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da Fundação

Getúlio Vargas

Nº 620

ISSN 0104-8910

The Evolution of TFP in Latin America

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Setembro de 2006

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The Evolution of TFP in Latin America*

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April 2006

Abstract

Due to widespread government intervention and import-substitution industrialization, there has been a general perception that Latin America has always been less productive than the leading economies. In this paper, however, we show that until the mid-seventies Latin America had high productivity levels relative to the US and other regions. Moreover, total factor productivity in Latin America increased relative to the US during this period, declining only in the subsequent years.

Key Words: Total Factor Productivity, Aggregate Production Function, Development Decomposition.

JEL Classification Code: O11, O47, O54

*The authors acknowledge the financial support of CNPq-Brazil and PRONEX.

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1 Introduction

There is a general perception that Latin America has been for many years less productive than the leading economies. Due to widespread government intervention, policy mistakes, institutions not favorable to growth and political instability, the common presumption has been that total factor productivity in the region would have lagged behind other regions during its entire development process. The list of problems and distortions is huge and include import-substitution industrialization, corruption, inflation, disrespect of property rights and contracts, income inequality, and competitive barriers such as monopolies and barriers to entry, among others.

Recent papers, such as Hopenhayn and Neumeyer (2004) and Cole, Ohanian, Riascos and Schmitz Jr.(2005), seemed to confirm empirically this perception. In particular, the first article found that average total factor productivity (TFP) growth in Latin America was slightly negative between 1960 and 1985, while Cole et al (2005) found that average TFP levels in Latin America corresponded to roughly 50% of US productivity between 1950 and 2000. Similarly, in Loayza, Fajnzylber and Calderón (2005) TFP growth in the region was found to be low from 1960 to 1980, and negative in the following decade.

In this paper, however, we show that until the mid-seventies Latin American countries had high productivity levels relative to the US and other regions. On average, TFP in Latin America was higher than that of a sample of Western European countries between 1960 and 1975. Moreover, TFP in Latin America increased relative to the US during this period. As far as 1980 it was around 88% of that of the U.S. and at least 25% above the rest of the world average. It is only after the mid-seventies that we observe a fast decrease of relative TFP in Latin America, which fell to 72% of the Western European productivity and 62% of US TFP in 2000. Hence, productivity in Latin America was close to that of the US when competitive barriers were highest in the region, between 1960 and 1975, only falling in the subsequent years. This note documents these stylized facts, using different methodologies and data sources.

2 Methodology and Data

Let the production function in terms of output per worker be given by:

$$y_{it} = A_{it} k_{it}^{\alpha} H_{it}^{1-\alpha}, \quad (1)$$

where y_{it} is the output per worker of country i at time t , k stands for physical capital per worker, H is human capital per worker, and A is total factor productivity (TFP). In our exercises we follow Bils and Klenow (2000) to model human capital and set:

$$H = \exp \phi(h) = \exp \left(\frac{\theta}{1-\psi} h^{1-\psi} \right),$$

where h stands for schooling.

In order to compute the value of A_{it} , we use the observed values of y_{it} and the constructed series of k_{it} and H_{it} so that the productivity of the i -th economy at time t was obtained as:

$$A_{it} = \frac{y_{it}}{k_{it}^{\alpha} H_{it}^{1-\alpha}}. \quad (2)$$

The physical capital series is constructed with real investment data from the Penn-World Table 6.1 using the perpetual inventory method. The initial capital stock, K_0 , was approximated by $K_0 = I_0 / [(1+g)(1+n) - (1-\delta)]$ where I_0 is the initial investment expenditure, g is the rate of technological progress and n is the growth rate of the population. In this calculation it is assumed that all economies were in a balanced growth path at time zero, so that $I_{-j} = (1+n)^{-j} (1+g)^{-j} I_0$.

We use the same depreciation rate for all economies, which was calculated from US census data. We employed the capital stock at market prices, investment at market prices, I , as well as the law of motion of capital to estimate the implicit depreciation rate according to:

$$\delta = 1 - \frac{K_{t+1} - I_t}{K_t}.$$

From this calculation, we obtained $\delta = 3.5\%$ per year (average of the 1950-2000 period). To minimize the impact of economic fluctuations we used the average investment of the first five years as a measure of I_0 .

When data was available we started this procedure taking 1950 as the initial year in order to reduce the effect of K_0 in the capital stock series. We obtained the rate of technological progress by adjusting an exponential trend to the U.S. output per worker series, correcting for the increase in the average schooling of the labor force and obtained $g = 1.53\%$. The population growth rate, n , is the average annual growth rate of population in each economy between 1960 and 2000, calculated from population data in the Penn-World Table 6.1. We measured h using average years of schooling of the population aged 15 years and over, taken from Barro and Lee (2000), interpolated (in levels) to fit an annual frequency.

Estimates in Gollin (2002) of the capital share of output for a variety of countries fluctuates around 0.40, so that we set α at this value. Finally, we follow Bills and Klenow and set $\psi = 0.58$ and $\theta = 0.32$.

3 Results

Figure 1 and Table 1 below present the main results of this paper. Figure 1 shows the evolution between 1960 and 2000 of the (geometric) mean and the median of TFP of 18 Latin American countries¹ relative to U.S. TFP.² Until the mid-seventies, total factor productivity in Latin America was very close to that of the leading economy. Moreover, both the mean and the median Latin American TFP increased relative to the US between 1960 and 1975. While the mean TFP in the region went from 87% to 93% of US TFP in the period, median Latin American TFP increased from 82% to 95% of US TFP. However, since the mid-seventies both the mean and the median TFP in Latin America fell continuously, especially since 1980, declining to 62% and 65% of US TFP in 2000, respectively.

In absolute values, TFP grew on average 1.1% per year in Latin America between 1960 and 1975, considerably above the US TFP growth rate of 0.6%. Median growth in Latin America was even higher,

¹The Latin America countries are Brazil, Mexico, Colombia, Argentina, Peru, Venezuela, Chile, Ecuador, Guatemala, Dominican Republic, Bolivia, Honduras, El Salvador, Paraguay, Nicaragua, Costa Rica, Uruguay and Panama.

²For each country i and year t , relative TFP is given by: $A_{it}/A_{US,t}$. We then computed the unweighted average of this ratio across countries for every year to calculate the Latin America relative TFP.

at 1.6% per year, because it does not take into account outliers such as El Salvador and Nicaragua that experienced revolutions and high political instability in the period. In the following two and a half decades, however, while U.S. productivity growth kept the same pace, at 0.6% per year,³ Latin America TFP collapsed, declining at an average annual rate of 1.1%. As a result, in the entire 1960-2000 period TFP in Latin America fell in absolute terms 0.3% a year, and in eleven out of 18 countries of our sample it had zero or negative growth.

<< **Insert Figure 1** >>>

Table 1 presents data on relative TFP for the largest economies in Latin America. In some countries TFP surpassed that of the US before 1980 (e.g., Brazil in 1975, Venezuela between 1960 and 1975 and Mexico from 1960 to 1980), and in eleven out of the 18 economies of our sample TFP was at least 80% of the American TFP between 1960 and 1980. This contrasts drastically with the situation in 2000, when relative TFP in Latin America was, on average, 62% of US TFP and in only two economies it was above 80%.

<< **Insert Table 1** >>>

Individual examples may be illustrative. TFP in Mexico corresponded to 77% of US TFP in 2000, whereas it was 18% above US TFP in 1975. The fall in Argentina was even more dramatic, and maybe the worst case was that of Venezuela, where relative TFP reached 1.64 in 1970, but in 2000 it was only 61% of US TFP.

We have identified, hence, two general patterns: relative TFP in Latin America was high and increasing until the mid-seventies and since then it fell continuously. Is this a general fact observed in other regions? Figure 2 shows that this is not the case. From 1960 to 1975 average TFP in Latin America was higher than that of Western Europe and 60% higher than East Asia TFP.⁴ Hence, productivity in Latin America was not only high but above that of richer or similar regions. However, while in Western Europe and East Asia we

³It should be noted, however, that the growth in US productivity was not constant between 1975 and 2000. In particular, it was close to zero between 1975 and 1983, corresponding to the well-known productivity slowdown. It increased since then, especially after 1995, averaging 1.4% between 1995 and 2000.

⁴The countries included in our comparison are as follows. Western Europe: Austria, Italy, Finland, Belgium, France, Norway,

observe a convergence to the US productivity level between 1960 and 2000, particularly dramatic in the case of the latter, in Latin America there was increasing divergence relative to US TFP since the mid-seventies. Specifically, in 2000 both regions surpassed Latin America TFP by more than 20%.

<< **Insert Figure 2** >>>

We observe the same qualitative patterns if we compare Latin America TFP with average TFP in a larger sample of 83 developed and developing countries ("world"). In particular, mean TFP in Latin America was 20% above the average world TFP between 1960 and 1975. However, in 1995 it was only 5% above and five years later it was 3% below average world TFP. Without any doubt, the region lost ground and only Sub-Sahara Africa fares worst in terms of TFP reduction in the period.

In order to check if our results are driven by measurement error in the TFP series, we performed a series of sensitivity exercises. We first reconstructed the capital stocks series using a 10% depreciation rate and used it to generate a new TFP series according to (2). This exercise is important because a higher depreciation rate reduces the importance of the initial capital stock in the capital stock series. However, results did not change much. If we eliminate from the sample those countries for which we do not have investment data starting in 1950, our main findings also are not affected.

Using the capital-output ratio instead of the capital-labor ratio to construct the TFP series, as in Klenow and Rodriguez-Clare (1997) among many, also does not affect our findings. Data from Baier, Dwyer and Tamura (2004), comprising historical data that goes as far as 1900 for some Latin America countries, lead to similar results. Finally, we repeat our exercises using capital and output data from Nehru and Dharaeshwar (1993), which were used by Cole et al (2005) among many. Our main findings were also confirmed: from 1950 to 1975, average TFP in the region fluctuates a little above 80% of US TFP and fell continuously after that. In 1990 it was only 55% of American TFP.

How come other papers found results so different from ours? In the case of Hopenhayn and Neumeyer

Iceland, Denmark, Germany, Netherlands, Sweden and Switzerland. East Asia: Taiwan, Hong Kong, Korea, Singapore, Thailand and Japan.

(2004) the disparity was caused by the choice of period: we obtained, using our data set, exactly the same rate of TFP growth in the region between 1960 and 1985 as they did (-0.02% per year). There is no contradiction, as productivity collapses in the early eighties. In the case of Cole et al (2005), they assume that Latin America is near its steady state growth path from 1950 and 2000, something that looks at odds with the data in Figure 1. Our result coincides with theirs for recent years, but this is due to the sharp decline in productivity after 1975.

4 Conclusion

In this note it was shown that at least until the mid-seventies the average Latin America economy was relatively productive, with a TFP level close to or above most rich nations. This result is very robust, as it was found using different datasets and alternative methodologies to construct capital stocks and total factor productivity. Moreover, TFP in Latin America increased relative to US productivity between 1960 and the mid-seventies. Another regularity is that TFP fell very fast in the region after 1975-80, and in 2000 TFP it was only 62% of that of the U.S. In only one country, Chile, TFP relative to the U.S. in 1995 was not below its corresponding value in 1975.

These results allow us to conclude that at least until the mid-seventies, TFP was not the main cause for the relative poverty of Latin America. The main determinants of low per capita income were factors of production, namely physical and human capital. However, after the mid-seventies the TFP decline was the main explanation for Latin America stagnation.

The puzzle raised by these results is that policies in Latin America during the entire post-war period were very distortive and in theory were supposed to be associated with low TFP. In particular, the period between 1950 and the early eighties was characterized by widespread government intervention and import-substitution industrialization in Latin American economies, not to mention persistent government budget deficits, excessive regulation and target investment subsidies. In spite of this, TFP in the region was relatively

high and increasing at a faster pace than in the leading economies. Why this is so and why only later productivity started to decline are open questions that need to be investigated in the future.

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Figure 1: Latin American Relative TFP (U.S.=1)

Table 1: Relative TFP (U.S.=1)

	1960	1965	1970	1975	1980	1985	1990	1995	2000
Argentina	0.99	0.93	0.93	0.98	0.93	0.75	0.58	0.74	0.69
Brazil	0.83	0.80	0.88	1.07	1.02	0.86	0.75	0.80	0.73
Chile	0.68	0.64	0.73	0.64	0.76	0.65	0.72	0.87	0.80
Colombia	0.81	0.80	0.90	0.91	0.96	0.87	0.90	0.77	0.64
Mexico	1.09	1.11	1.10	1.18	1.13	0.99	0.79	0.74	0.77
Peru	0.58	0.66	0.69	0.83	0.66	0.57	0.45	0.44	0.40
Uruguay	0.77	0.68	0.73	0.76	0.86	0.61	0.69	0.76	0.73
Venezuela	1.33	1.55	1.64	1.20	0.88	0.73	0.77	0.73	0.61
Latin America	0.87	0.86	0.89	0.93	0.88	0.75	0.68	0.69	0.62



Figure 2: Relative TFP, region and continent averages (U.S.=1)

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