INTERACTIONS BETWEEN PUBLIC AND PRIVATE INVESTMENT: EVIDENCE FROM DEVELOPING COUNTRIES(*)

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Abstract

This paper analyses the relationships between public and private investments in developing countries. First, we investigate whether public investment "crowds out" or "crowds in" private investment by using cointegration analysis and Granger-causality tests in a sample of 25 developing countries for the time period 1970-2000. This analysis identifies 11 countries where public investment crowds out private investment and eight cases where there is a crowding in effect from public investments to private investments. In six countries, no statistically significant crowding out or crowding in effects are present. In a second step of analysis, we run a probit regression where the dependent variable takes the value "1" if the private investment has been found to be crowded out by public investment for a given country. Thus, we attempt to find out under which conditions public investments are more likely to crowd out private investments. In doing so, we focus our attention to socio-political and -economic factors. For this purpose, the "Economic Freedom Index" and its sub-indices calculated by the Fraser Institute (Canada) have been utilised. The probit estimates show that size of the government sector, exchange rate controls and restrictions, well functioning financial markets and good monetary policy, and openness to international trade play a significant role in determining the likelihood of the crowding out effects of public investments.

Keywords: Private investment, Public Investment, Crowding out, Crowding in, Developing Countries, Cointegration, Granger-causality, Probit analysis

JEL Classification: O11, O23, E62, C22, C25

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I. INTRODUCTION

Whether public and private sector investments are substitutes or complements has been a ground for strong controversy in economic theory and policy. Free markets advocates argue that government intervention in the economy should be minimised. According to this view, state sector activity competes with private sector for scarce resources and drives their prices up. Especially if public sector investments are financed by borrowing, this leads to an increase in market interest rates and thus raises the cost of capital for the private sector. Hence, some private sector projects become unprofitable/infeasible. The end result is the crowding out of private investments by public sector investments. Since it is generally accepted that private sector investments contribute more to economic growth, an increase in the size of the public sector at the expense of the private sector also hinders economic growth and well-being.[1]

On the other side of the coin, it is argued that public investments may indeed be beneficial for the development of the private sector. The government sector, for example, can afford to invest in infrastructure projects that involve large sunk costs and need long lead times to become profitable. The private sector may benefit from the spillovers from such public sector projects during and after the completion of the project. A better developed infrastructure in roads and railways, for example, reduces transportation costs, and hence facilitates a better business environment. Furthermore, public investments in education and health care facilities help improve the level and the quality of human capital in an economy. In addition, as an aggregate demand management tool, government investments might be used as a counter-cyclical economic policy measure to smooth the business cycle and revitalise the private sector activity – at least in the short run. Last but not the least, the crowding out arguments explained in the paragraph above are based on the assumption that the economy operates at a point on its production possibilities frontier and that it has well-developed and efficiently functioning financial markets. These conditions are not always fulfilled – especially in developing countries. Thus, public investments may not necessarily compete with the private sector for scarce resources. Some private sector investments might also not be financed if financial markets are shallow. In such situations, public sector investments might indeed play a catalyst role in providing the economy with much needed and otherwise hard to undertake investments. As a result, the private sector and the economy in general may benefit from public sector investments.

In the above discussion about the possible beneficial effects of public sector involvement in the functioning of the economy, we restrict ourselves only to productive investments. This excludes other categories of public spending, such as wages and salaries, subsidies, and unproductive government consumption items. Some of these expenditure items may be used as counter-cyclical policy measures and thus help smooth business cycles, but the effect of such expenditures on private sector investments is another topic to investigate. Another issue is the source of financing the public investments. Or, is tax financing better than borrowing? As discussed earlier, bond financing might

raise the market interest rates to the detriment of the private sector investments. On the other hand, tax financing may distort relative prices and do more harm to the economy. These are empirical matters to be resolved, and lie outside the scope of this study.

On the empirical side, the studies on the effects of public investments on private investments in developing countries is rather scarce. Most studies focus on the industrialised countries. Even so, the main issue is the connection between such investments and economic growth. Or, the focus is whether private sector investments are more productive than public sector investments. Some studies devote special attention to the links between public and private investments. However, the method of analysis is usually restricted to single- or cross-country contemporaneous regressions. Given that public sector is more likely to undertake large projects with long completion and lead time, such studies may underestimate the effects of public investments on private sector activity. [2]

This paper attempts to fill a gap in this literature by analysing the interactions between private and public investments by using Granger-causality tests and long-term cointegration analysis on a sample of developing countries. The data are taken from the International Finance Corporation's (IFC) "Trends in Private Investment "(TPI) publication, authored in 2001 by Everhart and Sumlinski. The IFC has been publishing the TPI for more than a decade now, providing a consistent source for investment data in developing countries. The definition used in the TPI also improves on other standard measures that classify capital expenditures of state-owned enterprises as private investment. It "...accounts all investment undertaken by the public sector – including through state enterprises – as public sector investments" (Everhart and Sumlinski, 2001, *Foreword*).

Everhart and Sumlinski (2001) discuss and summarise the previous empirical studies of crowding out and crowding in effects of public investments on private investment.[3] Nevertheless, most of the previous studies employed correlation based analysis. As Everhart and Sumlinski (2001) emphasise "...correlation does not prove causation..." (p.12) To the knowledge of this author, the paper is the first one to employ a consistent Granger-causality and cointegration testing methodology to evaluate the interactions between public and private investment in a large number of developing countries.

The rest of the paper is organised as follows. Section II discusses the data and empirical methodology. Section III presents the results from Granger-causality and cointegration tests. Then, the implications of these results in view of the previous literature are discussed. Section IV puts the results from section III in a novel perspective. That is, we use a probit framework to analyse the determinants of crowding out by using the results from Granger-causality tests and cointegration analysis. In doing so, we focus our attention to the socio-economic and political factors of the business environment, and look at how the components of an economic freedom index help explain the crowding out phenomenon.

II. DATA AND METHODOLOGY

We use the data on private and public investment from Everhart and Sumlinski (2001). While data are available on a large number of developing countries, we restricted our sample only to those countries with longer spans of data (from the early the 1970s on). This left us with 25 countries. Of these countries, 12 are Latin American, eight are Asian, and five are African countries. The investment data are represented as percentage of GDP. Expressing the private and public investment data in terms of their shares of GDP has the advantage of controlling for GDP growth. In a growing economy, both public and private investment might be increasing and one may spuriously detect a positive relationship between them if GDP growth is not controlled for. Table 1 lists the countries and the time periods used in our study, and the simple correlation coefficients between the shares of private and public investments to GDP for different sample periods.

< Table 1 approximately here >

As Table 1 illustrates, the contemporaneous relationship between private and public investment has not been stable over the last three decades. In El Salvador, for example, the correlation coefficient is zero for the 1970-2000 period; but it changes from 0.88 in the 1970s to –0.89 in the 1980-1989 period and becomes a strong plus again (0.65) in the 1990s. Our analysis period, of course, reflects many external shocks, the debt crisis, and structural adjustment programs, further liberalisation episodes, and a drive to cut the size of the public sector through rationalisation and privatisation. It is, therefore, hard to detect robust relationships especially by employing contemporaneous correlation-based analyses.[4]

In addition, correlation does not necessarily mean causation. Even if one uses a lead-lag correlation analysis between the variables of interest, a statistically significant lag of variable X on another variable Y does not mean that X causes Y. In this study, we use Granger's (1969) definition of causality and its extensions. Before doing so, however, we test whether there exists a long-run equilibrium relation between public and private investments. The first step for the cointegration analysis is testing whether the variables in question are stationary or they are integrated of order 1 (i.e, I(1)) or higher. Our choice for the testing for unit roots is Phillips and Perron's (1988) test (PP). We preferred to use the PP test since it has less strict assumptions about the behaviour of the test equation's error term. In the PP test serial correlation and heteroscedasticity is corrected for, which may be relevant in our case. If both the private and public investment variables are found to be I(1) processes, then it is possible that they are also cointegrated. Normally, the combination of two I(1) series are I(1) – a random walk. However, there may exist a special parameter configuration which leads to an error term with I(0) properties. If this is the case, then the series in question are said to be cointegrated. Since the error term of their combination is stationary, these series have the property that despite some divergences from time to time, they move together and never diverge in the long run. To test for the presence of a cointegrating relationship between private and public investment, we use

Johansen's (1991) test. For the countries where a cointegrating relationship is detected, we present the normalised coefficients for the equation and also calculate the resulting error (correction) term. This term is then used as a factor driving the variables towards a long-term equilibrium (or "correcting" short-term divergences from a long-run equilibrium) in the subsequent Granger-causality tests.

The notion of causality received much coverage in statistics, economics, history, and philosophy. Here, we use the term causality in a pragmatic sense. According to Granger (1969), if the history (lags) of a stationary variable X can be used to predict better another stationary variable Y given all other relevant information, then X is a Granger-cause of Y. In other words, for a variable X to Granger-cause another variable Y, the information contained in the history of X should reduce the forecast error variance of Y when all other relevant information has already been accounted for. Of course, how the lag structures are determined is another practical problem to deal with. This has, indeed, important implications on the final results. We deal with this problem by using Schwarz's (1978) "Bayesian Information Criterion (SBIC)" in combination with a subset autoregression and transfer function approach as outlined by Penm and Terrell (1984) and Kang (1989) in choosing the optimal (flexible) lag orders.

The Granger-causality tests are carried out on the first differences of the ratio of private and public investment to GDP. This means, we are rather concerned with how a change in the ratio of public (private) investment to GDP affects private (public) investment. An increase in private (public) investment above the GDP growth rate will lead to an increase in the private (public) investment to GDP ratio. If public investment causally crowds in private investment, this will be confirmed as a finding that an increase in public investment to GDP ratio will also increase the ratio of private investment to GDP. That is, private investment will also grow above the GDP growth rate. This is, of course, a stricter test, but since GDP growth may be a factor linking everything together, it should either be explicitly controlled for (a trivariate relationship) or it should be a common denominator to the variables under investigation. We chose the latter option to keep the analysis simpler. Another point supporting our bivariate framework is that for a variable X to be a direct Granger-cause of another variable Y, X should Granger-cause Y in all systems, bivariate and multivariate. Thus, for public (private) investment to be a direct cause of crowding out or in of private (public) investment, public (private) investment should cause private (public) investment in a bivariate system in the first place.

After testing for the time series properties of the variables, testing for cointegration, and running the Granger-causality tests, we are in a position to evaluate the findings in an overall framework. The literature on the effects of public investments on private investments contains mixed findings. Some results show crowding in for some countries while some others show crowding out in other countries. Even for the same country, there are conflicting results coming from different studies which use different methods and analyse different time periods. It is already suggestive in Table 1 that the relationship between private and public investment may change according to the sample period.

One way to make sense out of such diverse results is to run a meta-analysis that controls for the distinct features for each study. Another way is to make use of the results obtained in the same study. We follow the latter path since the data are collected on the same basis, and a common methodology and a similar estimation sample period are used. Then, the question is how to identify the conditions under which crowding out is more likely to occur. We do this by employing a probit analysis framework and by denoting the cases where crowding out is detected in Granger-causality tests as "1" and denoting all other cases as "0". *A priori*, one may expect that economies with a large public sector and those with rather closed regimes are likely to be inefficient. Hence, they may not favour the development of the private sector. In such economically less free constellations, public investments might crowd out private investments. The studies by Everhart and Sumlinski (2001) and Pellegrini and Gerlagh (2004), for example, specifically investigate the effects of corruption on investments and economic activity. One of their main results is that corruption negatively affects investments and economic growth by lowering the quality of public investments and by introducing uncertainty / additional costs for private investors. [See Pellegrini and Gerlagh (2004) for a further analysis of the transmission mechanisms of the direct and indirect effects of corruption on economic growth.]

Given the importance of "economic freedom" especially for creating a suitable environment for the development of the private sector, we use the "Economic Freedom Index" calculated by the Fraser Institute in Canada. There exist several indices of economic freedom, general liberties, and socio-political conditions. Our choice of the index calculated by the Fraser Institute by no means implies that it is the best. We made use of the Fraser Institute's index since it was more available for our sample period (1970-2000), for all the countries under consideration, and it is also available in sub-categories. Any such index requires some subjective judgement, but since it is applied consistently over time and across countries, it should not create a major problem. In addition, we included per capita income in 1975 and the share of urban population to total population to capture any level of development effects. Then, by running probit regressions with the right-hand-side variables representing different dimensions of economic liberties and other socio-economic/political conditions, we obtain estimates of under which conditions public investments are likely to crowd out (or increase the marginal probability of crowding out) private investments.[5] Of course, it is subject to both the Type I error from the Granger-causality tests in addition to all its shortcomings, and also the Type I error from the probit regressions and any bias in estimates due to possible missing variables. Nevertheless, this approach is rather novel, and represents an attempt to put different country-specific results in a common perspective.

III. EMPIRICAL RESULTS FROM COINTEGRATION AND GRANGER-CAUSALITY TESTS BETWEEN PUBLIC AND PRIVATE INVESTMENTS

In this section, we first present the time-series properties of private and public investment to GDP ratio in the sample and the countries shown in Table 1. The results are presented in Table 2. First a few words about the selection of the appropriate model in Phillips and Perron's (1988) unit root test are in

order. We ran the tests with and without a trend variable. If the trend variable was not significant, it was dropped. Furthermore, we selected the Newey-West bandwidth by optimising the Schwarz's BIC. Employing the Phillips-Perron test in this way, it has been found that the null hypothesis of a unit root in the private investment / GDP process could be rejected at 5 % significance level in Chile, Costa Rica, Ecuador, and Kenya. By the same methodology, the public investment to GDP ratio has been found to be stationary in the Dominican Republic and Bangladesh. Thus, these countries were excluded from the cointegration analysis since the combination of I(0) and I(1) series is necessarily I(1).

< Table 2 approximately here>

The last column of Table 2 reports the results from Johansen's (1991) cointegration test. Both the trace and the maximum eigenvalue statistics are reported. The form of the test employed has been selected individually for each country, based on the minimum Schwarz BIC. In general, the number of lags to capture autocorrelation were set to two in the test equations since we have annual data.[6]

The findings indicate that private and public investments are cointegrated in Brazil, India, Pakistan, Morocco, and South Africa. A long-tem relationship between two series implies the existence of causality at least in one direction. The estimates of the cointegrating relationships are given below for the individual countries. The variable PRIV denotes Private Investment / GDP and PUBL is used to represent Public Investment / GDP, while TREND is a linear time trend. The standard errors are given in paranthesis.

Brazil:

PRIV = 17.67146 – 0.348509*PUBL
(1.2224) (0.1975)

India:

PRIV = 0.255585*Trend – 0.335567*PUBL
(0.1781) (0.0913)

Pakistan:

PRIV = 0.335294*Trend + 1.42130*PUBL
(0.4865) (0.2747)

Morocco:

PRIV = 0.472261*Trend + 1.829888*PUBL
(0.1391) (0.3727)

South Africa:

PRIV = 9.383584 + 0.361036*PUBL
(0.4293) (0.04135)

The long-run normalised estimates show that public investments crowd out private investment in Brazil and India, while there is a crowding in effect in Pakistan, Morocco, and South Africa. A further discussion of these results in view of the previous findings will be made after testing also for Granger-causality.

In running the tests for Granger-causality, we used the first difference of the PRIV and PUBL variables regardless of whether they were found to be I(1) or I(0) processes before. First differencing is necessary in the case of I(1) variables, but it may not be required for the I(0) processes. Nevertheless, upon investigating the correlogram of the I(0) cases, we found that the AR(1) terms are indeed high. Therefore, using first differencing should not present a serious case of overdifferencing. In any case, treating all variables on the same basis provides an ease of interpretation of the results, and even in the case of overdifferencing, this should not affect the results of Granger-causality tests since the effect of overdifferencing is limited to introducing further moving average terms into the specification. For the five countries where cointegration was detected, we included the error correction term in the specification.

The exact methodology is as follows. First, the best univariate specificications for PRIV and PUBL were selected by using the Schwarz BIC. In doing so, we used a subset autoregression approach. This approach has the advantage of suppressing any insignificant lags in the specification up to the maximum lag allowed, M. In our study, M was set to five representing a medium term time horizon for the effects of public or private investments to realise. Suppressing the insignificant lags leads to a gain in estimation efficiency. As the second step, we introduced the history (lags) of PUBL (PRIV) on the best univariate specification for PRIV (PUBL). We used a subset transfer function approach here as well, and suppressed any insignificant lags. We inferred Granger-causality from the resulting best specifications on the basis of two approaches: 1) minimum SBIC, and 2) by testing for the joint significance of the coefficients. Table 3 shows the best univariate specifications and Table 4 presents the best transfer functions of PRIV (PUBL) on PUBL (PRIV) – including the error correction term where appropriate.

< Table 3 approximately here>

< Table 4 approximately here>

The Granger-causal implications of the results presented in Table 4 are summarised below.

< Table 5 approximately here>

Table 5 shows that in 11 out of 25 countries there is some evidence for crowding out effects from public investments to private investments. On the other hand, we find some evidence for crowding in effects in eight countries. The question marks in parentheses indicate that results obtained from cointegration analysis and Granger-causality tests are different. Nevertheless, since Granger-causality

tests in an error correction model framework relate rather to short-term dynamics while the existence of cointegration indicates a long-term relationship in levels, they should not be necessarily interpreted as conflicting results. In any case, where there is some evidence for crowding in or crowding out from short-term or long-term relationships, this is indicated in Table 5.

Another interesting aspect, and perhaps one that has not received much attention in the literature, is the effect of private sector investments on the public sector. According to the cointegration and Granger-causality test results, private sector investments crowd in public investments. Especially considering that the data we used are expressed in terms of these investments to GDP, an increase their first differences reflects a higher growth rate of these investment compared to GDP growth. This points to a complementary effect from private to public investments in some countries. This may happen since an increase in private investments also necessitate an increase in public works and infrastructure. A new factory, for example, would increase the need for public infrastructure and services near that facility. In this case, public and private investment go hand in hand to enhance the productive capacity of an economy.

On the other side of the coin, for India and Malaysia, we see that private investments crowd out public investments. In the case of Malaysia, the size of the public sector investments amounted to about 10 percent in 1975, reached a high of 18 percent in mid-1980s, and declined to about 11 percent in 2000 with a high of 15 percent in the meantime in mid-1990s. The private sector investments, on the other hand, were about 20 percent in 1975 and after some ups and downs it reached up to 32 percent in mid-1990s, and came down to the same level as public investments (11%) in 2000 after the Asian crisis. The detected negative causality from private to public investments in this case must be capturing the huge increase in private investments between 1987 and 1997 and a slight decrease in the public investments in the same period. In India, one sees that public and private investment grow together from 1970 to mid-1980s, but then, the size of the public sector has decreased while the private sector continued to increase its share in GDP - creating a diverging appearance.

Coming back to the effects of public investment on private investment, we see more cases of crowding out than crowding in Table 5. One noteworthy aspect of our results is that while in Latin America and Asia we have mixed results, there is almost uniformly crowding out in Africa. On a country specific basis, it is interesting to observe that our findings for Brazil, that is there is both crowding in and crowding out effects depending on the time perspective, is the complete opposite of the study by Cruz and Teixeira (1999). In Cruz and Teixeira's (1999) study, it was found that public investments crowd out private investment in the short-run, while there is a crowding in effect in the long-run cointegrating relationship. Their study, however, did not use our definition of public and private investments and was conducted for the 1947-1990 period. Public investment to GDP ratio showed a steady decline from about seven percent in mid-1980s to about 3 percent in 2000 in Brazil, while the share of private investments to GDP fluctuated around 16 percent between 1990 and 2000. This divergence is captured as a negative relationship in our cointegration analysis.

Table 2.2 of Everhart and Sumlinski's (2001) study further summarises the main results of some of the studies of crowding out and crowding in effects. There are conflicting results even for the same country in the literature. For example, both crowding and crowding out were found for Mexico, while we have not found any such effects in our study. Also for Pakistan, where we find a long-run crowding in but a short-run crowding out effect, Looney and Frederiken (1997) find crowding in, while Sakr (1993) finds that government expenditure on non-infrastructure components crowd out private investment. In this case, our results would be compatible with Sakr's (1993) findings.

Overall, our findings are in line with the mixed evidence in the literature on the interactions between public and private investments. That is, there is no definitive verdict on whether public investments crowd out private investments or not. The effects change from country to country.

While previous studies stop their analysis at this point, we take it a step further by asking whether the countries where public investments crowd out private investments share some common characteristics. Or, is it possible to say that the likelihood that public investments will crowd out private investments would be higher under certain circumstances? This analysis is the topic of the next section.

IV. DETERMINANTS OF THE CROWDING OUT EFFECTS OF PUBLIC INVESTMENTS

1. Introduction

In this section, we use the results presented in Table 5 to analyse whether there are some common factors shared by the countries where private sector investments are crowded out by public investment in one way or another.[7]

The idea is to employ a probit-based analysis where the dependent variable is whether crowding out from public investments to private investments is observed (taking the value "1") or not (taking the value "0"). As candidate explanatory variables, we consider the "Economic Freedom Index" calculated by the Fraser Institute in Canada, urbanisation rate, and per capita GDP as discussed before.

Before presenting the probit estimates, a few words about the economic freedom index (EFI) would be in order. The EFI is calculated by the Fraser institute for a large number of countries (which includes all of the 25 countries in our study) from 1970 to 2003 (at the time of writing this paper). The overall EFI is a composite index of seven sub-categories and ranges from zero (worst) to 10 (best). The index is calculated by combining objective (e.g. inflation rate and variability, highest marginal tax rate, share of government consumption in GDP, etc.) and subjective measures (e.g. legal security, rule of law, etc.). The transformation of the objective measures on a 0 – 10 scale and the weighing mechanism to obtain the overall index might be open to discussion, but we use it since it is done on a consistent basis for all countries and overtime as much as possible. As such, it represents a consistent

ranking. Further details on the calculation of the index can be obtained from the Fraser Institute, Canada. Table 6. presents the components of the Fraser Institute's economic freedom index.

< Table 6 approximately here>

2. Cross-section Probit Estimates of the Likelihood of Crowding-out

In this section, we present standard cross-section probit model estimates of the determinants of the likelihood of the possible crowding out effects of public investments.[8] As discussed above, the EFI is generally available from 1970 to 2003. However, it is not available in 1970 and 1975 for some of the countries in our sample for some components of EFI. Hence, we estimate the probit model using the EFI index and its sub-indices starting at different time periods.

Table 7 shows how the dependent variable "crowding out" is coded and the available sample range of overall EFI for the countries in our sample. Since urbanisation rates are available for all countries from 1970 on, they are not included in Table 7. Table 8 shows the results from bivariate probit models, which were estimated by using the Bernt-Hall-Hall-Hausman optimisation algorithm and Huber & White robust covariances.

< Table 7 approximately here>

< Table 8 approximately here>

The estimates presented in Table 8 indicate that neither the overall economic freedom index nor the urbanisation rates alone explain the phenomenon of crowding out in our sample. However, the "size of government, (EFI 1)", "monetary policy and price stability (EFI 3)", and "international exchange or the trade openness (EFI 6)" appear to explain crowding out in a bivariate probit regression. In the case of EFI 1, a small government size in the economy is represented by a high number on the 0 – 10 scale. The estimated coefficients on EFI are negative and statistically significant. This indicates that the higher the government intervention in an economy the higher is the likelihood of crowding out effects on private sector investments. The estimates of EFI 3 carry a positive sign, with a tendency towards being slightly significant in 1990. Since EFI 3 represents the health of the monetary system and general investment environment (such as, inflation rate and volatility), a high number indicates a better macro environment. In this context, a positive coefficient implies that the better the macro- monetary environment is, the higher is the likelihood of crowding out. This is in line with the textbook explanation of crowding out effects in developed countries where increases in public investments or expenditures might crowd out private investments through the interest rate channel. EFI 6 is a measure of a country's openness to trade. The estimated coefficients are negative and significant, especially in the 1990s. Since a high number indicates a more liberal trade regime and higher share of exports and imports to GDP, our findings imply that crowding out is more likely to be observed in economies with

rather limited trade openness. This is interesting since it indicates that as international linkages increase, the effect of the government's intervention on the economy decreases (e.g., fiscal policy becomes ineffective in an open economy, therefore, crowding out is less likely to occur). Secondly, looking at the estimates in the opposite way, the estimates suggest that in countries with a more inward trade orientation, the level of bureaucracy is likely to be high and the state sector might be more inefficient. This environment deters private investors, leading to a crowding out effect.

Nevertheless, since these are results from bivariate probit regressions, they may be biased due to missing (correlated) variables. Thus, we continue our analyses in a multivariate framework. In constructing the multivariate model we tried to integrate as many different sub-categories of EFI as possible, and selected best model based on the SBIC criterion – an approach consistent with our model selection strategy in the earlier part of the paper. Nevetheless, the search procedure has been subject to the limitations imposed by the sample size and by the computational considerations to estimate the model efficiently. Table 9 presents the estimation results. Strikingly, our model has the prediction success of 13 out 14 cases of no-crowding out and 10 out of 11 cases of crowding out, using a cut-off probability of 0.50 to determine success. In case of Turkey, a crowding out case (crowding out probability = 0.54) effect was predicted, while no crowding out was falsely predicted for Thailand (crowding out probability = 0.16). In the case of Turkey, this is not so severe, as it lies close to the borderline. In the case of Thailand, Granger-causality tests indicate a crowding out effect from public investments while there is at the same time a crowding in effect from private investments to public investments. Therefore, the dynamics are not so clear-cut, and this may have led to the false prediction.

< Table 9A approximately here>

< Table 9B approximately here>

< Table 9C approximately here>

What do these results mean? In the final model, EFI 1, EFI 3, EFI 4, and EFI 6 were found to be significant in explaining crowding out effects of public investments. Furthermore, the time periods they cover are 1985-1995 for EFI 1, 1985, for EFI 3 and EFI 4, and 1980 for EFI 6.

We discussed the interpretation of EFI 1, EFI 3, and EFI 6 above in the context of bivariate analysis. EFI 4, that is, "freedom to use alternative currencies" or a variable representing exchange rate restrictions and black markets in a country, has a negative sign. Since the more liberal the exchange rate regime is the EFI 4 has higher values, the negative coefficient represents that there is more likelihood of crowding out in a closed and controlled economy. This may again represent bureaucratic inefficiency, corruption, and black market premiums; that is, a rather uncertain environment for private investors.

V. CONCLUSIONS

In this paper, we analysed the crowding out effects of public investments on private investments by using time series (Granger-causality and cointegration tests) and probit analysis in a sample of 25 developing countries. Our findings indicate that both crowding in and crowding out effects of public investments do occur in developing countries. The effects vary from one country to another. This is consistent with the mixed evidence found in the literature. Taking the analysis one step further, we attempt to find out what common characteristics the countries where public investments were found to crowd out private investment share. This was done by means of a probit analysis. As explanatory variables, we used an index of economic freedom and its sub-categories. The model correctly predicted 10 out of 11 cases of crowding out and 13 out of 14 cases of no crowding out. It was found that the higher the share of government involvement in an economy, the lower the trade openness, the more restrictions there are on the use of foreign currencies, and the more stable the macro and monetary environment is, the higher the likelihood that public investments may crowd out private investments. Note that, the first three factors rather characterise an economy with more state controls and inward orientation. In practice, this environment is likely to be correlated with an inefficiently functioning economy with few incentives and high uncertainties for private investors. Even in an economy which is liberalised, with little state sector involvement, and open to foreign trade, crowding out may still occur due to the effects of the financing requirements of government investments through the financial markets. This is captured by EFI 4, the macro-monetary environment factor we discussed above. This form of crowding is the textbook case illustrated rather for developed economies. What also strikes in our analyses is the time periods that were found to be more influential in explaining the crowding out behaviour. It was found that most of the crowding out occurred in the 1980-1995 period. This is a period where many developing countries experienced debt crises and undertook structural adjustment programs. Since the structural adjustment programs were aimed at opening up the economies, reducing the state's involvement in the economy, and liberalising foreign exchange and trade orientation, they might have indeed helped reduce the crowding out effects of public investments – further strengthening the private sector in the economy. After mid-1990s, most economies have much favourable values for the variables we have in our model – suggesting that crowding out, when it occurs, is now more likely to be a through-the-financial markets phenomenon as in a developed country framework.

FOOTNOTES

1 See, Khan and Reinhart (1990) and Khan and Kumar (1997).

2 There is a large literature on different aspects of the crowding in and crowding out effects of public investments. The following are some of the representative studies: Ahmed (1986), Ahmed and Miller (1999), Aschauer (1989), Barro (1974, 1981, 1990, 1991), Blejer and Khan (1984), Buiter (1977), Cruz and Teixieira (1999), Edwards (1992), Erenburg and Wohar (1995), Fisher (1993), Greene and Villanueva (1991), Khan and Kumar (1997), Khan and Reinhart (1990), Lynde and Richmond (1993), Onliner, Rudebush, and Sichel (1995), Otto and Voss (1996, 1998), Sundararajan and Thakur (1980), Voss (2002), among others. Gramlich (1994) provides a literature review regarding infrastructure investments.

3 See, Table 2.2 in Everhart and Sumlinski (2001).

4 Levine and Renelt (1992), for instance, find that the only robust variable in the framework of cross-country growth regressions is trade openness.

5 All data used in the analyses are available from the author upon request.

6 Further details on each country are available upon request.

7 Here, we register all cases as "crowding out" whether it is due to the results of Granger-causality tests or the long-run cointegrating relationship.

8 The panel-probit approach, though widely used in other contexts, is not preferable in our case. This is because the dependent variable is either "1" or "0" for all time periods for a given country. The coding of the dependent variable in this way represents an overall average conclusion that tended to hold during the sample period rather than laying a strong claim that the stated causal relationship between private and public investments in a given country always holds true. This is similar to representing a given country's real GDP growth rate by the sample period's average in cross-country growth regressions.

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TABLE 1. Correlation between Public and Private Investment

	Overall Sample	Simple Contemporaneous Correlation between the Shares of Private and Public Investments to GDP				
LATIN AMERICA		1970-2000	1970-1979	1980-1989	1990-2000	1985-2000
Argentina	1970-2000	-0.31	0.76	0.63	-0.80	-0.72
Brazil	1970-1999	-0.21	-0.16	0.38	-0.42	0.13
Chile	1970-2000	-0.56	-0.33	-0.22	-0.50	-0.00
Colombia	1970-2000	-0.17	-0.53	-065	-0.05	-0.12
Costa Rica	1970-1998	-0.14	0.20	-0.20	0.03	-0.41
Dominican Rep.	1970-2000	-0.11	-0.09	0.49	-0.51	-0.09
Ecuador	1970-2000	-0.02	0.61	0.66	-0.56	-0.46
El Salvador	1970-2000	0.00	0.88	-0.89	0.65	0.48
Guatemala	1970-2000	0.10	0.83	0.15	0.61	0.46
Mexico	1970-2000	-0.57	-0.05	0.29	-0.81	0.80
Paraguay	1970-2000	-0.34	0.39	-0.77	-0.97	-0.92
Uruguay	1970-2000	0.06	0.52	0.38	-0.33	-0.08
ASIA						
Bangladesh	1973-2000	0.63	0.90	0.19	-0.41	-0.43
India	1970-1999	-0.02	0.70	-0.12	-0.68	-0.88
South Korea	1971-1999	0.07	0.08	-0.47	-0.73	0.05
Malaysia	1970-2000	0.28	0.05	0.48	0.23	0.30
Pakistan	1970-2000	-0.02	-0.12	0.17	0.62	0.20
Phillippines	1975-2000	0.24	0.25	0.51	-0.53	0.18
Thailand	1970-2000	0.09	-0.42	-0.87	-0.52	-0.22
Turkey	1970-2000	-0.76	0.16	0.00	-0.73	-0.81
AFRICA						
Kenya	1970-1999	0.38	-0.05	0.73	0.17	0.19
Malawi	1973-2000	0.50	0.35	-0.34	0.57	0.41
Morocco	1975-2000	-0.35	0.24	0.04	-0.62	-0.54
South Africa	1970-1999	0.78	0.21	0.66	0.44	0.61
Tunisia	1970-1999	0.04	0.56	0.56	0.89	-0.11

Note: Where data are not available for the full 1970-2000 period, the correlation coefficients for the periods starting in 1970 or ending in 2000 are for the nearest possible samples.

TABLE 2. Time Series Properties of Private and Public Investment

	Private Investment / GDP (%)			Public Investment / GDP (%)			Cointegrated ?	
	Sample	Phillips-Perron test		Sample	Phillips-Perron test		Johansen Test	
LATIN AMERICA		Level	1st dif.		Level	1st dif.	Trace	Max EV
Argentina	1970-2000	-2.21	-8.45***	1970-2000	-2.27	-4.27***	9.61	7.23
Brazil	1970-1999	-3.00*	-10.45***	1970-1999	-2.81	-7.44***	19.70*	18.90**
Chile	1970-2000	-3.84**	-8.78***	1970-2000	-2.30	-7.02***	---	
Colombia	1970-2000	-2.68*	-6.28***	1970-2000	-2.40	-7.33***	16.82	11.83
Costa Rica	1970-1998	-2.96**	-5.54***	1970-1998	-2.54	-4.28***	---	
Dominican Rep.	1970-2000	-2.83*	-6.14***	1970-2000	-3.08**	-7.96***	18.15	11.72
Ecuador	1970-2000	-5.15***	-9.93***	1970-2000	-1.57	-4.19**	---	
El Salvador	1970-2000	-2.07	-4.53***	1970-2000	-2.67	-5.81***	9.03	6.16
Guatemala	1970-2000	-1.67	-5.07***	1970-2000	-2.25	-5.01***	16.60	11.32
Mexico	1970-2000	-1.36	-4.77***	1970-2000	-1.82	-4.90***	10.75	9.63
Paraguay	1970-2000	-1.91	-4.04***	1970-2000	-2.71*	-8.96***	19.90*	13.70*
Uruguay	1970-2000	-2.12	-4.53***	1970-2000	-2.01	-4.49***	14.26	12.40
ASIA								
Bangladesh	1973-2000	-2.40	-5.47***	1973-2000	-3.83***	-4.66***	---	
India	1970-1999	-2.98	-7.07***	1970-1999	-0.85	-11.02***	28.54***	24.00***
South Korea	1971-1999	-1.99	-3.46**	1971-1999	-2.34	-3.90***	12.32	10.39
Malaysia	1970-2000	-2.00	-3.93***	1970-2000	-2.11	-3.79***	14.07	8.51
Pakistan	1970-2000	-2.67	-5.64***	1970-2000	-1.39	-3.51**	32.54***	28.36***
Phillippines	1975-2000	-2.58	-5.99***	1975-2000	-3.11	-8.49***	11.89	8.53
Thailand	1970-2000	-1.47	-3.42**	1970-2000	-1.87	-3.47**	13.80	10.48
Turkey	1970-2000	-2.27	-5.73***	1970-2000	-2.10	-5.61***	13.94	12.75
AFRICA								
Kenya	1970-1999	-3.75**	-7.15***	1970-1999	-3.37*	-6.42***	---	
Malawi	1973-2000	-2.67*	-7.03***	1973-2000	-2.82	-6.21***	9.91	6.71
Morocco	1975-2000	-2.68*	-5.47***	1975-2000	-3.10	-6.41***	38.36***	27.91**
South Africa	1970-1999	-1.61	-4.07***	1970-1999	-2.83	-4.19***	22.74**	19.87**
Tunisia	1970-1999	-2.05	-5.27***	1970-1999	-1.63	-3.65**	16.94	13.38

Note: (***), (**), and (*) denote significance levels of 1%, 5% and 10%, respectively.

TABLE 3. Best Univariate Specifications for Private and Public Investments / GDP

	d(PRIV)		d(PUBL)	
	Specification	SBIC	Specification	SBIC
LATIN AMERICA				
Argentina	t-3	4.4294	t-2, t-3	2.9956
Brazil	ECT, t-4	4.1029	ECT, t-1	3.3405
Chile	t-2	4.9862	t-2	3.3490
Colombia	t-5	4.4522	t-3	3.1756
Costa Rica	t-4	3.9387	t-4, t-5	2.4665
Dominican Rep.	t-1	4.6572	t-3	4.0529
Ecuador	t-1	4.7927	t-4	4.0732
El Salvador	t-5	3.8261	t-1	2.4818
Guatemala	t-4	3.7710	t-5	3.0696
Mexico	t-3	3.0029	t-2	3.1398
Paraguay	t-3	4.9079	t-2	4.5477
Uruguay	t-3	3.2223	t-3	2.9485
ASIA				
Bangladesh	t-2	3.9802	t-2	2.9669
India	ECT, t-4	2.9051	ECT, t-4	2.1765
South Korea	t-1, t-2	4.5361	t-3	1.6355
Malaysia	t-1, t-3	5.5789	t-1, t-4	4.1041
Pakistan	ECT, t-2	1.5968	ECT, t-1, t-2	2.5645
Phillippines	t-2	4.7165	t-5	3.1691
Thailand	t-1	4.9858	t-1	2.8997
Turkey	t-5	3.8474	t-3	2.8474
AFRICA				
Kenya	t-1, t-4	3.6697	t-3	2.8973
Malawi	t-1	5.0188	t-3	4.9751
Morocco	ECT, t-1	4.1601	ECT, t-3	3.6106
South Africa	ECT, t-1, t-3	2.4605	ECT, t-4	2.2843
Tunisia	t-3	4.4956	t-1	4.2914

Notes: ECT stands for the "error correction term" from the cointegrating equation. t-i represent the lag order. SBIC is the Schwarz's (1978) Bayesian information criterion. SBIC = (ESS/T)*T (k/T) , where ESS is the error sum of squares from estimation of the model in question, T is the sample size, and k is the number of estimated parameters in the model. Here, we present the log (SBIC) values.

TABLE 4. Best Transfer Function Specifications between Private and Public Investments / GDP

	Ho: PRI does not Granger cause PUB		Ho: PUB does not Granger cause PRI	
	TF Spec., (Sign)	SBIC	TF Spec., (Sign)	SBIC
LATIN AMERICA				
Argentina	t-1, (+)**	2.9000 ‡	t-4, (+)	4.4460
Brazil	t-5 (-)	3.4357	t-1, t-2, t-4, (+)***	3.8905 ‡
Chile	t-3 (+)	3.4511	t-5, (+)	5.0613
Colombia	t-2, t-5 (+)*	3.2158	t-3, (+)	4.4990
Costa Rica	t-4 (-)	2.5638	t-1, (-)*	3.8986 ‡
Dominican Rep.	t-2 (-)	4.0769	t-2, (-)	4.6969
Ecuador	t-1, t-3 (+)***	3.8290 ‡	t-1, (+)**	4.7381 ‡
El Salvador	t-1, t-2 (+)***	2.3103 ‡	t-3, t-4, t-5, (-)***	3.5156 ‡
Guatemala	t-3 (+)**	2.9807	t-4, (-)	3.8682
Mexico	t-1 (+)	3.2334	t-4, (-)	3.0526
Paraguay	t-2 (+)	4.6246	t-2, (+)	4.9960
Uruguay	t-2 (+)***	2.7847	t-5, (+)*	3.2340
ASIA				
Bangladesh	t-1 (+)***	2.7915 ‡	t-4, (+)**	3.8885 ‡
India	t-3 (-)**	2.0654 ‡	t-3 (-)	2.9906
South Korea	t-1 (+)***	1.2472 ‡	t-1, (-)	4.6126
Malaysia	t-5 (-)*	4.0651	t-2, (+)*	5.5780 ‡
Pakistan	t-5 (-)	2.6564	t-2, (-)**	1.5732 ‡
Phillippines	t-5 (-)	3.2002	t-2, (+)**	4.5461 ‡
Thailand	t-1 (+)***	2.6917	t-1, (-)***	4.7726 ‡
Turkey	t-1 (-)	2.9200	t-1, (+)	3.8761
AFRICA				
Kenya	t-1 (+)	2.8043	t-4, (-)***	3.4558 ‡
Malawi	t-3 (+)	5.0435	t-1 (-)	5.0626
Morocco	t-5 (+)*	3.6026 ‡	t-2, t-3 (-)**	4.0167 ‡
South Africa	t-1, t-4 (+)***	2.0456 ‡	t-1, t-4, (-)**	2.3954 ‡
Tunisia	t-3 (+)	4.3159	t-3 (-)*	4.4744 ‡

Notes: As in Table 3. (*) and (**) indicate statistical significance at 5% and 1%, respectively. (‡) indicates that the log(SBIC) obtained under the subset transfer function specification is less than the log(SBIC) value from the subset autoregression. That is, there is evidence for Granger-causality based on the Schwarz criterion.

Table 5. Qualitative Summary Results from Cointegration and Granger-Causality Tests

Direction of Granger-causality	**Countries**
Public Investments crowd in Private Investments	Brazil(?), Ecuador, Bangladesh, Malaysia, Pakistan(?), Phillippines, Morocco, South Africa(?)
Public Investments crowd out Private Investments	Brazil (?), Costa Rica, El Salvador, Uruguay, India, Pakistan(?), Thailand, Kenya, Morocco, South Africa(?), Tunisia
Private Investments crowd in Public Investments	Argentina, Colombia, Ecuador, El Salvador, Guatemala, Uruguay, Bangladesh, South Korea, Thailand, Morocco(?), South Africa
Private Investments crowd out Public Investments	India, Malaysia
No Causality in any direction	Chile, Dominican Republic, Mexico, Paraguay, Turkey, Malawi

TABLE 6. Components of The Fraser Institute's Economic Freedom Index

I. Size of Government
a) Government Consumption
b) Transfers and Subsidies
II. Structure of the Economy and Use of Markets
a) Government Enterprises
b) Price Controls
c) Top Marginal Tax Rate
d) Conscription
III. Monetary Policy and Price Stability
a) Annual Money Growth
b) Inflation Variability
c) Recent Inflation Rate
IV. Freedom to Use Alternative Currencies
a) Ownership of Foreign Currency
b) Black Market Exchange Rate
V. Legal Structure and Property Rights
a) Legal Security
b) Rule of Law
VI. International Exchange
a) Taxes on International Trade
i) Taxes as a Percentage of Exports and Imports
ii) Mean Tariff Rate
iii) Standard Deviation of Tariff Rates
b) Size of Trade Sector
VII. Freedom of Exchange in Financial Markets
a) Private Ownership of Banks
b) Extension of Credit to Private Sector
c) Avoidance of Negative Interest Rates
d) Capital Transactions with Foreigners

Source: Fraser Institute, Canada.

TABLE 7. Coding of the Dependent Variable and Availability of Data on Regressors

Country	Crowding Out	EFI from:	EFI 1 from:	EFI 2 from:	EFI 3 from:	EFI 4 from:	EFI 5 from:	EFI 6 from:	EFI 7 from:
Argentina	0	1970	1970	1975	1970	1970	1970	1975	1970
Brazil	1**	1970	1970	1970	1970	1970	1970	1970	1970
Chile	0	1970	1970	1975	1970	1970	1970	1970	1975
Colombia	0	1970	1970	1975	1970	1970	1970	1970	1980
Costa Rica	1	1970	1970	1975	1970	1970	1980	1970	1970
Dominican Rep.	0	1975	1970	1975	1970	1970	1980	1970	1980
Ecuador	0	1970	1970	1975	1970	1970	1970	1970	1980
El Salvador	1	1980	1970	1980	1970	1970	1980	1970	1985
Guatemala	0	1970	1970	1975	1970	1970	1980	1970	1970
Mexico	0	1970	1970	1975	1970	1970	1970	1970	1975
Paraguay	0	1980	1970	1985	1970	1970	1980	1970	1990
Uruguay	1*	1975	1970	1975	1970	1970	1980	1970	1980
Bangladesh	0	1975	1975	1980	1970	1975	1985	1975	1975
India	1	1970	1970	1970	1970	1970	1970	1975	1970
South Korea	0	1970	1970	1975	1970	1970	1970	1970	1975
Malaysia	0	1970	1970	1975	1970	1970	1970	1970	1970
Pakistan	1***	1970	1970	1975	1970	1970	1970	1970	1970
Phillippines	0	1970	1970	1975	1970	1970	1970	1970	1975
Thailand	1	1970	1970	1975	1970	1970	1970	1970	1975
Turkey	0	1970	1970	1975	1970	1970	1970	1970	1975
Kenya	1	1970	1970	1970	1970	1970	1970	1970	1970
Malawi	0	1975	1970	1975	1970	1970	1980	1970	1975
Morocco	1	1970	1970	1975	1970	1970	1970	1970	1980
South Africa	1***	1970	1970	1975	1970	1970	1970	1970	1970
Tunisia	1	1970	1970	1980	1970	1970	1970	1970	1970

(*) No crowding out hypothesis could be rejected only at 10% significance level. Schwarz BIC did not indicate crowding out.

(**) Crowding out was detected in the long-run cointegrating regression. Granger-causality tests indeed indicate crowding in effects in the short-run.

(***) Crowding out was detected in Granger causality tests while there is evidence for crowding in in the long-run cointegrating relationship.

TABLE 8. Estimates of the Bivariate Probit Model

	1975	1980	1985	1990	1995	2000
Overall EFI (1)	0.1029	-0.2634	-0.1787	-0.2239	-0.2093	-0.1563
EFI 1	-0.2939	-0.4348(*)	-0.6319**	-0.8909***	-0.3793(*)	-0.3815*
EFI 2 (2)	-0.0713	-0.0895	-0.2116	-0.1372	-0.1897	0.0014
EFI 3 (3)	0.0863	0.0723	0.0550	0.1359(*)	0.0719	0.0962
EFI 4	-0.0275	-0.1032	-0.0961	-0.0654	-0.0643	-0.1044
EFI 5 (4)	---	0.0001	0.0714	-0.0462	0.1175	0.0267
EFI 6	0.1260	-0.1021	-0.1192	-0.2034(*)	-0.2226(*)	-0.2942(*)
EFI 7 (5)	---	0.0091	0.1118	0.0494	-0.1758	-0.0831
URBANISATION	0.0071	-0.0083	-0.0010	-0.0112	-0.0110	-0.0103

Significant at : (*) 20%, * 10%, ** 5%, *** 1%. Estimates for 1970 are not available due to missing data for a large number of countries.

(1) El Salvador and Paraguay have missing data in 1975.
(2) El Salvador, Paraguay, and Bangladesh have missing data in 1975.
(3) Bangladesh has missing data in 1980.
(4) 1975 is excluded from estimation due to missing data on eight countries.
(5) 1975 is excluded from estimation due to missing data on seven countries.
Data on El Salvador is missing for 1980 while the data on Paraguay is missing until 1990.

TABLE 9A. Final Model Estimates

Dependent Variable: CROWDOUT
Method: ML - Binary Probit (BHHH)

Sample: 1 25
Included observations: 25
Estimation settings: tol= 0.00010, derivs=analytic (linear)
Initial Values: C(1)=11.2556, C(2)=-1.04745, C(3)=-0.96790,
C(4)=0.85774, C(5)=-0.35385, C(6)=-0.17311, C(7)=0.05823
Convergence achieved after 74 iterations
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	70.93426	31.69344	2.238137	0.0252
EFI_1_85	-7.766842	3.841864	-2.021634	0.0432
EFI_1_90	-2.799816	0.570567	-4.907074	0.0000
EFI_1_95	2.844692	1.063996	2.673592	0.0075
EFI_6_80	-2.604959	1.293408	-2.014028	0.0440
EFI_4_85	-0.890040	0.461191	-1.929871	0.0536
EFI_3_85	0.987670	0.484417	2.038885	0.0415

Mean dependent var	0.440000	S.D. dependent var	0.506623
S.E. of regression	0.280523	Akaike info criterion	0.904466
Sum squared resid	1.416475	Schwarz criterion	1.245751
Log likelihood	-4.305824	Hannan-Quinn criter.	0.999124
Restr. log likelihood	-17.14825	Avg. log likelihood	-0.172233
LR statistic (6 df)	25.68484	McFadden R-squared	0.748906
Probability(LR stat)	0.000255		

Obs with Dep=0	14	Total obs	25
Obs with Dep=1	11		

TABLE 9B. Categorical Variable Statistics

Dependent Variable: CROWDOUT
Method: ML - Binary Probit (BHHH)
Sample: 1 25
Included observations: 25

Variable	Mean Dep=0	Mean Dep=1	Mean All
C	1.000000	1.000000	1.000000
EFI_1_85	8.428571	7.536364	8.036000
EFI_1_90	8.578571	7.418182	8.068000
EFI_1_95	8.114286	7.436364	7.816000
EFI_6_80	4.257143	3.572727	3.956000
EFI_4_85	5.114286	4.181818	4.704000
EFI_3_85	5.771429	6.563636	6.120000

Variable	Standard Deviation Dep=0	Standard Deviation Dep=1	Standard Deviation All
C	0.000000	0.000000	0.000000
EFI_1_85	1.070175	0.768470	1.034762
EFI_1_90	0.795350	0.984701	1.045116
EFI_1_95	1.056014	1.131612	1.120521
EFI_6_80	2.113588	2.138734	2.108530
EFI_4_85	2.161857	2.895451	2.499580
EFI_3_85	2.884555	3.363115	3.062815
Observations	14	11	25

TABLE 9C. Actual vs. Predicted

Actual	Fitted	Residual	
0.00000	0.01825	-0.01825	Argentina
1.00000	0.78512	0.21488	Brazil
0.00000	0.21478	-0.21478	Chile
0.00000	1.2E-08	-1.2E-08	Colombia
1.00000	1.00000	3.7E-08	Costa Rica
0.00000	0.00000	0.00000	Dominican Rep.
0.00000	4.7E-11	-4.7E-11	Ecuador
1.00000	1.00000	9.1E-08	El Salvador
0.00000	3.2E-15	-3.2E-15	Guatemala
0.00000	1.3E-15	-1.3E-15	Mexico
0.00000	0.00000	0.00000	Paraguay
1.00000	0.69300	0.30700	Uruguay
0.00000	0.27287	-0.27287	Bangladesh
1.00000	1.00000	0.00000	India
0.00000	1.1E-15	-1.1E-15	South Korea
0.00000	0.40892	-0.40892	Malaysia
1.00000	1.00000	8.0E-10	Pakistan
0.00000	0.00000	0.00000	Phillippines
1.00000	0.16979	**0.83021**	Thailand
0.00000	0.54599	**-0.54599**	Turkey
1.00000	1.00000	0.00000	Kenya
0.00000	0.00662	-0.00662	Malawi
1.00000	1.00000	0.00000	Morocco
1.00000	0.97722	0.02278	South Africa
1.00000	1.00000	0.00000	Tunisia