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Key Words: Argentina, expansion, growth model.

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Abstract

The paper examines Argentina's economic expansion in the 1990s through the lens of a parsimonious neoclassical growth model. The main finding is that investment remained considerably weaker than what the model would have predicted. The resulting excessive "capital shallowing" could be identified as a weakness of the rapid economic growth of the 1990s that may have played a role in Argentina's ultimate inability to escape the crisis that started to unfold towards the end of that decade.

Journal of Economic Literature Classification Codes: E32.

Key Words: Argentina, depression, growth model.

1. INTRODUCTION

In the heyday of its economic boom of the 1990s, Argentina was used to be proudly presented to the world as a living proof of the huge rewards that awaited all those emerging economies brave enough to implement free-market-oriented reforms as sweeping as the ones that country so diligently had carried out during that decade.

Indeed, between 1990 and 1998 Argentina's real GDP per capita grew at an average rate of 5% a year. This rapid growth, along with the far-reaching privatization and trade and financial liberalization program implemented in that same period, lit the hope that Argentina was leaving behind the economic stagnation of the previous "lost decade." In this optmistic view, Argentina, like its neighbor Chile and the so-called Asian tigers before it, was heading full speed to convergence to the standards of living of developed countries.

By the beginning of 2002 Argentina had not only lost its "success story" status but also become the world's leading counterexample of what emerging economies ought not to do to move up in the development ladder. Borrowing the expression from Pastor and Wise (2001), How come Argentina went "from poster child to basket case" almost overnight? Such a sudden change of heart is not easy to justify by rigorous scientific standards and certainly raises the suspicion that the optimistic views about the prospects of Argentina's economic growth often heard during the 1990s may have been formed on shaky grounds. At the very least, Argentina's abrupt downgrading from success to failure suggests the need to reexamine its economic growth experience during those years with a more systematic approach. The purpose of this paper is to do precisely that through the lens of a parsimonious neoclassical growth model.

The main result of the paper is that an observer equipped with that model would have detected early on in the 1990s reasons to be skeptical about the prevailing enthusiasm about Argentina's long run growth prospects. The worrisome sign for such an observer, our paper argues, would have been that capital accumulation did not show, during those years, nearly as much dynamism as a neoclassical growth model would have predicted in the face of the startling measured total-factor-productivity gains that Argentina's economy was experiencing.

In particular, between the end of the lost decade in 1989, and 1997, the capital stock was virtually unchanged, while the model predicts that it should have grown by at least 20 %. Put differently, such an observer would have verified that capital accumulation in the 1990s wasn't being as dynamic as "advertised," at least according to the frictionless world of a neoclassical model economy. This hint at the presence of considerable frictions in the capital accumulation process could have been exhibited by the skeptics as an early sign that not everything in Argentina was as fine as many seem to have believed at the time and that non-negligible growth risks might lie ahead. Indeed, the paper cannot dismiss the conjecture that the failure to identify and remove whatever frictions were responsible for the underperformance (relative to the model) of investment during the 1990s played a role in Argentina's ultimate inability to escape repeated threats of financial meltdown, default, and devaluation, threats that finally materialized at the beginning of 2002.

2. OVERVIEW OF THE EVIDENCE

The booming 1990s were preceded in Argentina, as illustrated in Figure 1, by a protracted economic decline, the so-called "lost decade," studied in detail in Kydland and Zarazaga (2002)-- KZ hereafter.[1] Given the performance during those lost-decade years, in which output per capita fell at an annual rate of 2.2 %, the seemingly stellar expansion of the 1990s would not appear as shocking to anyone familiar with neoclassical growth theory. After all, a neoclassical growth theorist unaware of the structural reforms that Argentina implemented in the first half of that decade would have failed to detect in that expansion any signs of those reforms and would have had no trouble in attributing all of it, in principle, to the typical strong recovery that theory would predict for any economy that has been drifting longer than usual below its long run path.

Figure 1 would not be enough to dismiss that "bounce back effect" view, as the line representing GDP per capita detrended with the average growth for the period 1950-97 shows indeed that by the end of the 1990s the economy had simply returned to trend. A somewhat more pessimistic picture emerges when actual GDP per capita is detrended by the average growth rate for the period 1950-79: by this measure, which completely excludes from trend the negative effects of the lost decade years, actual GDP per capita was still about 22 % below trend.

However, a neoclassical growth theorist would have indeed been puzzled by some of the figures in Table 1, which reports the results of a standard growth accounting exercise with the production function represented in its "intensive" (per capita) form.

[1] See the seminal work by Elías (1992) for the period 1950-80.

To be precise, throughout this paper it is assumed that the production function has the form:

$$Y_t = A_t K_t^{\theta} L_t^{1-\theta} \tag{1}$$

where Y is aggregate output, A is total factor productivity (TFP), K is aggregate capital, and L is employment, measured in terms of hours at work.[2] After dividing both sides by total population, N_t, and some algebra, it is possible to decompose output per capita into three factors: the TFP factor $A^{1/(1-\theta)}$, labor intensity (L) and the capital intensity factor $(K/Y)^{\theta/(1-\theta)}$. This decomposition in per capita terms, rather than in absolute terms, is convenient because the growth rate of the efficiency factor coincides with the trend growth rate of output per capita when employment per capita and capital intensity are constant.[3]

For the purpose of this growth accounting exercise, as discussed in the section on the calibration procedure below, the capital cost share was set at 0.4.

According to Table 1, GDP per capita during the lost decade declined at an annual rate of 2.3 percent. The TFP factor accounted for almost all of this decline. By contrast, the TFP factor experienced a big surge of almost 7% in the 1990s. In this case, information about the structural reforms introduced over the period would have been relevant to a neoclassical growth theorist who could otherwise be puzzled by the magnitude of those productivity gains.

However, another figure of Table 1 would have called his attention: the fact that the excess of TFP growth over GDP growth was compensated by a fairly large decline in

[2] Capital input corresponds to the capital stock in place *by the end* of the previous period, rather than of the current one, as in KZ . This different timing, along with updated GDP and employment series, accounts for the differences between the figures in Table 1 of this paper and the same table of that other paper.
[3] For details, see Kehoe and Prescott (2002.)

the capital-output ratio. This feature of the data would have led him naturally to wonder whether the extent of such "capital shallowing" was consistent with productivity gains of the magnitude observed in that same period. The goal of the quantitative exercise in the next section is to answer precisely this question.

3. ANALYTIC FRAMEWORK

Model

In this paper we examine the growth performance in the 1990s through the lens of the same stochastic neoclassical growth model as that studied in KZ, briefly summarized here for convenience.

Household preferences can be represented by:

$$Max\ E\sum_{t=0}^{\infty}\beta^t(1+\eta)^t\ (c_t^{\alpha}(1-l_t)^{1-\alpha})^{1-\sigma}/(1-\sigma) \tag{2}$$

where c_t represents consumption, l_t hours of work, α is a preferences share parameter that determines the fraction of utility originating in consumption and leisure, η the population growth rate, and σ the coefficient of constant relative risk aversion.

Technology is described by

$$c_t + x_t = z_t\, k_t^{\theta}\,[(1+\gamma)^t l_t]^{1-\theta} \tag{3}$$

$$x_t = (1+\gamma)(1+\eta)k_{t+1} - (1-\delta)k_t \tag{4}$$

$$z_{t+1} = \rho z_t + \varepsilon_t \tag{5}$$

where k_t is the capital stock, x_t is investment, θ the labor input share in national income, and z_t a stochastic, stationary, exogenous technological shock, where the innovation ε_t is

assumed to be an i.i.d. process with mean zero and standard deviation 1/(1-ρ). As should be apparent from the notation, the model assumes labor augmenting technological progress at the rate γ. On the balanced growth path of this model economy, output, consumption and capital grow at the rate $(1 + \eta)(1 + \gamma)$.

Calibration

Following the approach described in Cooley and Prescott (1995), the model economy was calibrated by choosing parameters so that the balanced growth path of the model matches certain steady-state features of Argentina's economy. With the exception of the persistence parameter ρ, the parameter values reported in Table 2 are the same as in KZ, where the readers can find a more thorough justification for the choices of those values, as well as a detailed discussion of the sources of the data and methodology followed in the construction of all the series, such as the capital stock, involved in the estimation of the TFP (or Solow residual.)

In setting the persistence parameter ρ, the autoregressive component of the total factor productivity process, we follow the same procedure as in KZ. That is, we set ρ to the value of the point estimate of the coefficient from an autoregression on detrended Solow residuals (TFP.) However, for the purpose of robustness check in this paper, we explore the quantitative effects of detrending the Solow residuals by the average TFP growth rate in two different periods: 1950-79, and alternatively, 1950-97, rather than 1950-70 as in KZ. As reported in Table 2, the resulting ρ for the first period was 0.7553 while for the second it was 0.8423.

Computation

The numerical experiments below report the allocations that a social planner maximizing the welfare of a representative household would pick in our artificial economy. Technically, this social planner problem was solved with the by now standard linear quadratic approach pioneered by Kydland and Prescott (1982). As is well known, under standards assumption that are satisfied in this paper, the social planner's preferred allocation can be decentralized as a competitive equilibrium in which households maximize their welfare and firms their profits.

4. EXPERIMENTS

Purpose

The purpose of this section is to address the question that the imaginary neoclassical growth theorist in the introduction might ask when confronted with Table 1. That is, Did the capital stock and employment in the 1990s behave as predicted by a neoclassical growth model in which TFP is taken as exogenous and no other exogenous factors change? In particular, would the "capital shallowing" observed during the 1990s stand as an anomaly from the perspective of a parsimonious neoclassical growth model?

To that end, we simulate the model by feeding the measured TFP into the competitive equilibrium (or social planner's) decision rules, after having set the initial capital stock at the value (detrended) that it had at the end of 1989.

For the purpose of comparing the outcomes generated by the model with the actual data, it is important to point out that the numerical experiments were carried out under the

assumption that the artificial economy does not exhibit any long-run growth. That is, with $\eta = 0$ and $\gamma = 0$. As in KZ, based in turn in the findings reported by Hansen (1997,) the appropriate comparison of the outcomes of the model with the data requires to detrend the latter with the long run average rates consistent with the parameter values reported in Table 2.

Findings

As more fully discussed in KZ, for the purposes of detrending there is some uncertainty about the long run growth features of Argentina's economy. In particular, as inspection of Figure 1 should make apparent, it is unclear whether the lost decade of the 1980s should be considered a normal occurrence along Argentina's long run growth path, or rather, a rare occurrence that should not be taken into consideration at the time of assessing the long run growth trend (or "potential output") of that economy.

To take into account this uncertainty about the "true" trends, the outcomes from the numerical experiments are compared with the data detrended with the relevant average growth rates for two different periods: 1950-79, and 1950-97.

Thus, for example, the capital stock for the first numerical experiment was detrended assuming long run population and TFP factor annual growth rates of, respectively, 1.71% and 0.92%, the same as the average annual growth rates of those variables during the period 1950-79 reported in Table 1. The corresponding detrending rates for the second experiment were 1.54% and 1.02%. Since along a balanced growth path employment should increase at the same rate as population, the employment series

were detrended by 1.71% and 1.54% for the comparisons with the first and second experiment, respectively.

As the above figures should make clear, the differences in the average TFP factor growth rates between the two benchmark periods were minimal, suggesting that the unusually large productivity gains of the 1990s more than compensated for the unusually heavy productivity losses of the 1980s. Accordingly, any differences between the first experiment (detrending by 1950-79 averages) and second experiment (detrending with 1950-97 averages) can be attributed mainly to differences in the population growth rates.

The results of the numerical experiments are reported in Figures 2 through 7.

Figures 2 through 4 compare the outcomes of our "no growth" artificial economy with the data detrended by the relevant 1950-79 average growth rates. As is apparent from Figures 2 and 3, the model economy overestimates labor and capital input. The overestimation of the latter is particularly important: while according to the model the capital stock should have been about 25% larger by the end of the 1990s than in 1989, it merely came back to its 1989 level according to the data. As a result, the extent of the "capital shallowing" observed in the 1990s was much more pronounced than what the neoclassical growth model would have predicted (Figure 4.) In particular, while, according to the model, by the end of the 1990s the capital-output ratio should have been only 10% below its long run (steady-state) value, in the data it was by then almost a fourth below its steady state value.[4]

[4] Some "capital shallowing" is not inconsistent with the predictions of a neoclassical growth model, as above trend TFP realizations may induce such an increase in employment (and output) in order to take advantage of the particularly "good times" to save and accumulate capital, that the capital-output ratio may initially decline and start rising to its long run value only later, when the unusually good TFP realizations subside.

As should be clear from Figure 5, the overestimation of capital input is a feature of the model that is robust to the choice of long run trend. In particular, as was the case when detrending by 1950-79 averages, the capital stock does not show much change between 1997 and 1989 when detrended by the relevant average growth rates for the period 1950-97 either. Yet, according to the model the capital stock in 1997 should have been 20 % larger than in 1989. In correspondence with this result, the process of "capital shallowing" was, again, much more pronounced in the 1990s than what the model would have predicted. (Figure 7.)

The choice of trend, however, does make a difference for labor input. As is apparent from comparing Figure 3 with Figure 6, the predictions of the model are much more in line with the employment data when they are detrended by the average population growth rate in the period 1950-97 than when they are detrended with the corresponding 1950-79 average.

CONCLUSION

This paper has examined the economic expansion that Argentina experienced during the 1990s through the lens of a very parsimonious neoclassical growth model. The main finding is that investment remained much weaker than what the model would have predicted. This result seems to be robust to different conjectures about the underlying trend growth rates, be they the ones observed for the period 1950-70, as reported in KZ, or for the periods 1950-79 and 1950-97 used for this paper.

A similar anomaly for the 1980s reported in KZ could be used to dismiss the relevance of the model for analyzing Argentina's growth experience in the last two

decades. However, as also pointed out in KZ, an open economy version of the parsimonious neoclassical growth model used there and here could still account for the 1980s. The reason is that the productivity decline observed in the lost decade would induce much larger capital outflows in that open economy model than in the closed economy model considered here. As a result, the model would predict lower investment than it does now and would produce, therefore, predictions eventually more in line with the data.

However, those same open economy features are likely to enlarge, rather than reduce, the overestimation of investment in the model during the expansion of the 1990s. The reason would be that for that period the productivity surge would induce large capital inflows and, therefore, an investment even higher than in the current closed economy version of the model.

Given that intuition, it seems fair to conjecture that an open economy model could correct the overestimation of investment during the 1980s but increase it during the 1990s. In other words, the open economy model would corroborate the finding in this closed economy model that investment during the 1990s did not grow as much as it should have. This discrepancy suggests the presence of considerable frictions to the capital accumulation process that were particularly noticeable during the 1990s. Such a result is not totally unexpected. In fact, a growing body of literature inspired by Alvarez and Jermann (1998) suggests that small open economies face borrowing constraints that are binding not during downturns, as intuition might suggest, but during expansions (see, for example, Kehoe and Perri (2000).) The reason is that lenders do not have much interest anyway in investing in a country undergoing a period of low or declining

productivity growth. Absent the possibility of default, however, the same foreign lenders would like to invest a lot during a period of high productivity growth. However, if they refrain from doing so as much as they would in a world without default, it is precisely because they realize that it is at good times, when it has plenty of capital, that a country will have the highest incentives to renege on its debt payments. If this conjecture were to be confirmed more formally, a possible explanation of why investment remained so weak (relative to the model) in Argentina during the 1990s is that investors still had fresh in their memories that country's sovereign debt default in the mid 1980s and confiscation of deposits in 1990. By the same token, the new confiscation of deposits in 2001 and default in 2002 would harbinger that a new lost decade lies ahead for Argentina.

Whether an open economy model that incorporates the possibility of default will be able to resolve the "capital shallowing" anomaly of the 1990s uncovered in this paper is a challenging open question that should stimulate much needed and exciting research efforts.

Table 1

Accounting for Growth:

Time period	GDP per capita	Factor		
		TFP	Capital intensity	Labor intensity
1979-1990	-2.22 %	-2.61 %	0.19 %	0.22 %
1990-1997	4.94 %	6.84 %	- 2.47 %	0.71 %

Table 2

Parameter Values

	For experiment detrending with averages in period:	
Time Period	**1950-79**	**1950-97**
γ (productivity factor)	0.92 %	1.02 %
η (population growth)	1.71 %	1.54 %
Technology level in 1989	0.8083	0.8007
Initial Capital Stock in 1989	1.3789	1.3878
ρ (shock persistence)	0.7553	0.8423
δ (depreciation Rate)	10 %	
r (real interest rate)	10 %	
σ (risk aversion)	2	
θ (capital share)	0.4	
α (intratemporal elasticity of substitution)	0.3638	
Steady State k/y (capital-output ratio)	2	

Figure 1
GDP per capita
Actual and Detrended

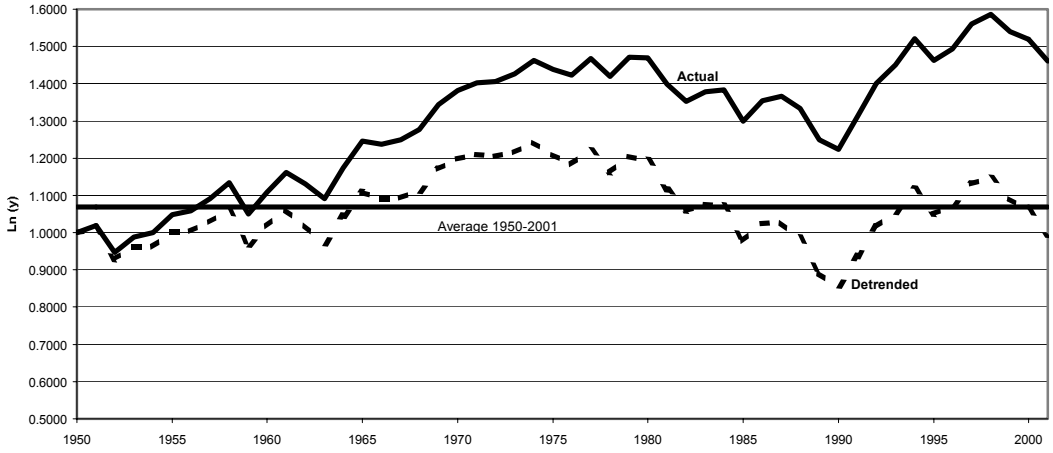


Figure 2
Capital Input
1950-79 Trend

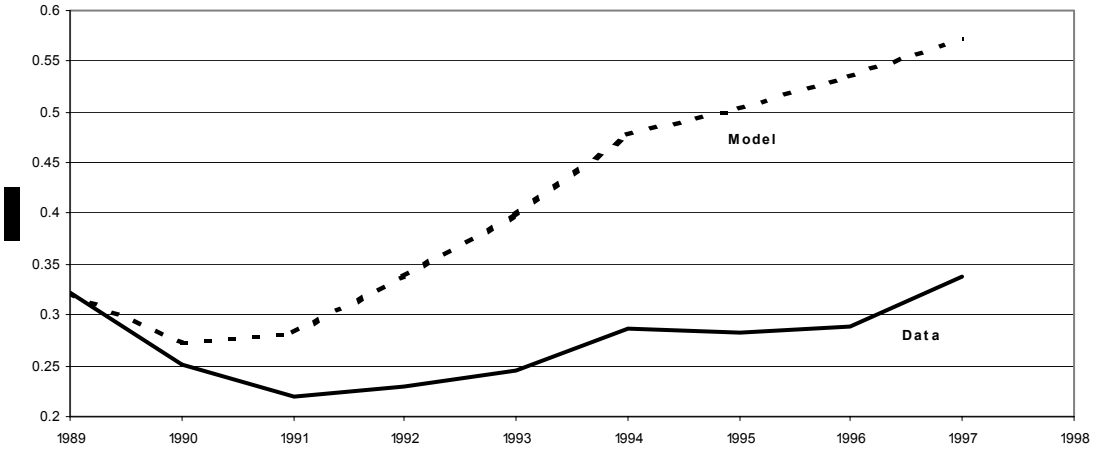


Figure 3
Labor Input
1950-79 Trend

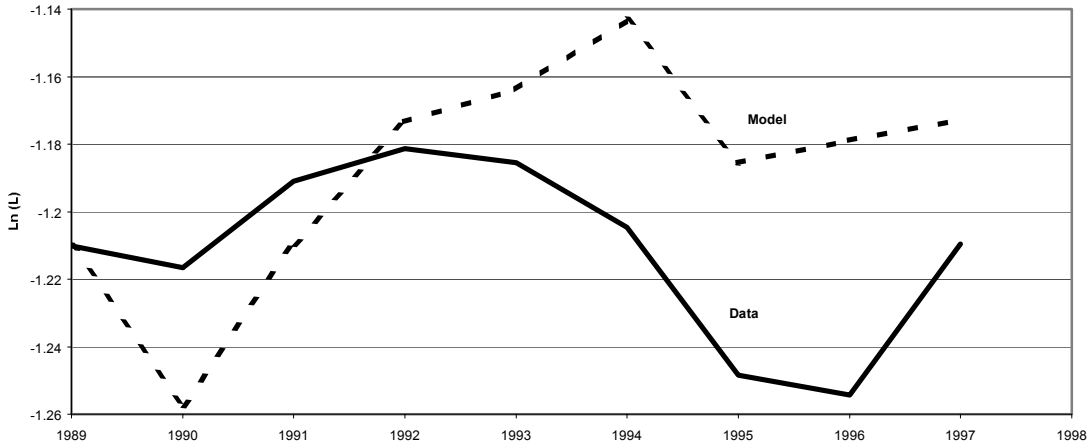


Figure 4
Capital-Output Ratio
1950-79 Trend

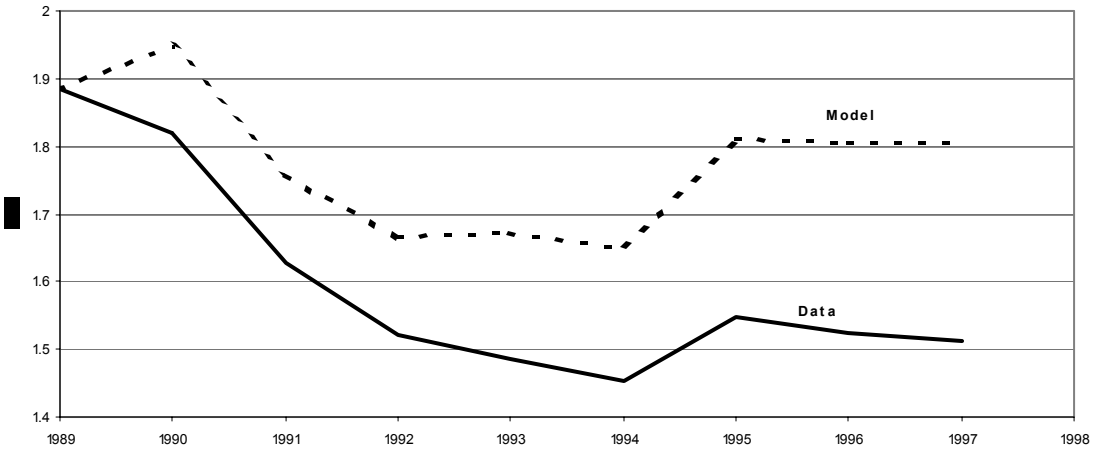


Figure 5
Capital Input
1950-97 Trend

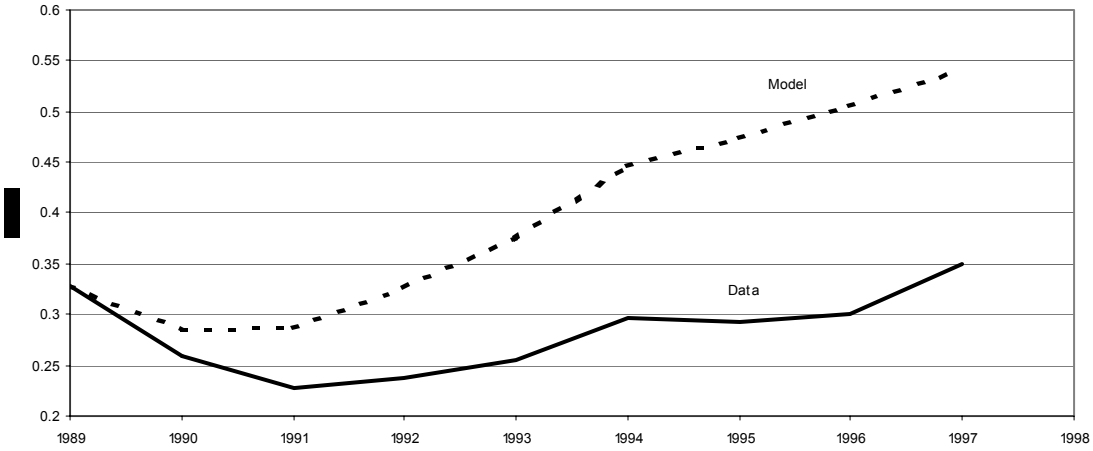


Figure 6
Labor Input
1950-97 Trend

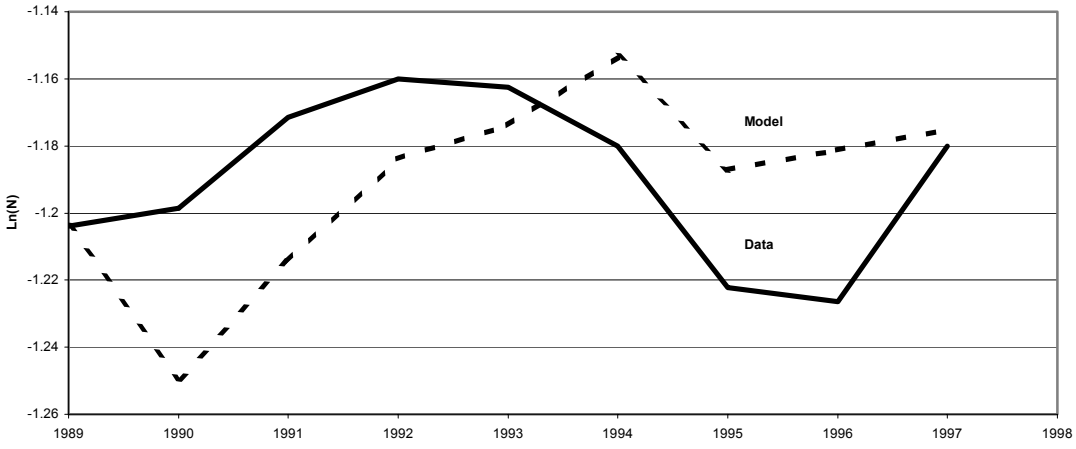
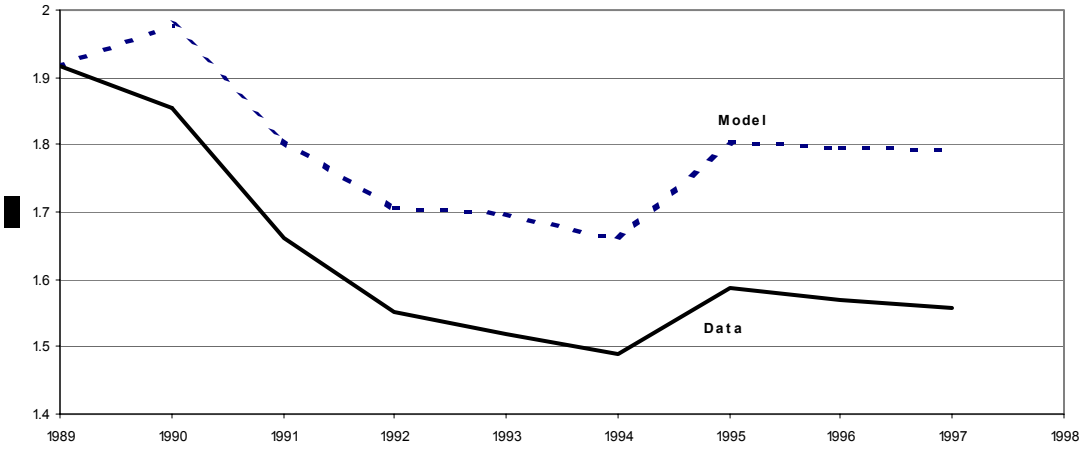


Figure 7
Capital-Output Ratio
1950-97 Trend



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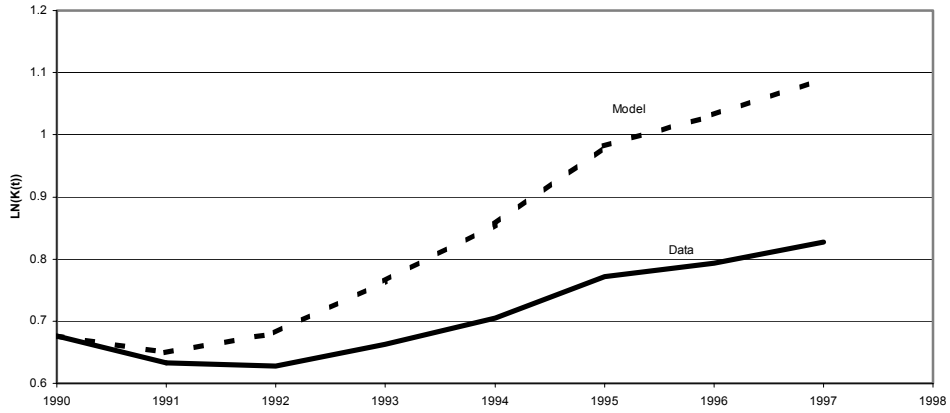
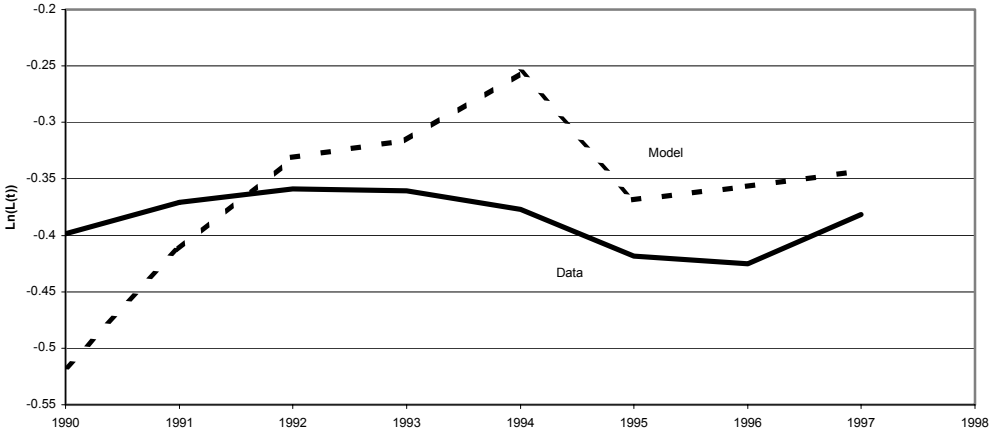
Capital Input
Perfect foresight, "Japanese" preferences
1950-97 Average TFP growth



Labor input
Perfect foresight, "Japanese" preferences
1950-97 Average TFP growth



Capital-output ratio
Perfect foresight, "Japanese" preferences
1950-97 Average TFP growth