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Economics Department Working Paper No. 57

Does Public Investment Enhance Labor Productivity Growth in Argentina? A Cointegration Analysis

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January 2009

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by

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Abstract

This paper addresses the important question of whether public investment spending on economic infrastructure enhances economic growth and labor productivity in Argentina. Following the lead of the endogenous growth literature, it presents a simple modified production function that explicitly includes the positive or negative externality effects generated by public investment. Using cointegration analysis, the paper estimates a dynamic labor productivity function for the 1960-2005 period that incorporates the impact of public and private investment spending and the labor force (rather than the rate of population growth). The results suggest that (lagged) increases in public investment spending on economic infrastructure–as opposed to overall public investment spending– have a positive and significant effect on the rate of labor productivity growth. In addition, the model is estimated for a shorter period (1970-2005) to capture the impact of foreign direct investment. The estimates suggest that foreign direct investment spending has a lagged positive and significant impact on labor productivity growth, while increases in the labor force have a negative effect . Thus, the findings call into question the politically expedient policy in many Latin American countries, including Argentina during the 1990s, of disproportionately reducing public capital expenditures to meet reductions in the fiscal deficit as a proportion of GDP.

Keywords: Cointegration Analysis; Complementatiry Hypothesis; FDI; labor productivity growth; Public investment; unit roots.

JEL: C22, O10, O40, O50**.**

I. Introduction.

The demise of Import-Substitution Industrialization (ISI) in Latin America has led many countries of the region to adopt an outward-oriented, market-based strategy of economic growth and development. Chile was the first major country of the region to adopt an outward-oriented strategy under the regime of Augusto Pinochet during the decade of the seventies, and after the onset and aftermath of the debt crisis in the early eighties, other major countries of the region began to follow suit by dismantling their state-owned enterprises and deregulating their economies.[1] Argentina began this process of economic stabilization and market-based structural reform in earnest following the country's adoption of the "Convertibility Plan," a currency board system introduced in 1991 under the administration of Carlos Saul Menem.[2]

The essential feature of this plan was to tie a new Argentinean peso to the dollar on a one-to-one basis, thus eliminating the ability of the government to finance budget deficits via money creation while, at the same time, restricting the amount of pesos in circulation to the inflow of foreign exchange. One of the most important accomplishments of the stabilization plan was to reduce dramatically the rate of inflation from 2,314 percent in 1990 to 4.1 percent in 1994, and less that 1 percent in 1998! The stabilization of the economy and the withdrawal of the state from key sectors of its economy, such as airlines, banking, electricity, gas, mining, steel, railways, telecommunications and petroleum, was welcomed by both domestic and (particularly) foreign investors, as well as free trade advocates, economists, and government officials working for the multilateral agencies. For example, FDI flows to the country surged during the 1990s, from US$ 1.84 billion to an all-time high of US$23.9 billion in 1999, before falling to US$11.7 billion in 2000, and precipitously to 1.6 billion in 2003 as a result of the economic and financial debacle the economy experienced following the collapse of the currrency board in 2002 [see World Investment Report, 2005].

The stabilization of the Argentine economy during the nineties, however, was not achieved without significant economic and social costs, particularly in view of the economic and financial

debacle associated with the collapse of the Convertibility Plan in 2001-2002. In this connection, several prominent investigators have focused on the long-term economic (negative) effects associated with the severe IMF-sponsored stabilization and adjustment measures implemented by the Argentine government, as well as other countries in Latin America and the Caribbean [see Calva, 1997; Maia and Kweitel, 2003; Pastor, 1989; Stiglitz, 2001;Sunkel, 1994; Taylor 1997; Baer et. al., 2002]. Nowhere is this more evident than in the disappointing and erratic behavior of Argentine private capital formation during the past two and a half decades. Table 1 below shows that in the case of Argentina the share of private investment as a proportion of GDP has fallen relative to its 1980 level, and the country's economic crisis drove the proportion to a dismal level of 16.9 percent in 1996.[3] What is particularly worrisome about these figures is that most economists believe that it is absolutely essential for Argentina-- and other countries of Latin America-- to improve its investment performance if it is going to lay the groundwork for rapid and sustained economic growth, as well as create future employment opportunities for its rapidly expanding labor force [see Moguillansky, 1996; and Werner et al., 2002].

A number of investigators have cited the dramatic fall in public investment in economic and social infrastructure, brought about by the need to meet the stringent fiscal deficit targets of the stabilization program, as one possible factor in explaining the poor investment performance of Argentina and other Latin American countries. Table 1 shows that public investment spending in economic and social infrastructure as a proportion of GDP fell precipitously from 4.6 percent in 1990 to barely 1 percent in 1994, only to rise to 2 percent during the 1995-99 period before falling precipitously in the 2000-2002 period. Moreover, the average public investment spending on economic infrastructure for the 1990s is half of that of the 1980s and just one quarter of the average level recorded during the 1970s. The basic idea is that public investments in highways, bridges, sewerage systems, water supplies, and education and health services often generate substantial positive spillover benefits for the private sector by reducing the direct (and indirect) costs of producing, transporting, and delivering goods and services to consumers [see Aschauer,

1989; Cardoso, 1993; Green and Villanueva, 1991; Khan and Reinhart, 1990; Ram, 1996; Ramirez, 1998; Serven and Solimano, 1993]. If the complementarity hypothesis is correct, then the steep reductions in public capital formation experienced in Argentina and elsewhere in Latin America during the past decade and a half may further depress private investment spending and productivity growth.[4] To make matters worse, it may also undermine some or all of the long-term efficiency gains anticipated from the implementation of market-oriented structural reforms such as privatization of state-owned firms and the liberalization of trade. After all, the newly privatized firms in liberalized (open) markets will need adequate and reliable economic infrastructure in order to produce, transport, and market their goods and services in a cost-effective manner.[5]

The economic rationale for increased public spending on these lumpy and non-rival goods is by no means new or unique, for it can be traced back to book V of Adam Smith's Wealth of Nations more than two hundred years ago.[6] What is new, however, is the incorporation of this basic idea into the endogenous growth literature and its empirical testing in both developed and less developed nations as reliable data on public and private investment becomes available [see Barro and Sala-I-Martin, 1995]. For example, Aschauer [1989] has shown that in case of the United States and other OECD countries, public sector spending on economic infrastructure raises the profitability and the productivity of private capital. Similarly, in the case of Latin America, Solimano and Serven [1993], as well as Cardoso [1993] and Green and Villanueva [1991], have found that a contraction in public-sector expenditure on gross fixed formation explained an annual drop in private investment equivalent to between 0.2 and 0.5 percent of GDP. Ram [1996] in a recent pooled study of 53 developing countries for the 1973-90 period has generated estimates from a standard growth model which suggests that during the 1980s "... public investment seems more productive than private investment in most cases" (p. 1376). Finally, Ramirez [1998] has shown that, in the case of Chile, a one-percentage point reduction in public investment as a proportion of GDP generates a *ceteris paribus* reduction in labor productivity of between .51 to .74 percent.

In view of the importance and controversial nature of this topic, this paper analyzes the impact of public investment spending on economic and social infrastructure--viz., *excluding* expenditures by state-owned enterprises--on economic growth and labor productivity in Argentina. The choice of Argentina is warranted for a number of reasons. First, Argentina is a large and strategically important country in Latin America. This is a situation that promises to continue as a result of the country's participation in the important regional trade agreement named Mercosur . Second, beginning with the Menem administration (1989-1999) and continuing under the ill-fated administrations of Fernando De La Rua and Duhalde (2000-2002), Argentina pursued a far-reaching outward-oriented, market-based strategy of economic growth and development. An empirical study of the role of the Argentine state in the process of capital formation should prove both interesting and useful to development scholars and policymakers as they decide where to allocate scarce public funds to maximize the country's growth potential. Finally, Argentina is one of the few countries in Latin America that has reliable and disaggregated time-series data on public investment spending on economic and social infrastructure (i.e., excluding investment expenditures by SOE's which are likely to crowd out private investment and output) going as far back as the decade of the sixties. This data set thus enables researchers to test whether increases in government *investment* spending on economic infrastructure *per se*, rather than *overall* public investment expenditures, displace or promote private investment spending, economic growth, and (labor) productivity.

The paper is organized as follows. Section II provides a conceptual framework for incorporating the public capital stock in a modified neoclassical production function. Next, the paper introduces a modified empirical counterpart to the model presented in the previous section, and discusses the nature and limitations of the data used in this study. Section IV presents the empirical results for the dynamic production relationship. Using cointegration analysis, this section tests whether there is a stable long-term relationship among the relevant regressors of the modified production function. In so doing, this paper goes beyond other empirical studies of the

complementarity hypothesis by addressing the important question of spurious correlation among the model variables. The section is brought to a close by generating several error-correction (EC) models that are used to track the historical data on the growth rate of output for the period under review. The last section summarizes the paper's major findings.

II. The Model.

On the supply side, the positive externality generated by additions to the public capital stock can be formalized by incorporating them in an augmented Cobb-Douglas production function of the following form [see Barro and Sala-I-Martin 1995; and De Mello 1997] :

$$Y = A\,\varphi\,[L, K_p, E] = A\,L^{\alpha}\,K^{\beta}\,E^{(1-\alpha-\beta)} \qquad (1)$$

where Y is real output, K_p is the private capital stock, L is labor, and E denotes the externality generated by additions of the public capital stock. α and β are the shares of domestic labor and private capital respectively, and A captures the efficiency of production. Initially, it is assumed that α and β are less than one, such that there are diminishing returns to the labor and capital inputs.

The externality, E, can be represented by a Cobb -Douglas function of the type:

$$E = [L, K_p, K_g^{\gamma}]^{\theta} \qquad (2)$$

where γ and θ are, respectively, the marginal and the intertemporal elasticities of substitution between private and public capital. Let $\gamma > 0$, such that a larger stock of public capital generates a positive externality to the economy. If $\theta > 0$, intertemporal complementarity prevails and, if $\theta < 0$, additions to stock of public capital crowd out private capital over time.

Combining equations (1) and (2), we obtain,

$$Y = A\,L^{\alpha + \theta(1-\alpha-\beta)}\,K_p^{\beta + \theta(1-\alpha-\beta)}\,K_g^{\gamma\theta(1-\alpha-\beta)} \qquad (3)$$

A standard growth accounting equation can be derived by taking logarithms and time derivatives of equation (3) to generate the following dynamic production function:

$$g_y = g_A + [\alpha + \theta(1-\alpha-\beta)]g_L + [\beta + \theta(1-\alpha-\beta)]g_{Kp} + [\gamma\theta(1-\alpha-\beta)]g_{Kg} \qquad (4)$$

where g_i is the growth rate of i = Y, A, L, K_p, and K_g. Equation (4) states that (provided γ and $\theta > 0$) additions to the stock of public capital will augment the elasticities of output with respect to labor and capital by a factor $\theta(1-\alpha - \beta)$.

III. Empirical Model.

In the development literature it is often not possible to generate estimates of equations (3) and (4) above because of the poor quality of existing data for public and private investment spending, as well as the actual paucity of data on the labor force over a sufficiently long period of time. Instead, investigators have used proxies for key variables such as the labor force and/or the stocks of private and public capital such as population data rather than labor force data, or substituted investment data (as a proportion of GDP) for capital stock data [see Aschauer, 1989; Cardoso, 1993; Greene and Villanueva, 1991; and Lin, 1994]. Alexander [1994] has shown, however, that models using these proxies have to impose unduly restrictive assumptions (e.g., such as a fixed capital-output ratio) or unrealistic assumptions (a constant labor force participation rate) that can generate both misspecified relationships and significant measurement errors.

In the case of Argentina we are fortunate to have labor force data going as far back as 1960, but we do not have consistent estimates of the public and private capital stock series, or for that matter, reliable estimates of the rate of depreciation from which such a series could be generated. Researchers in the field of economic development have circumvented this problem by estimating a dynamic production which defines the relevant variables in terms of percentage growth rates, thus permitting them to generate proxies for the percentage growth rates in the respective capital stocks. Following their lead, this study includes the ratio of public and private investment spending to gross domestic product as alternative proxies. [The inclusion of GDP in the denominator rather than the capital stock is rationalized by the plausible assumption that there is a positive association between higher levels of output per capita and higher levels of capital per worker.] The use of the ratio was also motivated by the fact that changes in effective demand

will not only induce changes in investment(the numerator) but also output (the denominator); therefore the inclusion of the ratio of investment spending to output should attenuate the inherent volatility present in the capital growth series. Finally, for reasons explained in Section IV, the empirical model was estimated with *changes* in the investment ratios because the ratios were non-stationary in level form. This study thus extends previous empirical work by estimating an empirical counterpart of the dynamic production function in equation (4) for the 1960-2005 period without the FDI variable and between 1970 and 2005 with the FDI variable.[7]

The most general formulation of the growth equation is given below,

$$\Delta y = \alpha + \beta_1 \Delta l + \beta_2 \Delta(i_p) + \beta_3 \Delta(i_g) + \beta_4 \Delta(i_f) + \beta_5 \Delta(c_g) + \beta_6 D_1 + \beta_7 D_2 + \varepsilon \qquad (5)$$

lower case letters denote natural logarithms, and Δ denotes the change in the variable in question; y is real GDP (1993 pesos); l, as indicated above, refers to the labor force (thousands occupied); i_p denotes the ratio of private investment to GDP, while i_g represents public investment spending on economic and social infrastructure as a proportion of GDP, viz., roads, bridges, and education--it therefore excludes investment expenditures by state-owned enterprises which are more likely to crowd out private investment spending and output; c_g is real government consumption expenditures as a proportion of GDP, and may directly or indirectly (via output taxes) crowd out private expenditures and thus affect output in a negative fashion; pesos), and i_f the ratio of foreign direct investment to GDP and it is expected to have a positive effect because increased FDI flows are associated with a greater transfer of technology, learning-by-doing, and greater market discipline; D_1 is a dummy variable that takes a value of one for the crisis years, and 0 otherwise, while D_2 equals 1 for the impact of the currency board, and 0 otherwise. Finally, ε is a normally distributed error term.

Data.

The data used in this study were obtained from official government sources such as the *Direccion Nacional de Politicas Macroeconomica, Ministerio de Economia y Produccion (Ministry of Economy and Production, various issues)* and the *Instituto Nacional De Estadistica*

y Censos de la Republica Argentina (National Institute of Statistics and Census of Argentina). Other relevant economic data have been obtained from ECLAC, *Statistical Yearbook for Latin America and the Caribbean, 2005,* and the *International Finance Corporation* [Everhart and Sumlinski, 2001].

The coefficients of equation (5) represent the annual percentage change in real GDP associated with a respective percentage change in the variables in question. In this study we focused on labor productivity so the dependent variable was estimated as the growth rate in labor productivity by subtracting the growth rate in the labor force from the percentage change in GDP. Defining the dependent variable in this manner reverses the expected sign of the labor variable because of diminishing returns to the labor input. The sign of β_1 is anticipated to be positive in the GDP formulation while, as indicated above, it is expected to be negative in the labor productivity specification. β_2 is expected to be positive, while the sign of β_3 can be positive or negative depending on whether accretions of the public capital stock complement or substitute for private capital formation. Lags were included for this variable because of the delayed impact of government investment spending on economic infrastructure, private investment spending and private output growth.[8] The sign of β_4 is also indeterminate because government expenditures on collective consumption goods such as food, housing, and salaries of public employees may directly or indirectly (via output taxes and subsidies) crowd out private consumption expenditures and thus affect output in a negative fashion. β_5 is expected to have a positive sign because increased inflows of FDI--a proxy for a higher degree of openness-- is often associated with a greater transfer of technology and greater market discipline [see Ram, 1996]. β_6 is expected to be negative for obvious reasons, while β_7 is anticipated to be positive.

IV. Empirical Results.

The (macro) time series data used in this study are likely to exhibit a time trend and are therefore non-stationary; i.e., the variables in question have means, variances, and covariances

that are not time invariant. Engle and Granger [1987] have shown that the direct application of OLS or GLS to non-stationary data produces regressions that are misspecified or spurious in nature. In view of this, this study tested the variables in question for a unit root (non-stationarity) by using an Augmented Dickey-Fuller test (ADF) [Dickey-Fuller, 1981] with a constant and .

Table 2 presents the results of running an ADF test (one lag) for the variables in both level and differenced form under the assumption of a stochastic trend only, i.e., the test is run with a constant term and no time trend.[9] It can be readily seen that all the variables in level form are nonstationary; i.e., they appear to follow a random walk with (positive) drift [see Nelson and Plosser, 1982]. In the case of first differences, however, the null hypothesis of non-stationarity is rejected for all var[10] iables (except one) at least at the 5 percent level. Thus, the evidence presented above suggests that the variables in question follow primarily a stochastic trend as opposed to a deterministic one, although the possibility that for given subperiods they follow a mixed process cannot be rejected.[11]

Having shown that the variables are integrated of order one, I(1), it is necessary to determine whether there is at least one linear combination of these variables that is I(0). In other words, does there exist a stable and non-spurious (cointegrated) relationship among the regressors in each of the relevant specifications? This was done by using the cointegration method proposed by Johansen and Juselius [1990]. The Johansen method was chosen over the one originally proposed by Engle and Granger [1987] because it is capable of determining the number of cointegrating vectors for any given number of non-stationary series (of the same order), its application is appropriate in the presence of more than two variables, and more important, the likehood ratio tests used in the procedure (unlike the ADF tests) have well- defined limiting distributions [see Harris, 1995].

Table 3 below shows that the Johansen test for both the output and labor productivity equations show that the null hypothesis of no cointegrating vector can be rejected at least at the one percent level; i.e., there exists a linear combination of the I(1) variables that links them in a

stable and long-run relationship.[12] The lagged residual (error correction (EC) term) from the cointegrating equation, measuring the deviation between the current level of output (labor productivity) and the level based on the long-run relationship, was included in a set of EC models. For simplicity, consider the EC model without lags (and dummy variables) given in equation (6) below:

$$\Delta y = \alpha + \beta_1 \Delta l + \beta_2 \Delta(i_p) + \beta_3 \Delta(i_g) + \beta_4 \Delta(c_g) + \beta_5 \Delta(i_f) + \delta EC_{t-1} + \varepsilon \qquad (6)$$

The coefficients (β's) of the changes in the relevant variables represent short-run elasticities, while the coefficient, δ (< 0), on the lagged EC term obtained from the cointegrating equation in level form denotes the speed of adjustment back to the long-run relationship among the variables. To conserve space, Table 4 below presents results only for the labor productivity growth rate relationship.[13]

The results for eqs. 1-3 (for the longer time period without the FDI variable) suggest that the immediate impact of changes in the growth rate of the private investment ratio are positive and statistically (and economically) significant, while contemporaneous changes in employment growth have a negative impact on the growth rate in labor productivity. Turning to the public investment variable, it can be readily seen that this variable has a positive and statistically significant effect when lagged two periods. This result is not altogether surprising because the positive externalities generated from additions to the stock of roads, bridges and ports are likely to affect labor productivity with a lag. The estimate for the government consumption variable, on the other hand, has a negative albeit small and statistically insignifciant effect on the rate of labor productivity growth. The estimates for the dummy variables in eqs. 2 and 3 suggest that the economic and financial crises that have buffeted Argentina have had a highly adverse effect on labor productivity growth, while the implementation of the Convertibility Plan had a highly positive and significant impact.

As the theory predicts, the lagged EC terms are negative and statistically significant, suggesting, as in equation (3), that a deviation from long-run labor productivity growth this

period is corrected by 30 percent in the next year. The results in Table 3 are also robust to the exclusion and inclusion of the dummy variables. Finally, the Chow breakpoint test suggested that the null hypothesis of no structural break could not be rejected for the economic crises years of 1981 (p-value= .3762), 1989 (p-value=0.6821), and 1995 (p-value= .9127).

Turning to the results with the FDI variable in eqs. 4 and 5, they suggest that inflows of FDI have a positive (lagged) and significant effect on labor productivity growth. The other variables retain their statistical significance both with and without the dummy variables.

The EC models were also used to track the historical data on labor productivity growth in Argentina. Table 5 below reports selected Theil inequality coefficients obtained from historical simulations of the productivity growth equations (3) and (5). In general, the predictive power of the model is considered to be relatively good if the coefficient is below 0.3 [Theil, 1966]. The results reported in Table 4 clearly meet this performance criterion (the root mean squared error (RMS) are relatively low as well). The sensitivity analysis on the coefficients shows that changes in the initial or ending period did not alter the predictive power of the selected models (or, for that matter, any of the models run in this study). Figures 1 and 2 corresponding to equations (3) and 5, respectively, provide further visual evidence of the models' ability to track the turning points in the actual series. (DPROD refers to the actual data and DPRODF denotes the forecast.) They show that the rate of labor productivity growth was, in general, positive during the decade of the nineties, highly erratic in the seventies, and mostly negative during the "lost decade" of the eighties. In fact, during the first half of the nineties there was a sharp upward turn in output (labor productivity) growth, punctuated by a sharp drop in 1995 as a result of the "tequila effect" associated with the Mexican peso crisis of 1994-95, followed, in turn, by three years of positive growth, only to culminate in a sharp contraction during the economic crises years of 1999-2002 and an upward surge during the 2003-2005 period.

V. Conclusion.

Following the lead of the endogenous growth literature, this paper developed a simple model that explicitly includes the impact of the public capital stock on the supply side of a hypothetical economy. The discussion showed that if significant complementarities are present between public and private capital (i.e., if a positive externality is present), then diminishing returns to the private inputs can be prevented or postponed indefinitely. The conceptual model laid the groundwork for the empirical analysis of labor productivity growth in the Argentine case for the 1960-2005 period in Sections III and IV. Several key findings were obtained.

First, the Johansen cointegration method revealed that the null hypothesis of no cointegration can be rejected at the one percent level, thus suggesting that the I(1) variables have a unique and stable relationship that keeps them in proportion to one another in the long run. This is an important finding because previous empirical studies have applied the OLS method directly to nonstationary variables in level form, thus generating spurious or misspecified regressions. Second, the cointegrating equations were used to generate a set of EC models that reconcile both the short and long-run properties of the variables included in the output and labor productivity relationships. As the theory predicts, the EC models have negative and statistically significant error correction terms, suggesting that deviations from long-run labor productivity (output) growth are corrected in subsequent periods.

Third, the individual EC estimates indicated that the growth rate of private and public investment as a proportion of GDP, as well as the growth rate in the FDI ratio, have a positive and statistically significant effect on the growth rate of labor productivity, while the growth rate in the labor force has a negative impact. Fourth, the reported Theil inequality coefficients for the selected EC models suggested that they were able to track and simulate the turning points of the historical series in labor productivity relatively well.

Finally, the EC model estimates showed that during the decade of the nineties the rate of labor productivity growth was mostly positive, while during the decade of the seventies the annual

estimated rate of output growth became erratic, culminating in a marked decrease (often negative rates) during the decade of the eighties--the so-called "lost decade of development." The labor productivity growth estimates for the first half of the nineties did reveal a robust increase, thereby suggesting that the currency board and the opening of the economy had (initially) a positive effect that for reasons beyond the scope of this short paper could not be sustained [see Baer et. al, 2002; and Weisbrott, 2007].

From a policy standpoint, the findings in this paper are important because they suggest that cash-strapped governments of Latin America, such as the Argentine one, can maximize the growth potential of their economies by directing scarce resources to investments in economic and social infrastructure and away from collective consumption goods that compete directly with those provided by the private sector. In addition, the findings suggest that attracting "bolted down" capital in the form of FDI inflows is likely to have a beneficial effect on labor productivity growth. These investments, through a positive externality effect, are likely to increase the marginal productivity of the private inputs directly (as well as indirectly), thereby increasing private investment, output, and labor productivity.

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Notes

1. For an informative and balanced discussion of the economic benefits and social costs associated with Chile's market-oriented policies, see Bosworth, Dornbusch, and Laban [1994].

2. Argentina's privatization, liberalization, and deregulation program is discussed and analyzed in Baer et. al. [2002], Petrecolla [1993], and Randall [1997].

3.It should be mentioned that during the 1990s only a handful of countries, notably Chile and Costa Rica, have managed to record investment ratios comparable to those before the onset of the debt crisis in the early 1980s. See Glen and Sumlinski [1996, pp. 16-19].

4. This paper only addresses the direct output effects of increasing public investment spending. It ignores the impact of public investment spending on the relative prices that private firms face for key inputs and services. To the extent that increases in public investment on economic and social infrastructure reduce the relative price of energy, transportation, and human capital to firms in the private sector, it will, *ceteris paribus*, reduce their prime costs, raise profit margins, and spur further investment.

5. It can also be argued that the public sector need not provide these public goods directly; the goods can be contracted out to the private sector in accordance with government regulations and guidelines. In fact, many governments in Latin America (including Mexico) are in the process of awarding concessions to private firms to produce and provide quasi-public goods and services. However, as Prager [1992] correctly observes, relatively little or no attention has been given to the monitoring or supervision cost of outsourcing public works projects. If these costs are substantial, particularly in the medium run, the bias in favor of privatizing these types of expenditures is removed.

6. For further details see Smith [1976; originally 1776], Book V, Ch. I, Part III, pp. 244-253.

7. Data for the FDI ratio was not available before 1970.

8.Another important reason for including lags is that it reduces, to some extent, the criticism of reverse causation from the rate of growth in GDP to the growth rate in public investment spending, i.e., the economic argument which suggests that public investment is a normal good whose rate of growth will decline when the rate of output growth (or productivity) declines and tax revenues fall and increase during periods of rapid economic activity and rising tax revenues.

9. A stochastic trend is one where the random component of the series itself, say variable x_t, contributes directly to the long run pattern of the series, either upward or downward. However, in the case of a deterministic trend the deviations from the non-stationary mean over time are quickly corrected. It is also possible for the variable in question to display both a stochastic and deterministic trend process over time. For further details see Charemza and Deadman, [1997, pp. 84-92].

10. The order of the lag length was determined by applying both the Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBC). For all the variables in this study, the ADF tests with one lag showed the lowest value for both the AIC and SBC criteria.

11. This study also performed an ADF test (one lag) on the variables in logarithmic form with a deterministic trend. The results indicate that the null hypothesis of non-stationarity cannot be rejected for any of the variables in level form with a deterministic trend, suggesting that the variables in question do not exhibit a deterministic time trend throughout the period under review. In other words, the common practice of detrending the data by a single trend line will not render the data in level form stationary because the trend line itself may be shifting over time [see Harris 1995]. When the ADF test is applied to these variables in first differences under the assumption

of a constant and deterministic time trend, most of the variables become stationary at the five percent level of significance (in one case at the 10 percent level)

12. The variables in question are cointegrated with and without a deterministic trend. The results are available upon written request.

13. The EC regressions for the output equation are essentially the same as those for the labor productivity regressions (except for the reversal in sign of the labor force variable) because they are a parametric transformation of one another (the results are available upon request). Again, the length of the lag for the public investment and FDI variables were determined by applying the AIC and SBC criteria.

TABLE 1. Argentina: Investment as a Share of GDP (in percent), 1980-2005.

Year	Private Investment	Public Investment
1980	19.2	6.1
1981	16.9	5.8
1982	16.6	5.2
1983	14.8	6.1
1984	14.9	5.0
1985	12.5	5.1
1986	13.2	4.3
1987	15.7	3.9
1988	14.4	4.3
1989	12.2	3.3
1990	9.4	4.6
1991	12.7	1.9
1992	14.9	1.8
1993	18.1	1.0
1994	19.1	0.8
1995	15.8	2.2
1996	16.1	2.0
1997	17.3	2.0
1998	17.9	2.0
1999	16.1	1.8
2000	15.4	1.0
2001	12.1	0.8
2002	9.2	0.8
2003	7.6	1.5
2004	10.5	1.9
2005	12.9	2.2
Average		
1970-1979	13.6	9.1
1980-1989	15.0	4.9
1990-1999	15.7	1.6
2000-2005	11.3	1.2

Source: IFC, **Trends in Private Investment in Developing Countries, Statistics for 1970-2000**. Washington, D.C., The World Bank, 2001;and M.E.P., **Argentina: Sustainable Output Growth After the Collapse.** Buenos Aires, Ministerio De Economia Argentina, 2003, Tables 1 and 2 pp.7-11.

TABLE 2. Argentina: Unit Root Tests for Stationarity, Sample Period 1960-2005.

Variables	Levels	First Difference	5% Critical Value[1]	1% Critical Value
ln(Y)	-1.36	-5.32**	-2.94	-3.59
ln(Y/L)	-1.78	-3.39*	-2.94	-3.59
lnL	0.66	-5.84**	-2.94	-3.59
lnI_g	-1.24	-6.51*	-2.94	-3.59
lnI_p	-2.67	-5.60**	-2.94	-3.59
lnC_g	-1.66	-4.19**	-2.94	-3.59
lnI_f [2]	-2.64	-6.98**	-2.94	-3.59

[1]MacKinnon critical values for rejection of hypothesis of a unit root. [2]Unit root tests for the FDI variable were undertaken for the 1970-2005 period. *Denotes significant at the 5 percent level; **denotes significance at the 1 percent level. Lag length based on SIC crit with a Maximum lag = 9. Estimations undertaken with Eviews6.0.

TABLE 3. Johansen Cointegration Rank Test (Trace), 1960-2005.

A. Series: lnY, lnL, LnI_g , and lnI_p.

Test assumption: No Linear deterministic trend in the data.

Eigenvalue	Likelihood Ratio	5% Critical Value	No. of CE(s)
0.510	56.126	54.08	None
0.333	26.847	35.19	At most 1
0.136	10.217	20.26	At most 2
0.098	4.229	9.17	At most 3

B. Series: ln(Y/L), lnL, lnI_g , and lnI_p.

Test assumption: no linear deterministic trend in the data.

Eigenvalue	Likelihood Ratio	5% Critical Value	No. of CE(s)
0.505	28.809	28.09	None
0.281	13.526	22.29	At most 1
0.149	6.610	15.89	At most 2
0.077	3.300	9.16	At most 3

Normalized Cointegrating Vector; coefficients normalized on ln(Y/L) in parenthesis.

Vector	ln(Y/L)	lnL	lnI_g	lnI_p	Constant
1.	1.000	6.413	-1.367	-1.976	-59.347
		(1.121)	(0.257)	(0.533)	

Note: Standard errors are in parenthesis. Estimation undertaken with Eviews6.0.

TABLE 4. Argentina: Error Correction Model; Dependent Variable is: ($\Delta lnY_t - \Delta lnL_t$), 1960-20

	OLS Regressions				
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Constant	0.01 (1.89)**	0.02 (2.00)**	0.02 (4.56)**	0.02 (2.00)**	0.02 (2.64)**
ΔlnL_t	-0.47 (-2.39)**	-0.63 (-3.34)**	-0.65 (-4.51)**	-0.56 (-1.64)*	-0.81 (-2.44)**
$\Delta ln(I_p/Y)_t$	0.22 (7.85)**	0.17 (4.12)**	0.15 (3.79)**	0.22 (5.64)**	0.18 (7.51)**
$\Delta ln(I_g/Y)_{t-2}$	0.04 (3.17)**	0.03 (2.59)**	0.03 (2.84)**	0.03 (4.97)**	0.04 (2.57)**
$\Delta ln(I_f/Y)_{t-3}$	---	---	---	0.01 (1.65)*	0.01 (2.00)**
$\Delta ln(C/Y)_t$	---	-0.01 (1.13)	---	---	---
ECT_{t-1}	-0.30 (-3.85)**	-0.26 (-4.25)**	-0.22 (-2.93)**	-0.31 (-4.98)**	-0.32 (-6.02)**
DUM1	---	-0.04 (-3.47)**	-0.04 (-3.64)**	---	-0.04 (-2.63)**
DUM2	---	---	0.02 (2.32)**	---	---
Adj R^2	.67	.72	.76	.72	.80
S.E.	.028	.026	.025	.026	.023
D.W.	2.03	1.99	2.03	2.12	2.05
AIC	-4.14	-4.36	-4.34	-4.19	-4.42
SIC	-3.93	-4.02	-4.04	-3.87	-4.05

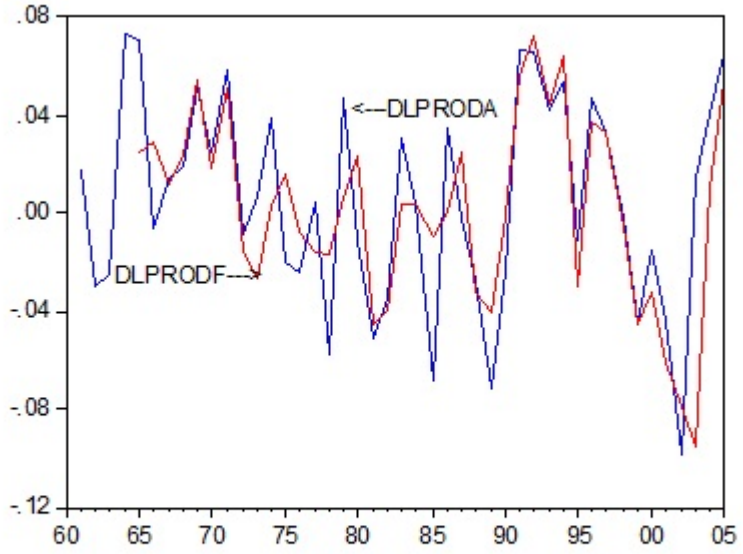
Note: Figures in parentheses are t-ratios and the number of asterisks denotes significance as follows: * at the 10 percent level and ** at least at the 5 percent level. AIC denotes Akaike Information Criterion and SIC is the Schwarz Information Criterion.

TABLE 5. Argentina: In-Sample Forecast Evaluation for Error Correction Models.

	Equation (3)	Equation (5)
	Sample: 1960 2005	**Sample: 1970-2005**
Root Mean Squared Error (RMS)	0.0244	0.0231
Mean Absolute Error (MAE)	0.0192	0.0193
Theil Inequality Coefficient (TIC)	0.3008	0.2847
Bias Proportion (BP)	0.0000	0.0000
Variance Proportion (VP)	0.0971	0.0881
Covariance Proportion (CP)	0.9019	0.9118
	Sample: 1960 1999	
RMS	0.0246	---
MAE	0.0189	---
TIC	0.3011	---
BP	0.0000	---
VP	0.0996	---
CP	0.9017	---
	Sample: 1970 2005	
RMS	0.0245	---
MAE	0.0194	---
TIC	0.3124	---
BP	0.0001	---
VP	0.1130	---
CP	0.8968	---

Note: In-sample forecast evaluation estimates generated with EVIEWS 6.0

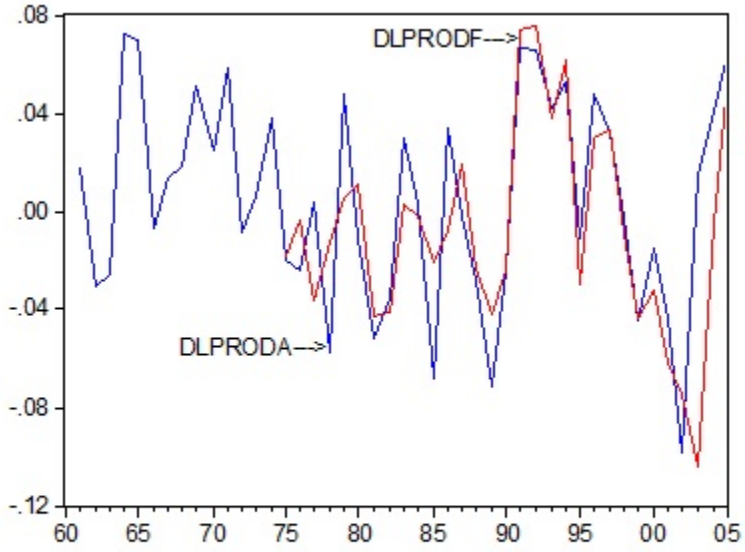
FIGURE 1



DLPRODF = In-sample Forecast of Labor Productivity Growth Rate.

DLPRODA = Actual Labor Productivity Growth Rate for Agentine Economy, 1960-2005.

FIGURE 2



DLPRODF= In-Sample Forecast of Labor Productivty Growth Rate.

DLPRODA = Actual Labor Productivity Growth Rate, 1960-2005.