggregate demand management attempts successful in practice.

In many empirical analyses, the government sector's involvement in the economy is generally represented by a broadly defined government size variable that also includes unproductive government consumption items, government sector wages and salaries as well as transfer payments. Nevertheless, even with such aggregate variables to represent the government sector, empirical studies on the impact of government size on economic performance have produced mixed results. Aschauer (1989), Ram (1996), Sanchez-Robles (1998), and Esfahani and Ramires (2003), for example, find evidence that larger government size or increases in public capital investments are positively correlated with economic growth. Landau (1983), Grier and Tullock (1989), Barro (1991), and Gwartney, Holcombe and Lawson (1998), among others, do not support these conclusions and report a negative relationship, while Kormendi and Meguire (1985) find no relationship. Terasawa and Gates (1998) argue that the relationship between government size and economic growth is positive in less developed countries and a negative relationship arises in developed countries. Terasawa and Gates' (1998) argument is based on the assumption that the share of productive

uses of government spending decreases while the share of unproductive (especially, transfer payments) items rises as the level of development increases.

On the methodological side, there are two main approaches to the analysis of whether the public sector activity hinders or enhances economic performance. The first one is a cross-country regression framework where the effects of various variables representing government size, such as government expenditures, consumption, or investment, are evaluated on economic growth or on private sector investments. The models employed in this approach are derived from a production function using a neoclassical or endogenous growth theory framework and thus they are closely linked to the literature on the determinants of economic growth. Indeed, the inference on the effects of government spending on economic growth is usually obtained as a by-product of the production function estimation.<sup>2</sup>

The second approach uses time series analysis methods to examine the impact of government expenditures and economic performance in general, or the interactions between public and private sector investments in particular, for a particular country or a group of countries.<sup>3</sup> Nevertheless, the differences in econometric methodologies should not be responsible for the mixed results found in this literature since both negative and positive effects of public expenditures have received empirical support using the same type of methodology even for the same countries. It is also interesting to note that while there is less disagreement about the growth enhancing effects of productive public infrastructure investments, the empirical evidence is again not uniform.<sup>4,5</sup> Everhart and Sumlinski (2001: 10) summarise the state of evidence on whether public investments crowd in or crowd out private investments as: ‘not only is there consensus on the topic, but there are contradictory results, even for the same regions and countries.’

In an attempt to examine why there are differences in the effects of public investments on private investments in different countries, Atukeren (2005) employed a two-step methodology. In the first step, cointegration and Granger-causality tests were used to analyse the nature of the interactions between public and private sector investments in 25 developing countries. The data were taken from Everhart and Sumlinski (2001), who used consistent definitions of the private and public investments across countries and covered the period from the early-1970s to late-1990s. This analysis yielded causal evidence that public investments crowd out private investments in 11 of the 25 countries under investigation.<sup>6</sup> The second step was directed towards explaining the crowding-out cases by means of a multivariate probit regression where the dependent variable was assigned the value “1” for the countries where crowding-out effects were found and “0” otherwise. Then, using the components of Gwartney

and Lawson's (2004) "economic freedom of the world (EFW) index" as explanatory variables, the incidence of the crowding-out effects of public investments was linked to a number of proxies that capture various aspects of the environment of economic freedom in individual countries. This framework puts the results obtained from cointegration and Granger-causality tests for individual countries in a common cross-country perspective and attempts to find answers as to under which circumstances public investments are more likely to crowd out private investments. The probit analysis results in Atukeren (2005) indicate that larger government size, lower trade openness, higher degree of foreign currency restrictions, and a more developed and stable macro and monetary environment increase the marginal likelihood of the crowding-out effects of government investments. Note that the first three factors characterise a rather inward oriented and inefficient economy. The last one, however, points to a textbook case where the crowding-out effects might occur via increases in (market-determined) interest rates stemming from government borrowing.

This paper looks at the other side of the coin and examines the determinants of the incidence of the "crowding-in" cases reported in Atukeren (2005) using a similar methodology: that is, by running probit regressions where the dependent variable takes the value "1" for the crowding-in cases and "0" otherwise. The aim is to investigate whether public investments are more likely to crowd in private investments under certain economic and institutional setups. It is true that the sample size (25 countries) is not large. Nevertheless, the distribution of the countries by their geographical location, level of development, and in other dimensions is diverse enough and the degrees of freedom are sufficient to conduct meaningful analyses.

The politico-economic approach taken in this paper recognizes the fact that in order for public investments to be able to crowd in private investments, there should be a favourable business environment for the private sector in the first place (see, for example, Wai and Wong, 1982; Pastor and Sung, 1995; Ghura and Goodwin, 2000 for an investigation of the determinants of private investments in developing countries). Furthermore, we highlight the role of good governance through sufficient checks and balances in the political power structure and the importance of the rule of law and the legal infrastructure. We also take the initial level economic of development into account. The results obtained from this analysis contribute to the literature on the effects of public investments on private investments by shedding light on the dynamics between the public – private sector interactions under different institutional and political setups and policy paths.



The rest of the paper is organised as follows. Section II discusses the definition of the dependent variable (*CROWD-IN*) and the various hypotheses associated with the explanatory variables in the model. Section III discusses the empirical issues in choosing the final model specification and presents the estimation results from the multivariate probit regressions. Section IV concludes.

## II. DATA DEFINITIONS AND THE MODEL STRUCTURE

### A. Data Considerations

Since Everhart and Sumlinski's (2001) dataset was used in Atukeren (2005) to analyse in which countries public investments crowd in (or crowd out) private investments, a closer look into the definitions of Everhart and Sumlinski's public and private investment variables is in order. Everhart and Sumlinski (2001) focus on fixed capital investments (infrastructure investments and investment in machinery and equipment) by the public and private sector. An important adjustment made to these series is that investments undertaken by state enterprises are classified as public investments. As such, possible crowding-out cases due to the competition between state enterprises and private businesses are also taken into account in the empirical analysis. This is an important issue since state enterprises may enjoy subsidies and other privileges which are not necessarily quantified in the public investment variable. Furthermore, the resulting public and private investments are expressed as their shares in GDP. Thus, in order to conclude that public investments crowd in (crowd out) private investments, an increase in the share of public investment in GDP should lead to an increase (decrease) in the ratio of private investments in GDP. Hence, this approach provides a stronger test of the crowding-in or crowding-out hypotheses using implicitly a trivariate framework of analysis, which avoids the detection of a spurious relationship that may result when a boom or recession in GDP growth rates reflects itself in public and private investments as well.

Table 1 shows the 25 countries included in the sample and the coding of the dependent variable used in the subsequent probit analysis. The dependent variable (*CROWD-IN*) is dichotomous, taking the value "1" if public investment is found to crowd in private investment for a given country and "0" otherwise (see Atukeren, 2005, Tables 1 and 3). This leads to seven cases of crowding-in, namely, Brazil, Ecuador, Bangladesh, Malaysia, Pakistan, Philippines, and Morocco.<sup>7</sup> It should be noted that the coding of the dependent variable as a "crowding-in" or "no-crowding-in" case represents a conclusion that tends to

hold on average during the sample period.<sup>8</sup> This is similar to using the average values of the variables in a given period in cross-country regressions.

< Table 1 approximately here >

Given that there are statistically sufficient number of crowding-in cases (28%) among the 25 countries shown in Table 1, the question of under what economic, institutional and/or political circumstances public investments are more likely (not) to crowd in private investments can be investigated by means of regression analysis. This approach may help reconcile the mixed results reported in the literature. For example, the same sort of economic policies may yield different results under different initial conditions, different institutional setups, and different timing and sequencing of reforms. It may be that public investments were more conducive to private sector activity in some periods while they were impeding private sector activity in some other periods in the same country – depending on the politico-economic conditions in those episodes. In other words, how the political, institutional, and economic freedom variables take turns in due course may lead to different outcomes in different countries and/or in different periods in a given country and thus explain the mixed results found in the literature.

#### *B. The Politico-Economic Model and the Hypotheses*

In this section, we outline the underlying arguments and the hypotheses associated with the explanatory variables used in our analysis. As reviewed earlier, productive government investments might help enhance economic performance and growth potential especially in a developing country framework. The improved infrastructure should help the private sector in undertaking investments since the private businesses will normally not build a factory in an area where there are no roads or powerlines. Hence, one can argue that productive public investments are more likely to crowd in, rather than crowd out, private investments especially at earlier stages of development. On the other hand, a larger share of government expenditures in GDP resulting from higher levels of unproductive consumption items and transfer payments is likely to hinder the private sector activity. It is worth noting that the GDP share of such expenditure items, especially transfer and social security payments, increases as the level of economic development increases. Therefore, we also take the differences in the (initial) level of development into account.

For the government size variable itself, we use the “government size” subcomponent of Gwartney and Lawson’s (2004) economic freedom index as a proxy. We expect that a reduction in the government size through cuts in the unproductive government consumption items and transfer payments should lead to an improvement in the private business environment and increase the crowding-in probability by public investments. Since the values of the government size variable in Gwartney and Lawson (2004) ranges from 0 to 10, 0 being the largest and 10 being the leanest, any reductions in the government size are denoted by positive values when calculated on the end-year minus first-year basis. Hence, the expected sign is positive.

Furthermore, our investigation of the determinants of the crowding-in effects of public investments can indeed be seen as a special case of the determinants of private investments in developing countries. That is, for public investments to enhance private sector investments, the economic and political conditions and the institutional environment should be right (or, at least, not hostile) in the first place. This relates to the economic, political, and institutional environment of private business. Macroeconomic stability, sound and credible economic policies, and improvements in the economic conduct should enhance private sector activity. In addition, the availability of domestic credit is an important factor in developing countries since borrowing constraints would limit the private sector’s ability to undertake investments. Wai and Wong (1982), for example, provide empirical evidence that increases in bank credit and capital inflows along with higher levels of government investments enhance private sector investments in developing countries.

Another factor that should be taken into account is the impact of the debt crises and the subsequent structural adjustment programs. In a country which is experiencing difficulties in servicing its external debt, the environment of private business also deteriorates. For example, in international country risk assessments, a country’s credit rating is lower, the higher the debt / GDP or the debt service / foreign exchange revenues ratios are. In general, a lower credit rating is also associated with higher costs of borrowing not only internationally but also domestically. Therefore, as a country solves its indebtedness problems and the external debt service ratios decrease, the environment for private businesses should also improve and the cost of capital should decrease, among other favourable effects resulting from also a possibly better country risk rating.

Uncertainty is one of the standard variables in models of private investment behaviour since investments require longer term commitment. While there are many proxies that should serve to that purpose, we employ the volatility of the private investment / GDP ratio as a

measure of uncertainty in our model since it directly relates to investment behaviour. This variable also acts as a proxy to capture the effects of any excluded and/or unquantifiable variables that drive private investments.

In addition, this study takes the extent of the rule of law and the degree of property rights protection explicitly into account. The rule of law was found to be an important variable with a positive sign in explaining the cross-country differences in economic growth (see Barro, 1991; Sala-i-Martin, 1997; Sturm and De Haan, 2005). Furthermore, Acemoglu, Johnson, and Robinson (2001) show that an index of the degree of property rights protection (average protection against expropriation risk between 1985 and 1995) yields a positive and statistically significant coefficient when regressed against the log of purchasing power parity adjusted per capita GDP in a sample of 110 countries.

In the literature, there are a number of studies linking economic performance to political and institutional variables.<sup>9</sup> Regarding private investments, Pastor and Sung (1995) and Feng (2003), for example, find that a democracy index enters with a positive and significant sign into the specification of a private investment function in developing countries. It is indeed intuitive that there would be no incentives to invest in a hostile environment, such as in a civil war or widespread anarchy in a country, or if the laws and regulations are restrictive and possibly changing frequently and unpredictably. Nevertheless, the empirical literature on the interactions between private and public investments has largely overlooked the impact of the rule of law and the degree of property rights protection. This paper establishes and emphasises this link. For operational purposes, we employ the “legal structure and property rights” index, which is a sub-category of the economic freedom index of Gwartney and Lawson (2004). The index is measured on a 0 – 10 scale, 10 being the best.

A further consideration is that public infrastructure investments are often vulnerable to government and policy failures. Regardless of whether they are productive or not in essence, government investments are prone to misuse for political purposes or for the benefit of interest groups. As such, they may not fulfil their original purpose in practice and may indeed hinder private sector activity due to the possible uncertainty and a lack of accountability in policy making. This points to the importance of the governance factor as a determinant of the quality and thus the effectiveness of public investments. Corruption, for instance, is one way through which public resources could be wrongly channelled (see Everhart and Sumlinski, 2001; Lambsdorf, 2003). Nevertheless, it is not the only way; and the problem relates in general to the degree of checks and balances in the political power structure. It is well-known

that even the best efforts to increase economic efficiency are doomed to fail if the political system cannot sustain them due to weak institutions and low credibility.<sup>10</sup>

To account for the degree of potential checks and balances in the political system, we use the political constraints index calculated by Henisz (2000, 2004). This variable is derived from a spatial model of political interaction. It is designed to capture the extent of constraints each effective independent veto player faces in changing the policy course in a country. We assume that the larger the number of such veto players, there would be a higher degree of cross-control among the political actors, making the misuse of public funds more difficult by any single one. As such, this variable should serve as a better proxy for the systemic potential for the misuse of public resources than a particular measure, such as a (perceived) corruption index, or an index of democratic institutions. As a drawback, a higher value of this variable indeed might make it difficult for a country to undertake the necessary reforms since a stable coalition of players would be needed for their acceptance and implementation. Nevertheless, once (if) reforms take place, they become more credible. In other words, the effectiveness and sustainability of policy reforms necessitate a good degree of checks and balances and accountability in the political system. As a result, those countries that undertake economic, social, and legal reforms under a system containing higher levels of checks and balances may benefit more from productive public investments due to the improvements in the investment environment, better governance, and more policy credibility.

Overall, the candidate variables to explain the phenomenon of crowding-in are the following. 1) size of the government (*Government Size*) as represented by the corresponding sub-component in Gwartney and Lawson's (2004) economic freedom of the world index, 2) per capita income in 1975 (*Per capita GDP in 1975*) to capture the differences in the initial level of development across countries, 3) a broad proxy for the degree of constraints in the exercise of political power (*Checks & Balances in the Political Structure*), 4) availability of domestic credit (*Domestic Credit*), 5) changes in the external debt servicing burden (*Foreign Debt Service*), 6) rule of law and the degree of protection of property rights (*Legal Environment*), and 7) the volatility of the private investment to GDP ratio as a measure of the uncertainties in the private business environment (*Uncertainty*). Further definitions and the data sources for these variables are given in the Appendix.

### III. FURTHER CONSIDERATIONS AND THE ESTIMATION RESULTS

Before presenting the estimation results, we first elaborate on some specification and estimation issues. Given the above set of candidate variables to explain the likelihood of the crowding-in effects of public investments in developing countries, we have tried various constellations of them to arrive at a final specification of the politico-economic model. The empirical problem is that the candidate variables can be included in the model in levels, as possible interaction effects, and in changes over time. There are, for example, a large number of possibilities to express the variables as changes over time in our sample period. However, the number and the nature of variables that can be included in various alternative specifications are limited in view of the possible collinearity between the variables, lack of degrees of freedom, and computational considerations. In view of these practical empirical problems, the choice and the specification of the variables in the final model were made in view of their ability to shed independent light on as many different aspects of the economic and political arguments outlined above as possible and the behaviour of several model selection criteria upon the inclusion of each variable in the model. Regarding the variables expressed as changes over time, for instance, we used a search procedure employing various model selection criteria to identify the most significant periods of change. This approach indicated that the change between 1975 and 1995 for the government size variable and the change in the 1980 – 1995 period in the legal environment variable were the periods with the highest information content. Overall, the variables included in the final specification include all the candidate variables discussed in Section II.

The probit model estimates are obtained by using the quadratic-hill-climbing algorithm with robust covariances (Huber & White method). Table 2 shows the estimation results for the final specification of the politico-economic model discussed above.<sup>11</sup>

< Table 2. approximately here >

The estimated coefficient on the initial per capita income level is negative. Thus, it can be said that while an increase in public investments, *ceteris paribus*, promotes private sector investments in some countries, this effect decreases as the level of development increases. This finding suggests that there may be diminishing returns (in terms of crowding-in likelihood) to productive public investments as the income level increases. This is in line with

the idea that public investments are more conducive to private investments at earlier levels of development.

The volatility of private investment, the availability of domestic credit, and the change in the external debt service to export revenues (good and services) ratio are all found to be statistically significant and carry their expected signs. The volatility of private investment has a negative sign in line with the theory: as uncertainty increases, there is less room for increased public investments to crowd in private investments. That is, even if the public investments provided the necessary infrastructure, the unwillingness of the private sector to invest due to a volatile macroeconomic environment and other uncertainties would appear as if public investments were not conducive to private investments. The domestic credit variable has a positive coefficient. This is in line with the argument that credit bottlenecks hinder private investments. As these bottlenecks ease, the private sector can act or obtains the means to respond to the opportunities in the business environment, whether they are brought about by productive public investments or not. The coefficient on the external debt variable is negative. This is because it is expressed in terms of changes in the external debt ratios overtime (as end-period minus first-period). That is, decreases (increases) in external indebtedness increase (decrease) the crowding-in probability.

It is also notable that the degree of checks and balances in the use of political power has a positive and statistically significant coefficient, providing support for the arguments outlined in Section II about the vulnerability of public investments to political misuse. In countries where the political structure contains more checks and balances (that is, a higher number of effective independent veto players), the channelling of public resources for personal or political purposes become more difficult. Hence, public investments are more likely to accomplish their productive functions. Furthermore, the estimated coefficients on the change in the overall government involvement in the economy and the change in the legal environment of business are positive and significant. Therefore, the favourable impact of policy reforms that reduce the size of the government and ensure the rule of law and property rights on private sector investments is also given empirical support.

Evaluating the empirical findings in another perspective, it may at first appear contradictory that a reduction in the government size is positively associated with the crowding-in phenomenon brought about by higher public investment levels. This puzzle is, nevertheless, resolved by the definitions of the variables. The government size variable in the “economic freedom of the world index” includes government consumption items and transfer payments, the productivity of which might be questionable. On the other hand, the definition

of the government investment variable is more on the productive side – barring for the possibility of policy mistakes and misuses. The implications of taking these two forms of government expenditure items together [that is, public investment (implicitly) on the left hand side and public consumption and transfer payments on the right hand side] are important to note: Reductions in the unproductive components of the government size create a more favourable investment environment for the private sector. In other words, increases in government size due to increases in unproductive components reduce the positive spillovers from public fixed capital investments. The policy implication is that reducing the government size by cutting productive government investments is not recommended, especially if the political system contains sufficient level of checks and balances to prevent their misuse.

It is also found that changes in the rule of law and the degree of protection of property rights have paramount importance for public investments to crowd in private investments. Indeed, looking at the summary statistics on the explanatory variables (see Table 4), the change in this variable is +2.51 on a 0 – 10 scale for the countries where *CROWD-IN* = 1, and –0.05 in countries where *CROWD-IN* = 0. That is, in those countries where public investments did not crowd in private investments, there were no changes in the legal environment of business whereas the countries which improved their internal security situation and ensured the protection of property rights benefited most from the public fixed capital investments. This effect, however, should also be evaluated in view of the initial conditions since we consider the change in the rule of law and property rights protection index during the 1980-1995 period. Regarding the variables expressed as changes over time, it should be noted that if a country had favourable initial conditions (level) and if it did not worsen (change), the likelihood of crowding-in remains high. On the other hand, if a country had unfavourable initial conditions but undertook successful reforms, the chances of crowding-in improves – especially when the political power structure can sustain them.

Overall, our findings show that the crowding-in likelihood of public investments increase with a leaner government size measured by government consumption and transfer payments, less uncertainty, lower foreign debt service burden, and more availability of credit to the private sector. These factors bear affect especially for countries starting from lower levels of economic development. The overall success of the productive public investments, however, also depends on the levels of checks and balances in the exercise of political power, and the improvements in the legal environment of business – both highlighting the importance of the governance factor.



How does this specification perform in predicting the crowding-in cases in our sample? Table 3 shows the values of the assumed and the predicted values of the crowding-in variable.

< Table 3. approximately here >

Strikingly, the model explains all 18 cases of no-crowding-in cases correctly. Out of the seven crowding-in cases, six are correctly predicted – the exception being the Philippines. A comparison of the values of the explanatory variables for the Philippines with their average values for the *CROWD-IN=1* and *CROWD-IN=0* cases shows that the Philippines had a higher initial per capita GDP in 1975 than the other crowding-in cases (US\$ 1430 vs. US\$ 1090). Secondly, the value of the checks and balances variable in the Philippines is below the average of the other crowding-in cases (0.14 vs. 0.39) and indeed closer to the no-crowding-in cases. Finally, the reduction in the foreign debt service ratio in the Philippines is much lower than the average of the other crowding-in cases (3.63 vs. 7.25 percentage points). The last two factors highlight the importance of the checks and balances in the political power structure and the impact of external debt problems on the interactions between public investments and private sector activity.

As a general caveat, it is still possible that the Philippines or any other country in the sample is wrongly classified as a crowding-in or no-crowding-in case. Or, in the case of Philippines, it may be that some missing variable leads to the incorrect prediction. In any case, it must be kept in mind that the decisions on the crowding-in cases are subject to a statistical Type I error from the cointegration and Granger-causality tests conducted in Atukeren (2005). In addition, the statistical inference from the probit regression is also subject to Type I error. Nevertheless, it can be said that the model has an overall satisfactory predictive power. For completeness, the categorical statistics on the variables in the final model are shown in Table 4.

< Table 4. approximately here >

#### IV. CONCLUSIONS

This study analyses the determinants of the crowding-in effects of public investments in a sample of 25 developing countries using a multivariate probit model. The cases of crowding-in reported in Atukeren (2005), which were obtained by means of cointegration and Granger-

causality tests, were used to code the dependent variable as “1” or “0” in the probit regression (see footnote 7 for some qualifications). The cross-section data range covers the period from mid-1970s to 2000 in most cases.

The explanatory variables were chosen in line with literature on the determinants of private investments in developing countries – augmented by institutional variables. This is because, for increases in public investments to lead to increases in private investments, the right economic, political, and legal framework (including the rule of law) should be in place for the private sector.

The results of this study show that the likelihood of the crowding-in effects of productive public investments is higher in countries with a more stable macro environment and in those countries which reduced the overall size of their government sector while increasing the level of productive government investments. Furthermore, the probability that public investments enhance private investments is higher at lower levels of economic development. It was also found that public investments are more likely to crowd in private investment, the higher the availability of domestic credit, and the more successful they are in lowering their foreign debt burden. In addition, the degree of the checks and balances in the political system and the improvements in the rule of law and property rights protection play an important role in paving the way for realizing the positive effects of public fixed capital investments on private sector activity. These findings highlight the importance of ensuring accountability and good governance in undertaking public investments.

Assessing the politico-economic model in terms of its predictive ability, it failed in only one of the seven crowding-in cases (the Philippines). As an equally important criterion, however, the model could successfully explain the incidence of all 18 cases of no-crowding-in in our 25-country sample. This is an important consideration since the reasons why public investments would not crowd in private investments in those countries can be traced back to their economic, political, and legal environments.

In sum, it can be said that productive public investments may crowd in private investments, but this still depends on the developments in the governance-related factors and the overall environment of private business in individual countries. As such, our findings capture the essence of the mixed results found in this literature well. Overall, the results of this study shed further light on the conditions under which public investments are more likely (not) to crowd in private investments in developing countries by explicitly considering the differences and the developments in their economic, political, and legal environment of business.

## ENDNOTES

**1** See Gramlich (1994) for a review of the literature on infrastructure investments.

**2** Some influential studies in this approach are Ram (1996), Barro (1991), and Mankiw et al (1992). Barro and Sala-i-Martin (2003) provides a comprehensive account of the theoretical and empirical literature on economic growth.

**3** Another approach is the computable general equilibrium (CGE) modelling. See Kim (1998) for an application of the CGE approach.

**4** The literature on the effects of different components of government expenditures on economic performance is large. Nijkamp and Poot (2004) uses the meta-analysis technique to review the literature on the effects of fiscal policies on economic growth. Their paper provides a comprehensive list of the published studies on the topic. In addition, see Ram (1996), Deverajan, Swaroop, and Zou (1996), Khan and Kumar (1997), Agell, Lindh, and Ohlsson (1997), Ahmed and Miller (2000), Poot (2000), Everhart and Sumlinski (2001, especially Table 2.2), Zagler and Dürnecker (2003), Romp and De Haan (2005), and the references cited therein for a further survey of the literature.

**5** Based on Sala-i-Martin's (1997) dataset, Sturm and De Haan (2005) reinvestigate the robustness of the relationship between various economic, political, institutional, and historical factors (overall 59 variables) on long-term economic growth. Their estimation results by using robust methods (least trimmed squares and re-weighted least squares) show, among others, that the public consumption share in GDP has a negative and statistically significant coefficient, while the coefficient on the public investment variable is positive but not statistically significant. Nevertheless, these results are not found to be robust upon applying a sensitivity analysis using two versions of the extreme bounds analysis technique. These findings reflect the essence of the wide spectrum of mixed results found in the literature on public spending and economic performance quite well.

**6** These countries are: Brazil, Costa Rica, El Salvador, Uruguay, India, Pakistan, Thailand, Kenya, Morocco, South Africa, and Tunisia.

**7** The results reported in Atukeren (2005) indicate complex dynamics between public and private sector investments for South Africa and Morocco. For example, the cointegration tests indicate crowding-in effects, while the Granger-causality tests in an error correction model that takes the long-run cointegrating relationship into account indicate crowding-out effects. Furthermore, crowding-in effects from private investments to public investments were also detected. An examination of the data on the public and private investments in South Africa shows a negative trend in both of them, which is picked as a stable (non-diverging) positive relationship between them in the cointegration equation. Also, it was found that the short-run dynamics captured by the Granger-causality test which indicate a crowding-out relationship explains the relationship between public and private investments in South Africa better. This is not the case for Morocco. As a result, we treat Morocco as a crowding-in (“1”) case, but consider South Africa as a no-crowding-in (“0”) in our subsequent empirical analysis.

**8** It should also be noted that our study uses aggregate data on public and private investments. Thus, we do not account for the interactions between the public and private investments at the regional or micro level. For example, public investments undertaken in a local development program may promote private sector activity in that particular region or locality, but any offsetting effects from elsewhere in the country may blur these positive effects in the aggregate. The micro-level interaction between public and private investments in developing countries is a further topic to investigate.

**9** See Brunetti (1997), Rodrik (2000), Feng (2003), and Keefer (2004) for a discussion of the impact of the political and institutional variables on various measures of economic performance. See also Goldsmith (1997) and Guseh (1997). Sturm and De Haan (2005) provides a robustness analysis of the institutional factors on long term economic growth.

**10** See Persson (2002). Calderón, Duncan, and Schmidt-Hebbel (2004) analyse the relationship between policy credibility (derived from the credit spreads the countries have to pay in international bond markets) and the policy makers’ ability to conduct counter-cyclical (stabilisation) policy in a cross-country panel of eight Latin American and three Asian countries as well as using time series analysis for Chile. Their findings support Persson (2002) in that ‘countries with low credibility (and weak institutions) are unable to sustain the monetary and fiscal policy stance they have previously announced.’ (Calderón, Duncan, and Schmidt-Hebbel, 2004: 629). Their results are also in line with the argument that as countries

solve their external debt problems and improve their international credit ratings (that is, as the credit spreads decrease), the environment of private business improves.

**11** Alternatively, the model was estimated by a multivariate logit model. All variables were found to have the same estimated signs as in the probit model and they remained statistically significant. That is, the estimation results are robust to the distributional assumptions – a normal distribution in the probit case and a logistic distribution in the logit case.

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## TABLES

Table 1. *Countries Analysed in the Study*

Country	Sample range	CROWD-IN
Argentina	1970-2000	0
Brazil	1970-1999	1
Chile	1970-2000	0
Colombia	1970-2000	0
Costa Rica	1970-1998	0
Dominican Rep.	1970-2000	0
Ecuador	1970-2000	1
El Salvador	1970-2000	0
Guatemala	1970-2000	0
Mexico	1970-2000	0
Paraguay	1970-2000	0
Uruguay	1970-2000	0
Bangladesh	1973-2000	1
India	1970-1999	0
South Korea	1971-1999	0
Malaysia	1970-2000	1
Pakistan	1970-2000	1
Philippines	1975-2000	1
Thailand	1970-2000	0
Turkey	1970-2000	0
Kenya	1970-1999	0
Malawi	1973-2000	0
Morocco	1975-2000	1
South Africa	1970-1999	0
Tunisia	1970-1999	0

Source: Atukeren (2005, Tables 1 and 3) See also the Endnote 7 in the present paper.

Table 2. *The Estimation results from the Politico-Economic Model*

Dependent Variable: <i>CROWD-IN</i>				
Method: ML - Binary Probit (Quadratic hill climbing)				
No. of Observations: 25				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
Constant	3.389412	1.601242	2.116740	0.0343
Per capita GDP (1975)	-0.004253	0.001417	-3.001480	0.0027
Government Size (1995-1975)	0.469185	0.260147	1.803537	0.0713
Legal Environment (1995-1980)	1.327759	0.399576	3.322917	0.0009
Uncertainty	-2.176178	0.999187	-2.177948	0.0294
Checks & Balances in the Political Structure	6.175077	2.136443	2.890354	0.0038
Foreign Debt Service Ratio (1990s – 1980s)	-0.224943	0.070099	-3.208954	0.0013
Domestic Credit	0.109096	0.062234	1.753001	0.0796
Mean dependent var.	0.280000	Std Dev. dependent var		0.458258
Log likelihood	-3.756755	Schwarz criterion		1.330581
Probability(LR stat., 7 d.f.)	0.002409	McFadden R-squared		0.746573
Obs. with <i>CROWD-IN</i> = 0		18	Obs. with <i>CROWD-IN</i> = 1	7

Table 3. *Actual (Assumed) vs. Fitted Values*

<b>Country</b>	<b>Assumed</b>	<b>Predicted</b>
Argentina	0	0.001
Brazil	1	0.999
Chile	0	0.001
Colombia	0	0.001
Costa Rica	0	0.109
Dominican Rep.	0	0.023
Ecuador	1	0.938
El Salvador	0	0.164
Guatemala	0	0.301
Mexico	0	0.001
Paraguay	0	0.001
Uruguay	0	0.001
Bangladesh	1	0.887
India	0	0.029
South Korea	0	0.001
Malaysia	1	0.998
Pakistan	1	0.999
Philippines	1	0.109
Thailand	0	0.217
Turkey	0	0.001
Kenya	0	0.326
Malawi	0	0.004
Morocco	1	0.999
South Africa	0	0.001
Tunisia	0	0.001

Table 4. *Categorical Variable Statistics in the Politico-Economic Model*

<b>Mean</b>	<b>CROWD-IN = 0</b>	<b>CROWD-IN = 1</b>
Per capita GDP (1975)	1886.111	1090.000
Government Size (1995-1975)	-0.416667	-0.057143
Legal Environment (1995-1980)	-0.050000	2.514286
Uncertainty	2.807133	2.784722
Checks & Balances in the Political Structure	0.149444	0.394286
Foreign Debt Service Ratio (1990s – 1980s)	-5.449534	-6.733602
Domestic Credit	33.45973	35.26416
<b>Standard Deviation</b>	<b>CROWD-IN = 0</b>	<b>CROWD-IN = 1</b>
Per capita GDP (1975)	1287.415	628.0923
Government Size (1995-1975)	0.813308	1.404584
Legal Environment (1995-1980)	2.600735	3.837286
Uncertainty	1.228425	1.536313
Checks & Balances in the Political Structure	0.524495	0.868451
Foreign Debt Service Ratio (1990s – 1980s)	6.163982	2.002283
Domestic Credit	19.20441	20.29832
<b>No. of Observations</b>	<b>18</b>	<b>7</b>

## APPENDIX

### DATA SOURCES AND DEFINITIONS

*CROWD-IN*: The dichotomous dependent variable taking the value “1” for the cases of crowding-in reported Atukeren (2005, Table 3) and “0” otherwise. In that study, public and private investments are found to be cointegrated in Brazil, Pakistan, Morocco, and South Africa and an error-correction-model (ECM) framework was used to analyse the interactions between them. An ECM has two parts: one part capturing the long-term relationship between the variables of interest and the other part showing the short-term dynamics. The ECM for Brazil, for example, suggests a long-run crowding-out effect, while the short-run dynamics between the public and private investments indicate a crowding-in effect. Similarly, the short-run causality from public investments to private investments indicates a crowding-out effect, while the long-run relationship shows a crowding-in relationship in Pakistan, Morocco, and South Africa. In our study, we classify all cases of a positive influence from public investments to private investments, whether they arise in a short-run or in a long-run perspective, as a crowding-in effect. (See also endnote 7)

*Per capita GDP 1975*: Per capita GDP in current PPP US\$, World Development Indicators CD-ROM, 2003.

*Government Size*: Includes two components: 1) Government consumption, 2) Transfers and Subsidies. It is measured on a 0 – 10 scale, 10 representing the least or the most efficient. Source: Gwartney & Lawson (2004).

*Domestic Credit*: Domestic credit to private sector as percentage of GDP. World Development Indicators CD-ROM, 2003.

*Uncertainty*: The standard deviation of the average share of private investments in GDP between 1975-2000. Source: calculated from the data in Everhart and Sumlinski (2001).

*Foreign Debt Service Ratio*: External debt payments (publicly guaranteed and IMF) as a percentage of the revenues from the exports of goods and services. The difference in the foreign debt service ratio between 1979-1989 (period average) and 1990-2001 (period average) is used in our estimations. Source: World Development Indicators CD-ROM, 2003.

*Legal Environment:* Includes two components: 1) Rule of Law, 2) Property Rights. It is measured on a 0 – 10 scale, 10 representing the best or the most efficient. Source: Gwartney and Lawson (2004)

*Checks and Balances in the Political Power Structure:* The degree of checks and balances, (based on the number of effective independent veto players) in the political system. This variable captures the extent of constraints in which any political actor faces over the choice of future policies. It ranges between 0 (least constrained) and 1 (most constrained). Source: the normalised POLCONV variable in Henisz (2004, Appendix, Table A1). A detailed discussion of this variable is provided in Henisz (2004:, 9-20).