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WHY DOES LATIN AMERICA GROW MORE SLOWLY?

Juan S. Blyde
Eduardo Fernandez-Arias

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I. Introduction

This paper provides an overview of the most salient features of the Latin American growth performance during the last four decades. The analysis sheds light on the strengths and weaknesses of long-run growth of Latin America by identifying similarities and differences with other regions and assesses their economic performance on that comparative basis.

During the past four decades, many countries in Latin America went through several episodes of economic crises, political instability and social unrest. In the same period, they also experienced episodes of economic stabilization, political reorganization and structural reforms. A cursory look at some basic development indicators suggests a positive net result (see table 1). Generally speaking, income per capita increased and health and education indicators improved, while the underlying economic structure turned more integrated to global trade and there were improvements in institutional quality and macroeconomic management (as measured by an index of quality of institutions and inflation, respectively). However, how satisfactory are these achievements?

Table 1: Basic Indicators (averages over decades)

	Real GDP per capita in 2000 dollars				Life expectancy at birth, total years				Years of education in pop of age 15 and higher			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Latin America	1590	2000	2050	2170	56	61	65	68	3.1	3.8	4.7	5.4
Rest of the World	2380	3350	4100	4810	58	61	65	67	3.3	4.3	5.3	6.3
Developed	13420	18860	23160	27790	71	73	75	77	7.1	7.8	8.7	9.4
East Asia	1860	3360	5590	9480	60	65	70	73	4.5	5.3	6.5	7.6

	Trade volume (% of GDP)				Annual inflation (%)				Index of institutional quality **			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Latin America	37	44	48	57	11	30	240	164*	na	na	-1.3	-0.2
Rest of the World	55	67	72	78	4	11	14	10	na	na	1.0	1.6
Developed	47	55	61	64	4	10	10	7	na	na	3.0	3.4
East Asia	112	131	166	193	4	9	5	5	na	na	1.2	2.0

Sources: Penn World Tables, World Development Indicatiors (WB), International Country Risk Guide (ICRG).

* In the second half of the 1990s the average inflation rate was equal to 15%

** First principal component of ICRG variables: rule of law, corruption, bureaucratic quality, risk of expropriation and risk of repudiation of contracts

In order to analyze how satisfactory the growth process in Latin America has been over the past 40 years it is important to make relevant comparisons with other experiences. To tackle this issue, we focus on the per-capita economic growth rate and its contributing factors, comparing the experience of the typical country in Latin America (LAC) with that of benchmark countries, namely a typical country of the rest of the world (ROW) and of its subsets of developed countries (DEV) and East Asian countries (EASIA).

We find that, in the period 1960-99, the typical Latin American country experienced a slower growth rate than that of the typical rest of the world country, and in particular of the typical developed country, thus producing a widening of the income-per-capita gap between Latin America and the developed world. The key to these differences is productivity, not factor accumulation. It is slower productivity growth what accounts for the slower growth of Latin America relative to the other regions. We provide some econometric evidence suggesting that the worse institutional quality of Latin America relative to rest of the world, and to a lesser extent, the lower degree of openness and the higher degree of macroeconomic instability, were important factors behind these differences in productivity growth.

The rest of the paper is organized as follows. Section II describes the economic performance of Latin America during the last four decades and compares it with the experience of the benchmark countries. Section III conducts accounting exercises in order to examine the contributions of various factors to the differences in performance observed in Section II. Section IV develops an econometric model to explore the role of policy and institutional variables as drivers of these contributions. Finally, Section V concludes.

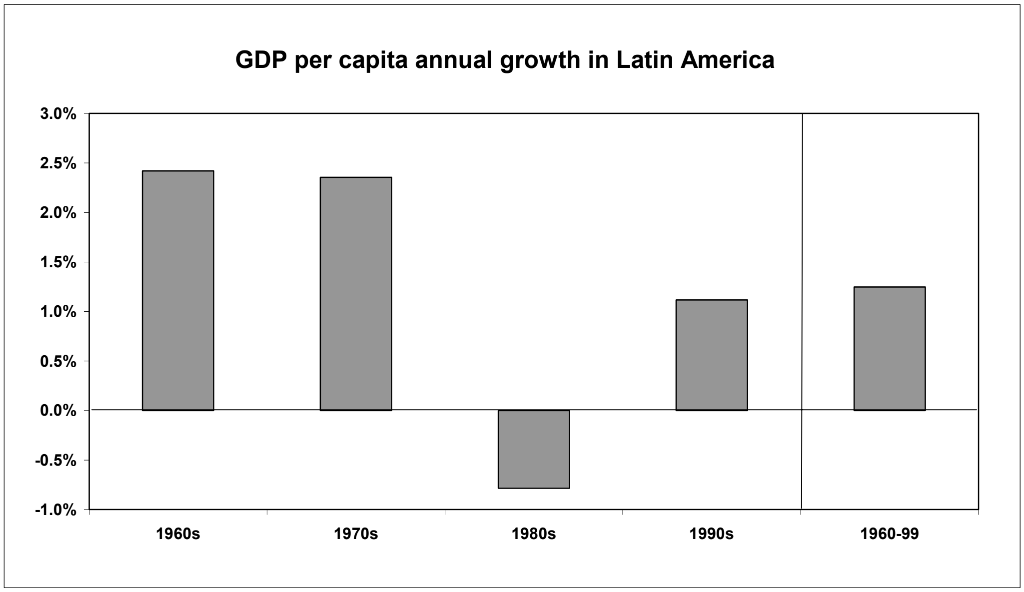
II. Performance

In order to compare the Latin American countries with other benchmarks we use a sample of 73 countries[2], of which 20 are from Latin America and 53 from the rest of the world (20 of them belong to developed countries and 5 to East Asia). In constructing the benchmarks, we use simple (un-weighted) averages across countries in the control group to account for the growth experience of the typical country in it. A detailed list of the country groupings is shown in Appendix A. Our summary measure of economic performance is the growth rate of real (PPP-adjusted) GDP per capita. The data is taken from the Penn World Table 5.6 and supplemented by other sources described in Appendix A.

Figure 1 presents the annual growth rate of GDP per capita for the typical Latin American country during the last four decades. Overall, Latin American countries made progress during the period 1960-1999 despite shrinking during the eighties, the lost decade. The average growth rate of GDP per capita during the nineties, however, was slower than during the sixties and seventies. It does not come as a surprise then that the sixties and seventies are perceived as the "golden decades" and the nineties are often found disappointing.

[2] Maximum set for which complete information was available.

Figure1



Comparing absolute growth rates across decades, however, is somewhat misleading. If one considers the performance of Latin America relative to other regions the story is quite different. This is shown in figure 2. Throughout the four decades, Latin America was consistently outperformed by the rest of the world and other relevant comparators, so that it lost ground in the world. Contrary to the message in figure 1, the relative performance of the region was poorer during the sixties and seventies than during the nineties. Therefore, it follows that the "golden decades" were also golden for the rest of the world, not an indication of Latin American virtue in these times.[3] This confirms the finding in Fernandez-Arias and Montiel (2001) who used this differential approach to measuring the growth effect of the reforms of the early 1990s.

Although Latin America performed relatively better during the nineties, its average growth rate was still below that of the rest of the world. In that sense the nineties were no different from the other decades as the region continued to experience a relative regress. Accordingly, the income per capita relative to comparators worsened over time (see table 2). In the next subsection we seek to determine the origins of this poorer performance.

[3] It is worth noting that if the comparison is done using weighted averages, the golden decades would still look better than the nineties. However, as pointed out by De Gregorio and Lee (this volume), this is a misperception that some analysts have incurred, since the weighted results likely reflects mostly the strong performance of Brazil and Mexico during this time. An appropriate comparison should use un-weighted averages in order to account for the growth experience of the "typical nation".

Figure 2

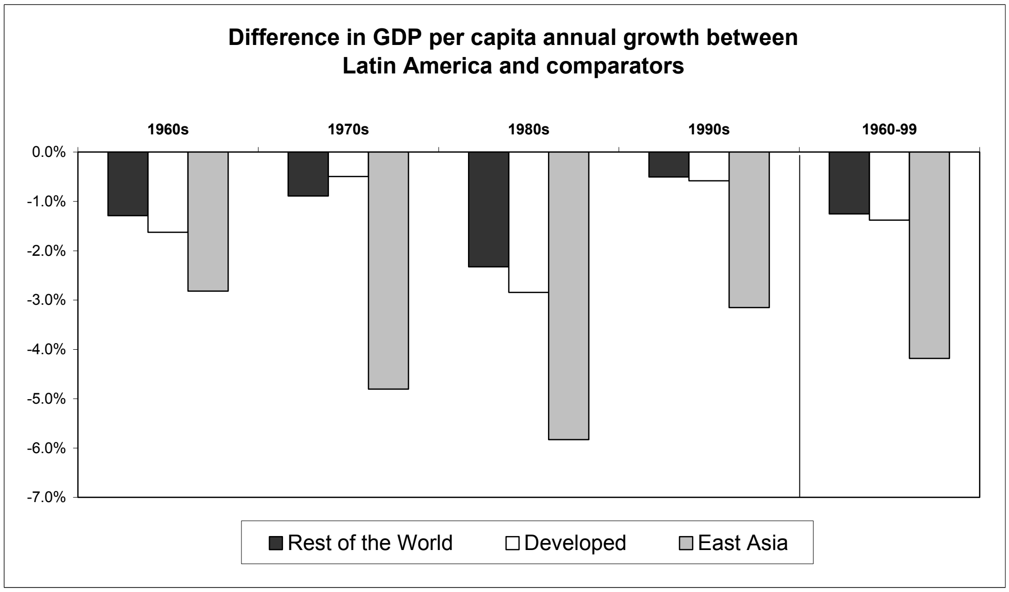


Table 2: Latin America Income Per Capita (%)
(with respect to comparators)

	60s	90s
Rest of the World	87%	59%
Developed	31%	20%
East Asia	128%	31%

Based on real GDP per capita (PPP)

Beyond averages, the swings in the per capita growth rates across decades are indications that growth performance was unstable in Latin America. Low persistence of country growth performance is a well known fact established by Easterly, Kremer, Pritchett and Summers (1993) as a general feature in the world over a similar period (and historically). Using our sample, we find that for Latin American countries are especially unstable. Their correlation coefficient of growth per worker between the first two decades (1960-79) and the last two (1980-99) is 0.26 lower than a respectable correlation of 0.45 for our full sample of 73 countries.[4]

[4] These relatively high correlation coefficients significantly differ from the uncorrelation found by Easterly and Levine (2001) over a similar period for a larger sample of countries. Our analysis with our sample reveals that their uncorrelation result changes significantly when periods are updated and is also dependent on including countries we chose to discard from our sample because of low informational value.

III. Accounting for Performance

In this section we perform growth and level accounting exercises based on a Cobb-Douglas production function to identify the proximate causes of growth performance. Let *Y* represent domestic output, *K* physical capital, *L* labor force, *h* the average quality of the labor force (scaled in such a way that *hL* measures human capital in units of unskilled labor), and *A* total factor productivity or TFP (that is the combined productivity of physical and human capital)[5]:

(1) $$Y = K^{\alpha} \cdot (h \cdot L)^{1-\alpha} \cdot A$$

The production function can be written in terms of number of workers as follows:

(2) $$\frac{Y}{L} = \left(\frac{K}{L}\right)^{\alpha} \cdot h^{1-\alpha} \cdot A$$

In order to account for the growth rate in per capita terms, we can express (2) in terms of the entire population, rather than labor force. Let *P* be total population. We can use the following relationship:

(3) $$\frac{Y}{P} = \frac{L}{P} \cdot \frac{Y}{L}$$

to express (2) in income per capita terms:

(4) $$\frac{Y}{P} = \frac{L}{P} \cdot \left(\frac{K}{L}\right)^{\alpha} \cdot h^{1-\alpha} \cdot A$$

In terms of growth rates this is expressed as follows:

(5) $$\left(\frac{\hat{Y}}{P}\right) = \left(\frac{\hat{L}}{P}\right) + \alpha \cdot \left(\frac{\hat{K}}{L}\right) + (1-\alpha) \cdot \hat{h} + \hat{A}$$

The output and population data are taken from the Penn World Table 5.6. The capital stock series are taken from Easterly and Levine (2001), which is consistent with Penn World Table 5.6. The labor input is measured by the labor force. This data is taken from the World Development Indicators of the World Bank.

(Alternatively, factor inputs could be measured only to the extent to which they are actually utilized in production, i.e. labor input could be measured by employment, excluding the unemployed, and capital input could be measured according to its actual utilization rate. Appendix B describes how this alternative choice of measurement would amount to a more narrow definition of productivity and shows that the use of employment as labor input would not qualitatively change the interpretation of our findings).

We follow Hall and Jones (1999) and consider h to be relative efficiency of a unit of labor with E years of schooling. Specifically, the function takes the form:

$$h = e^{\phi(E)} \qquad (6)$$

where the derivative $\phi'(E)$ is the return to schooling estimated in a Mincerian wage regression. We take Hall and Jones approach and assume the following rates of return for all the countries: 13.4% for the first four years, 10.1% for the next four years, and 6.8% for education beyond the eighth year. Average quality of the labor force h results from applying (6) to the average years of schooling of the labor force. Finally, we consider a capital income share α of 1/3. Sensitivity analysis, however, showed no qualitative differences in the results when we use capital shares of 0.4 or 0.5.

The contributions of the various components in (5) to account for the overall effects on income per capita *Y/P* help identify the proximate drivers of growth. The first component, *L/P*, measures the labor participation rate, i.e. the labor force as a proportion of total population.[6] The second component refers to capital intensity *K/L* and measures the effect of physical capital accumulation. The third component refers to labor skills h and measures the effect of human capital accumulation. The combined effect of these three components can be interpreted as the effect of factor accumulation, respectively of labor force size, physical capital intensity, and skill level of the labor force. Finally, the last component A is obtained as a residual once the effect of the rest of the observable variables on to income per capita *Y/P*, that is the effect of factor accumulation, is accounted for. This last component thus measures the effect of total factor productivity or TFP.

TFP turns out to be key to explain some of the observed trends in the evolution of income per capita, so it is important to be precise about how to interpret our estimations of it. Evidently, our measure of TFP in part reflects technology available. However, this is not the interesting aspect of the interpretation of this measure

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[5] In this specification, total factor productivity excludes the effect of changes to the skill level of the labor force, which is captured by h and accounted as factor accumulation of human capital.

[6] A more detailed analysis can decompose this component into a demographic factor, dealing with the fraction of the population of working age, and a behavioral factor concerning their participation rate in the labor force (i.e., the fraction of the able who are willing to work).

because our main findings are based on gaps resulting from comparisons across countries, which in principle could benefit equally from technological progress, thus rendering no effect on these gaps. Apart from technology, our measure of TFP also incorporates the degree to which available factors of production, both physical and human capital, are utilized. This is so because we chose to account for all available production factors, i.e. including unutilized physical capital and unemployed labor, so that any waste in these resources available to market forces due to non-utilization gets reflected into a lower TFP. The use of this more encompassing measure of TFP is very important to explain cyclical variations driven by factor utilization rates, but once again is unimportant in the long run (see Appendix B). In the long-run our preferred interpretation of TFP to explain gaps between countries, especially changes in these gaps, is that of distortions in the workings of the economy that drive aggregate efficiency below the technological frontier even if each firm is technologically efficient at the micro level (see Parente and Prescott, 2002).

As expected, in all regions TFP explains a large portion of the annual variability of GDP per capita (Easterly and Levine, 2001). For the case of the typical Latin American country, the contribution of TFP even exceeds 100% which implies that TFP was more volatile than output. As reported by De Gregorio and Lee (this volume), this is also true for many Latin American countries individually. However, although TFP is the dominant driver underlying the variability of the annual growth rate in Latin America, its importance is minor for explaining long run growth rates. As shown in figure 3, factor accumulation (resulting from labor participation rates, worker's skills and physical capital intensity) is the main driver explaining progress in the region during the 1960-99 period.

When we consider the contributions of productivity by decades, however, the results are mixed: it was a dominant positive factor in the sixties, a dominant negative factor in the eighties and was negligible in the seventies and nineties (see figure 4). A negative contribution of TFP in a whole decade, like in the eighties, is hard to explain as a technology reversal. In Appendix B we argue that our measure of productivity is associated with a broad definition of efficiency because it also captures changes in input utilization. Figure B.1 shows, however, that the reductions in the utilization of labor account only for a very small part of the fall in productivity during the eighties. Still a very large portion of the decline in productivity remains unexplained. As we argued before, a more plausible alternative is to consider a rise in the level of distortions which would hinder the level of efficiency with which the economy operates. This decrease in aggregate efficiency goes directly into the productivity measure because it is calculated as a residual from the aggregate production function.

Figure 3

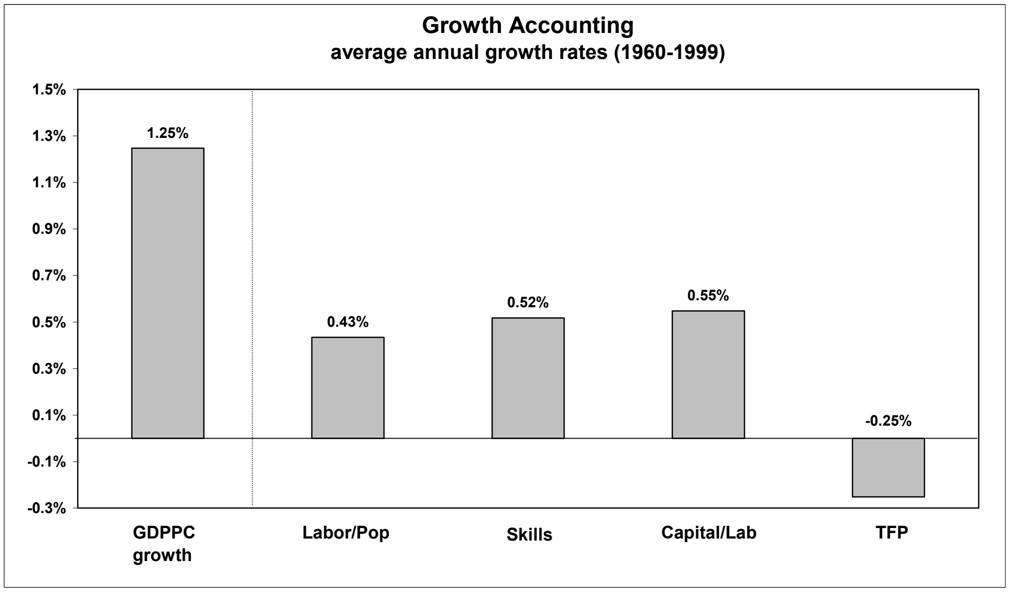
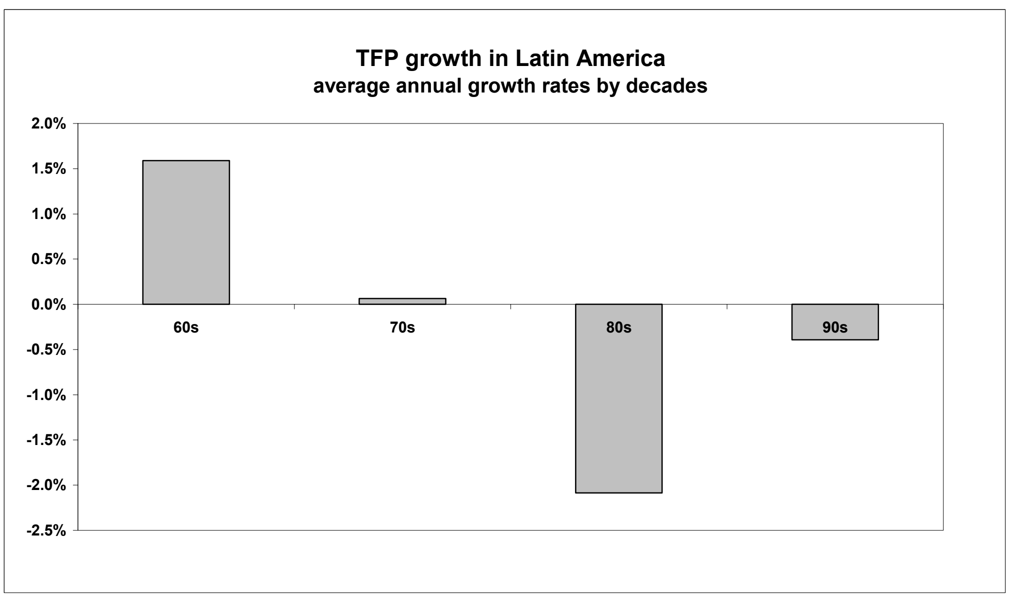


Figure 4



The next step is to pursue our comparative approach and use these growth accounting exercises to examine the factors underlying the slower growth of Latin America relative to the benchmarks during the 1960-99 period. This is shown in table 4. The lack of TFP growth is very important to account for the slower growth of the region relative to the comparators. In fact, it is the dominant factor to account for the growth gap over this period.[7] It is worth noting that the results in table 4 hold true consistently across decades (see table 5). The only exceptions are when we compare Latin America with the developed countries in the 1960s and the East Asian countries in the 1990s, in which slower capital accumulation is the key factor to account for the growth gap.

Table 4: Difference in growth contributions between Latin America and comparator average annual growth rates (1960-99)

	GDP per-capita Growth	Labor/Pop	Skills	Capital/Lab	TFP
Rest of the World	-1.25%	0.19%	-0.01%	-0.35%	-1.07%
Developed	-1.38%	0.02%	0.14%	-0.38%	-1.16%
East Asia	-4.19%	-0.33%	-0.13%	-1.62%	-2.11%

Table 5: Difference in growth contributions between Latin America and comparator by decades average annual growth rates (1960-99)

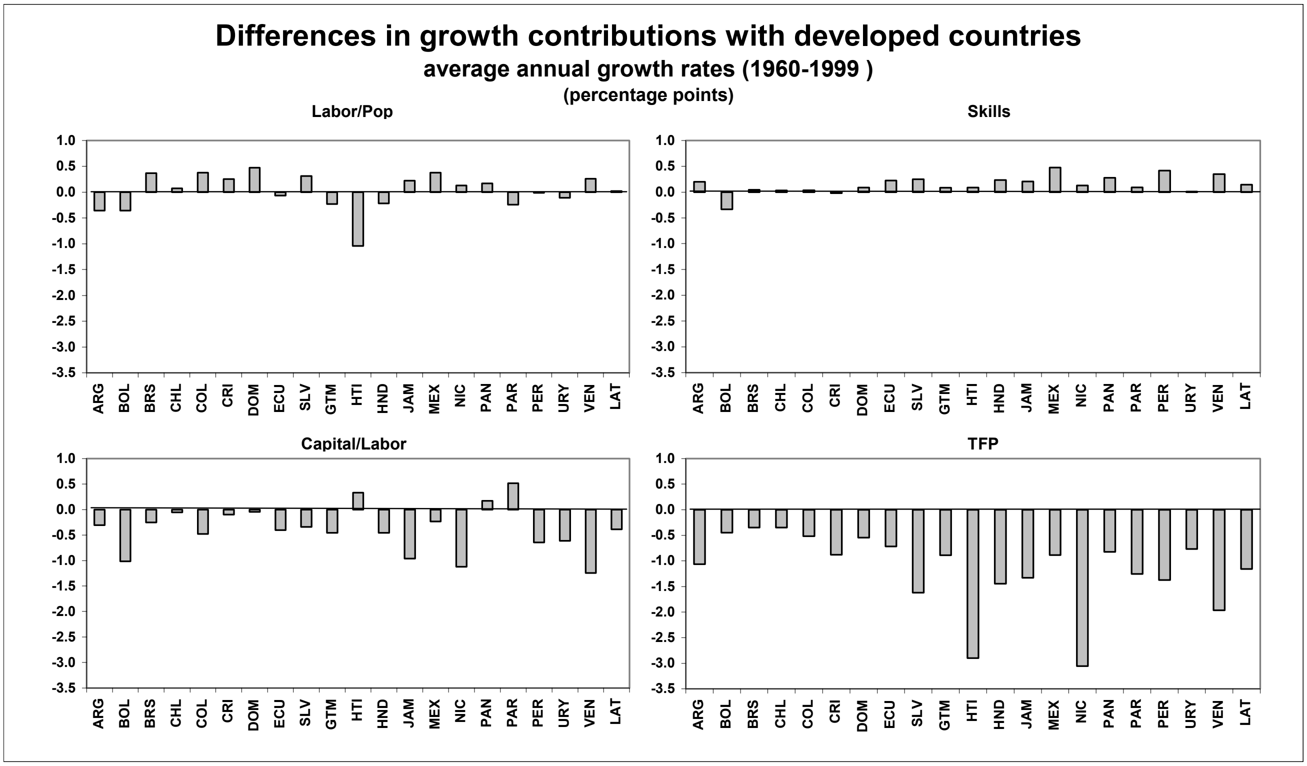
	GDP per-capita Growth	Labor/Pop	Skills	Capital/Lab	TFP
1960s					
Rest of the World	-1.29%	-0.10%	-0.07%	-0.54%	-0.58%
Developed	-1.63%	-0.34%	0.01%	-0.91%	-0.38%
East Asia	-2.82%	-0.49%	-0.20%	-0.96%	-1.17%
1970s					
Rest of the World	-0.89%	0.04%	0.06%	-0.22%	-0.78%
Developed	-0.50%	-0.20%	0.22%	0.01%	-0.52%
East Asia	-4.81%	-1.02%	-0.15%	-1.36%	-2.27%
1980s					
Rest of the World	-2.21%	0.40%	0.10%	-0.56%	-2.15%
Developed	-2.85%	0.12%	0.23%	-0.45%	-2.74%
East Asia	-5.71%	-0.07%	0.02%	-1.95%	-3.72%
1990s					
Rest of the World	-0.50%	0.38%	-0.03%	-0.11%	-0.74%
Developed	-0.58%	0.46%	0.11%	-0.23%	-0.91%
East Asia	-3.15%	0.26%	-0.09%	-2.14%	-1.18%

The finding that TFP is the dominant factor to account for the growth gap between Latin America and other comparators also applies quite uniformly to each of the countries of the region. Figure 5 shows the differences in the growth contributions between each country in Latin America and the Developed countries during the period 1960-99. According to the figure, many of the growth differences in labor participation and in skills are, in fact, positive. Negative differences, on the other hand, are very common in the growth rate of capital accumulation. However, the largest negative differences are seen in TFP growth. This is true for all

[7] Sensibility analysis with a capital share of 0.4 shows that the slow growth of Latin America's total factor productivity is still the dominant factor to account for the growth gap relative to all the regions except with respect to East Asia. With this region, lack of capital accumulation becomes the most important factor to account for the growth gap during the 1960-99 period.

the countries of the sample (except for Bolivia in which the largest difference is in capital accumulation). Similar results arise when using the other benchmarks.

Figure 5



Results so far have shown that the slower growth rate of Latin America relative to the benchmarks is mainly the result of the slower TFP growth in the region. This however, does not tell us anything about the size of the income gap. In order to explore how far behind is Latin America relative to the other regions in terms of each of the resource factors contributing to income, we perform level accounting exercises. To facilitate the exposition, we leave aside differences in labor participation and perform level accounting exercises with respect to income per worker. The exercises are based on the following equation:

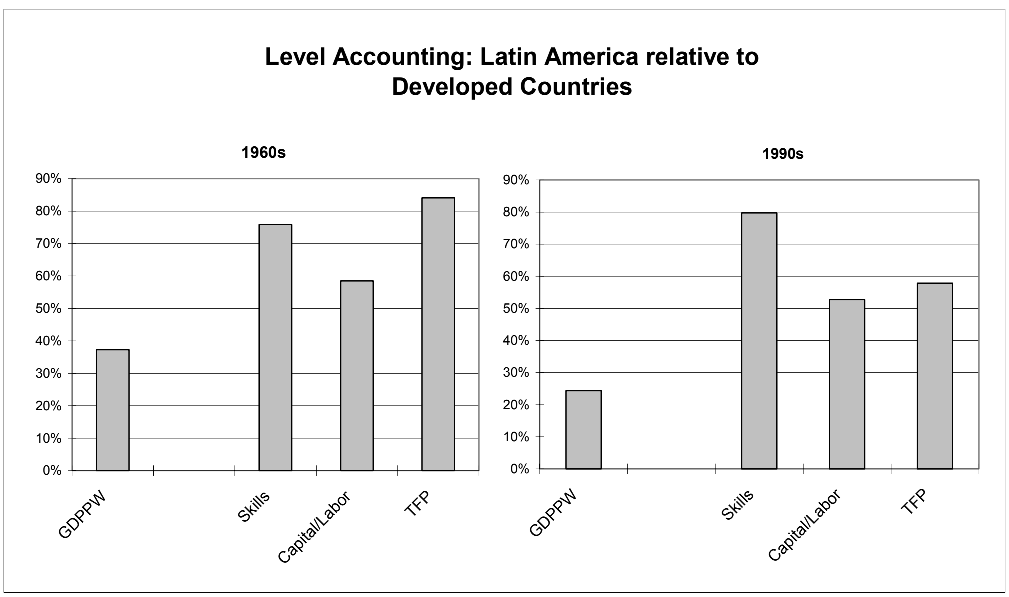
(7) $$\frac{y}{y*} = \left(\frac{k}{k*}\right)^{\alpha} \cdot \left(\frac{h}{h*}\right)^{1-\alpha} \cdot \frac{A}{A*}$$

where y is real GDP per worker and k is capital per worker. Variables with an asterisk refer to the typical Developed country from the sample and variables without asterisk refer to the typical Latin American country.

The results are presented in figure 6. The first column is the income per worker in Latin America during the 1960s relative to that of the developed countries. We see that worker productivity in Latin America was 37% of that in developed countries. The next three columns represent the relative level of the contribution of each factor. The shortfalls in each one of these three contributions combine to produce that result. Following (7), the product of these three columns is equal to the value of the relative income per worker given in the first column (0.37 = 0.76 x 0.58 x 0.84). In the right-hand side of the figure the exercise is repeated for the 1990s. In both cases, lower capital/labor ratios are the main cause of lower incomes.

Latin America experienced a decline in relative income per worker from 37% to 24% between the three decades. In that period, the gap in TFP experienced a large opening: TFP in Latin America was around 84% of the TFP in the Developed countries during the 1960s, a small shortfall, and it went to 58% during the 1990s. This confirms that the collapse in relative TFP of about 30% is behind the similar decline in relative income. In fact, the other two growth contributions largely offset each other: labor skills made some marginal progress (from 76% to 80%) but physical capital intensity regressed further (from 58% to 53%).

Figure 6



What can we make of these shortfalls and their trends? One insight is that the skills of the labor force is not the key to Latin America's (relatively) low and deteriorating income. In fact, if the skills of the labor force were the only difference with developed countries, income-per-worker would be as high as 80% (that is similar to the level of Spain) and getting better over time. Notwithstanding the benefits of policies aimed at improving the skills of the labor force to increase average income[8], the key to Latin America's dismal and worsening relative income of about one fourth of that of developed countries is to be found in physical capital and total factor productivity.

A second insight is that physical capital intensity in Latin America, low and declining as it is relative to that in developed countries, is not following an anomalous path but, rather, it is evolving as it would be expected in capitalist economies driven by profit. Investment, and a fortiori the stock of physical capital, is determined by the existence of profitable opportunities in the economy as measured by marginal returns to investment, r and r^*, from (1):

(8a) $$\alpha \cdot \frac{y}{k} = r$$

(8b) $$\alpha \cdot \frac{y^*}{k^*} = r^*$$

Equations (8a) and (8b) yield:

(9) $$\frac{y}{y^*} = \delta \cdot \frac{k}{k^*} \ , \qquad \text{where } \delta = \frac{r}{r^*}$$

Figure 6 implies that in the 1960s, δ was around 1.9 and in the 1990s it was around 1.7. One standard interpretation of δ, the gap between rates of return to physical investment, is that it measures the degree of financial integration of Latin America (δ =1 would mean perfect integration; the higher δ the less integrated, so that excess returns in Latin America would be left unexploited).[9] Under this interpretation, better financial integration to the point of perfection could improve relative income only to 31%, still below than what it was back in the 1960s (this is also roughly similar to the improvement of income that would take place from a total elimination of the skill gap). Alternatively, δ may reflect other costs associated with investment, such as taxation or risk of expropriation, or a risk premium due to uncertainty. In that case the policies to produce higher capital intensity lie elsewhere.

Once again, the analysis reveals that the gap in total factor productivity is the key to understanding low and declining relative incomes in Latin America. First, it should be noted that if Latin America were to increase

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[8] And also to alleviate poverty and social inequities when focalized in the disadvantaged, an issue outside this study.

[9] In this formulation, r and r* refer to gross returns, inclusive of depreciation. Another interpretation for δ is that it reflects different depreciation patterns in investment in both types of economies.

its total factor productivity to the level of developed countries, with the same physical and human capital resources that is has in place now, relative income would significantly improve by 18 percentage points, to 42%. And second, and equally important, impressive as these measures of the significance of TFP gaps are, they severely underestimate the impact of the TFP shortfall. In fact, the handicap in TFP has equally important indirect effects on lower incomes because it is low productivity what underlies low stock of physical capital (and to some extent human capital) by reducing the returns to investment. A conservative estimation of the indirect effects of closing the TFP gap, leaving aside any effects on the incentives for human capital accumulation and on the rate of return gap δ , yields an estimated increase in relative income-per-worker of additional 17 percentage points through the increase of the equilibrium physical capital stock in (9).

The overall conservative estimation of the effect of closing the TFP gap would improve the relative income-per-worker of the typical Latin American country by 35 percentage point to 59%, a level above that in Portugal or Greece. It is therefore essential to analyze the factors that underlie TFP performance and the policies that may be employed to increase it, a research agenda to which we will return in section IV.

Another approach to learn from figure 6 about the nature of the shortfalls is to look at their relative imbalances with respect to a benchmark of normal economic development, which may reveal important features of the growth performance in Latin America. In what follows we utilize a prediction model for the variables in figure 6, that is the relative gaps with respect to developed countries, controlling for the level of development of countries as measured by income per capita on the basis of world cross-country experience in each period. We then apply this model to Latin American income levels to construct a benchmark of normal development and contrast it with the actual performance shown in figure 6 (see figure 7).

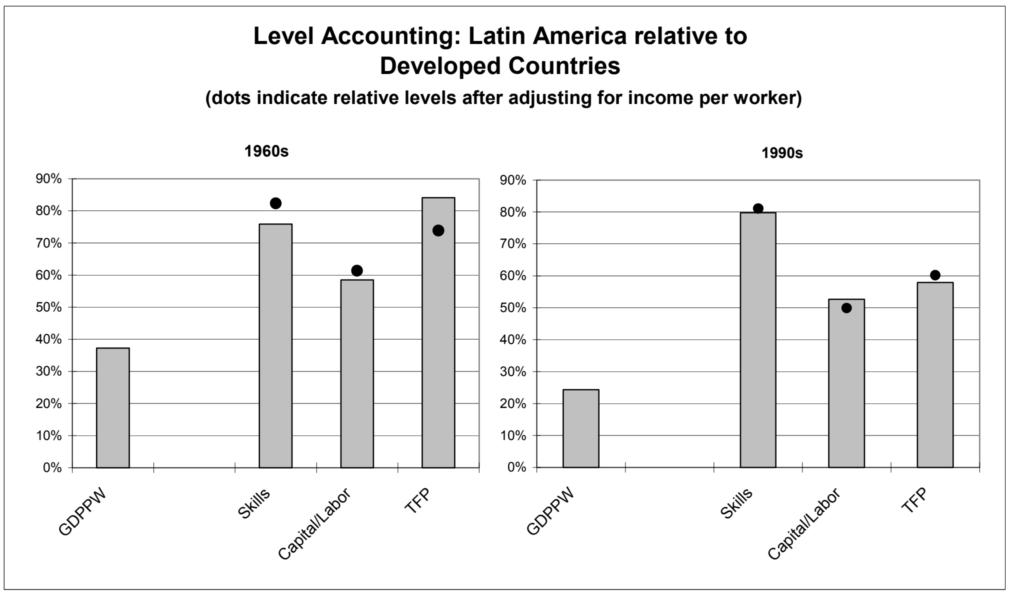
The fact that Latin America exhibits gaps (in figure 6) in all the contributing factors is perhaps not surprising given the lower level of development in the region. An interesting question, however, is whether the size of these gaps are consistent with the levels of income observed in Latin America. This is presented in figure 7, where the bars indicate again the observed relative levels of the contributing factors and the dots indicate these same relative levels adjusted by the level of development.[10] During the 1960s, the relative level of TFP in Latin America was above the level that the region should have had according to its development stage. The opposite was true with respect to skills and physical capital. These imbalances disappeared by the 1990s. By then, the relative levels of these contributing factors were more in tune with the levels of development of

[10] For this, we regressed the log of each contributing factor on the log of income per worker using the entire sample of countries excluding the Latin American countries in each decade. We then calculated the level of the contributing factor that Latin America

the region: only marginally below in terms of skills, marginally above in terms of physical capital and slightly below in terms of TFP. This finding suggests that the large drop of Latin America's productivity between the 1960s and the 1990s was partly the result of an adjustment from relatively high levels of productivity in the 1960s that were atypical for the region's income at that time.

The current state of affairs in Latin America is not characterized by development imbalances: accumulated physical and human capital appear to match productivity at this stage of development. While in the 1960s there was an argument for unleashing development through faster accumulation to exploit high productivity, the current situation calls for a focus on productivity.

Figure 7



To gain perspective on the sizes of the gaps across the Latin American region, figure 8 shows level accounting exercises for each individual country during the 1990s decomposing the income gaps with respect to developed countries into its components by taking logarithms in equation (7) (we multiply all the values by minus one for presentation purposes).

The figure provides useful information of the relative gaps in each country and identifies areas of deficit that might deserve policy attention. For example, a simple comparison between Mexico and Argentina in figure 8 shows that both countries had roughly similar income gaps relative to the Developed countries in the 1990s.

should have had in each decade according to its level of development using the regression estimates and the observed income per worker for Latin America.

However, in Mexico the relative gaps in skills and in capital per worker were higher than in Argentina and the relative gap in TFP was smaller.

Figure 8

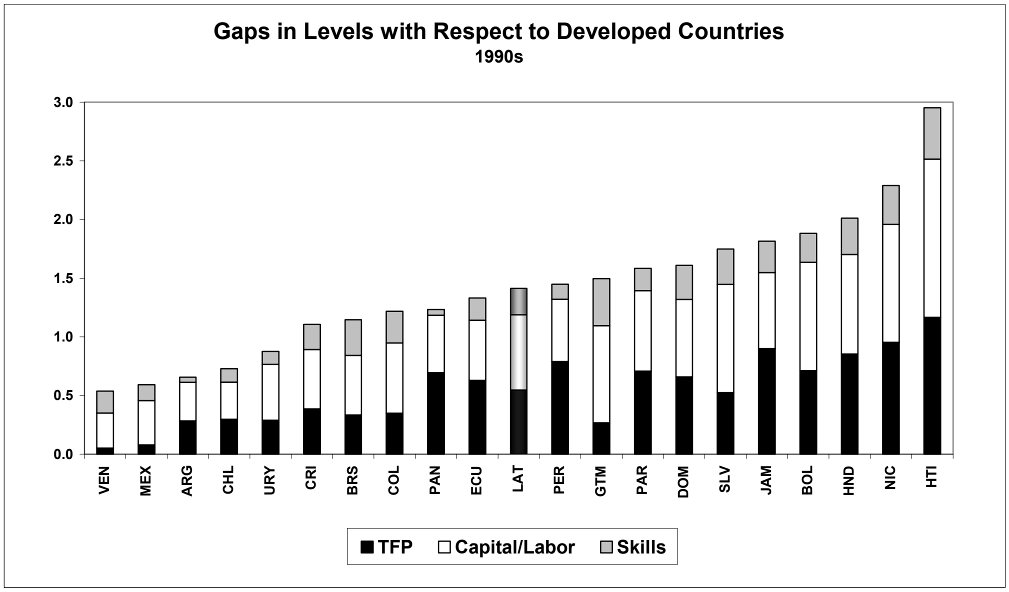


Figure 9, 10 and 11 show the differences between the observed level of each contributing factor and the expected level on the basis of the level of development of each country (i.e. the deviation of each country from the norm). Returning to the example of Mexico and Argentina, the figures show that Mexico had levels of skills and capital per worker lower than expected, while Argentina had lower levels of total factor productivity. From a policy point of view, this kind of analysis provides a measure of the size of the shortfalls to address and a framework to establish priorities. We now turn into the question of what policies might be more effective to address these shortfalls.

Figure 9

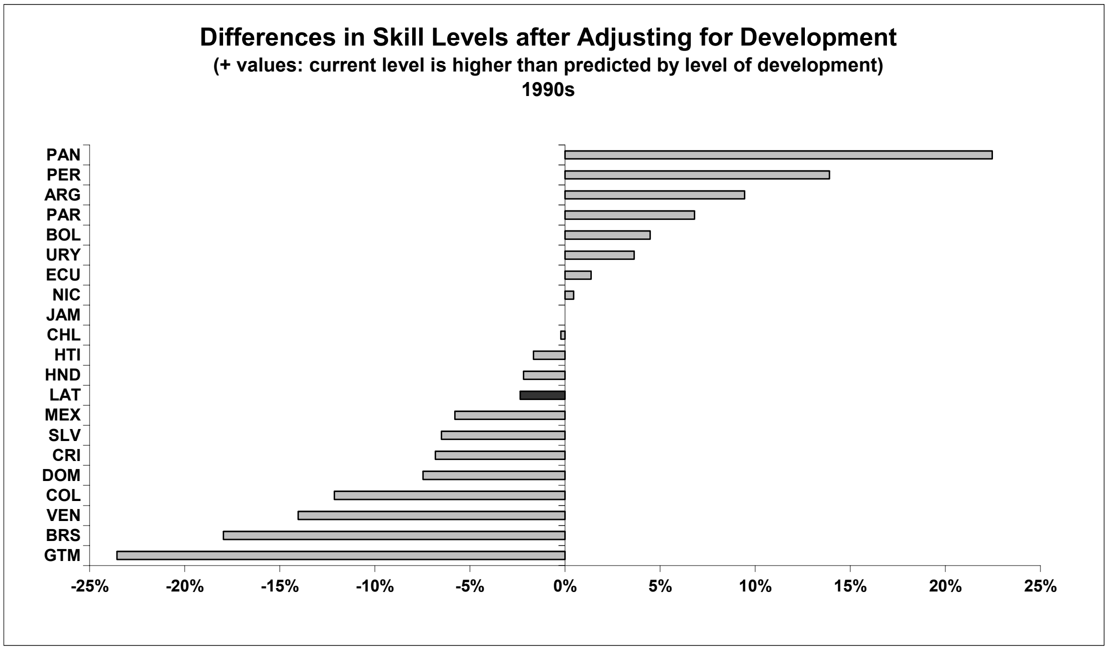


Figure 10

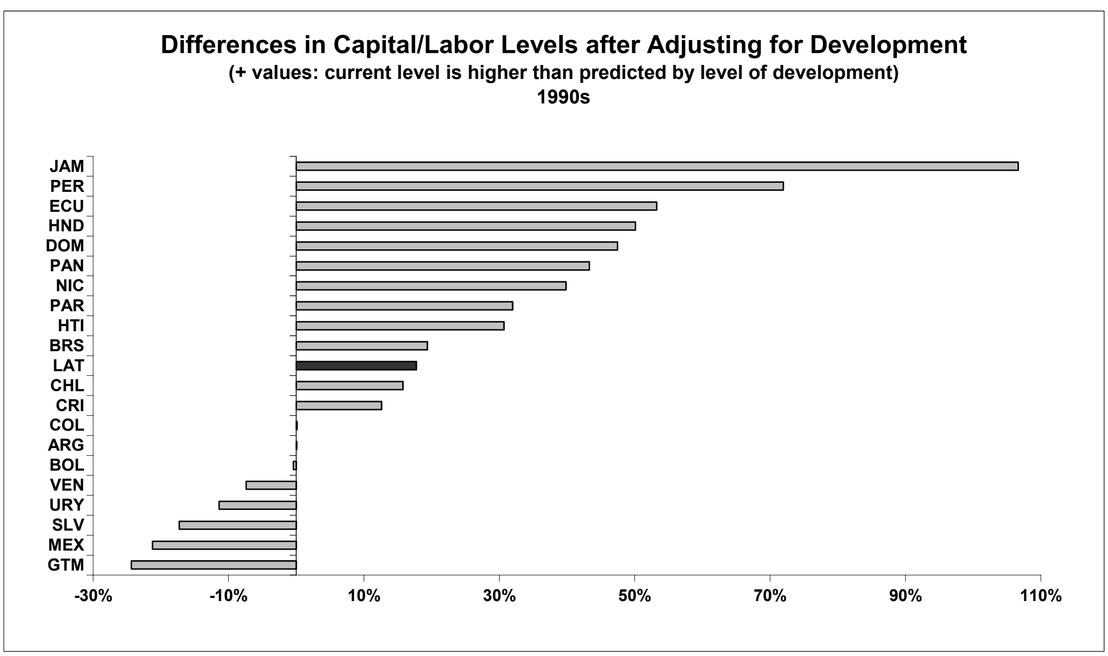
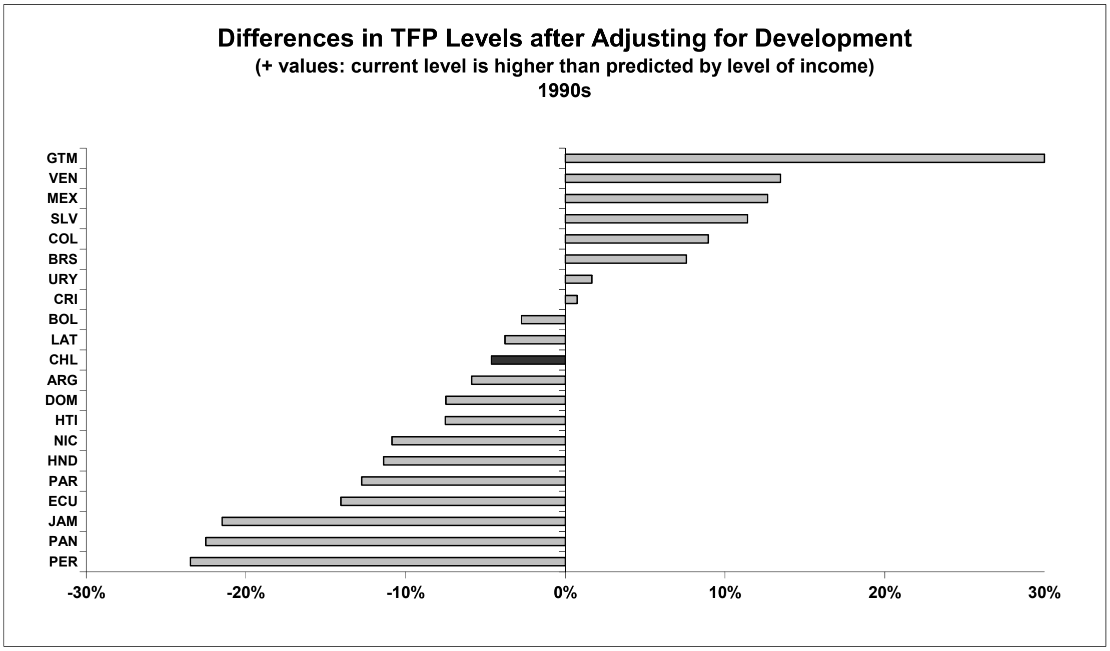


Figure 11



IV. Explaining Productivity Growth

We found that lower productivity is the main factor behind lower income in Latin America and that slow productivity growth is the main factor behind the slower growth of the typical Latin America country relative to the rest of the world and other relevant comparators. Therefore, we are interested in explaining what drives productivity. To this end, we study TFP growth through Barro-style regressions. We also run similar regressions on factor growth to sharpen the focus of the analysis and reconcile our results with the traditional growth regressions, which do not distinguish between factor growth and TFP growth components. In fact, in our estimations, growth effects can be obtained by adding the estimated effects on factor growth and those on TFP growth.

The explanatory variables are divided in policies-related variables (variables affected by a wide range of public policies), institutions (quality of the institutions within which policies and economic decisions are carried out) and external factors (terms of trade shocks). The policies are proxied by the following variables: education (log of average years of secondary schooling in the male population over age 25); life expectancy (log of average years of life expectancy at birth); openness (structure-adjusted trade volume as % of GDP)[11]; imports of machinery and equipment (log of machinery and equipment as % of GDP); credit to private sector (log of credit to private sector as % of GDP); government consumption (log of government expenditure as % of GDP)[12]; inflation (log of inflation rate), and black market premium (log of 1 + black market premium). The institutions are proxied by the first principal component of the International Country Risk Guide (ICRG) variables, which combines risk of repudiation of contracts by government, risk of expropriation, corruption, rule of law and bureaucratic quality. The terms of trade shocks are measured by the growth rate of the terms of trade. The panel data consists on a sample of 73 countries and 6 five-year average subperiods from 1970-74 to 1995-99. We also control for conditional convergence by including the initial per capita GDP and by cyclical reversion to the long run trend within each five year period (see Loayza, Fajnzylber and Calderón, 2002).[13]

Unfortunately, most of the variables that are used to construct the index of institutions are available starting from 1982, and for some countries, they are available only from 1985. Therefore, in order to use all our data, we construct the index of institutions for the subperiods that are not available using a predictive model based on the explanatory variables of the growth model. Here we follow the method used by Fernandez-Arias and Montiel (2001) to construct missing values of the structural reform index to explain GDP growth. Consider the following equation:

(11) $$I_{it} = a + b \cdot M_{it} + e_{it}$$

where I_{it} is the index of institutional quality, and M_{it} is a set of the explanatory variables included in the growth model (policy-related variables and the terms of trade shocks). Equation (11) is estimated using data for the subperiods 1985-89, 1990-94, and 1995-99. Then, with the estimated parameters of the model and data values of M_{it} for the subperiods 1970-74, 1975-79 and 1980-84, we estimate the missing values of I_{it}.[14]

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[11] The idea of adjusted trade volume is taken from Pritchett (1996) and is measured as the residual of the following equation: $(IMPORTS+EXPORTS)/GDP)_i = a + b*\log(POB)_i + c*\log(AREA)_i + d*\log(GDPPC)_i + e*\log(GDPPC)_i*\log(GDPPC)_i + f* OIL\_dummy_i + g*LANDLOCK\_dummy_i + E_i$. The measure indicates the amount by which a country's trade intensity exceed (or falls short) of that expected for a country with similar characteristics.

[12] It does not include expenditures for defense.

[13] Loayza et al (2002) consider the cyclical reversion to the long run trend in GDP per capita. In contrast, since our estimate of TFP reflects changes in the rates of factor utilization (as explained in Appendix B) which are the key of economic fluctuations, we control for the economic cycle in our three regressions by the cyclical reversion to the long run trend in TFP.

[14] Note that this procedure does not add any new information to the growth regressions but allows us to use the entire sample available. The estimation of equation (11) produces an R-square of 68 percent.

Tables 6 and 7 provide a complete definition of all the variables as well as their descriptive statistics and correlations for the sample of 73 countries during the entire 1970-99 period. We control for potential endogeneity in all the regressions using instrumental variable (IV) estimation based on lagged values.

We first run bilateral regressions for TFP growth as well as for GDP per capita growth and factor growth (shown in table 8) to explore the strength of the associations. For this exercise we estimate the impact of each of the explanatory variables individually while controlling, in all the cases, for conditional convergence and cyclical reversion. The results show that our proxies for education, life expectancy, openness, imports of machinery and equipment, credit to the private sector, institutions and growth rate of terms of trade, have all positive individual effects on TFP growth as well as on GDP per capita growth and factor growth (although the effects are not always significant). Inflation and black market premium, both proxies of policy mismanagement, have negative associations with the three variables. Government consumption, a variable that often appears with a negative sign in growth regressions, is normally taken as an indicator of the burden that government imposes on development if the public sector interferes with the market. Our regressions suggest that this negative effect on the growth rate of output is the result of crowding out effects on private activity, as the coefficient of government consumption is negative in the factor growth regression but not in the TFP growth regression.

Another interesting result of these exploratory regressions is that the proxy for institutional quality has positive impacts on GDP per capita growth and TFP growth but not on factor growth. The result seem to suggest that if better institutions have positive effects on growth, these effects are likely to be channeled primarily through improved efficiency. We will come back to this point later.

Table 8 shows that the coefficient estimates in the TFP regressions are often larger than those in the factor regressions. This implies that for equal changes in any explanatory variable, TFP growth is expected to be more sensitive than production factors growth (see table 9, which shows the ratio of the estimated coefficient in the TFP regression of table 8 relative to the estimated coefficient in the factor regression). Given these results, TFP growth is expected to have a larger response to any given change in the explanatory variables than factor growth (except for education, life expectancy and credit to private sector).

Table 10 shows the results of multivariate regression analysis when all the explanatory variables are included at the same time. The estimated coefficients of the growth effects of the explanatory variables (first column) can be decomposed into effects on factor growth (second column) and on TFP growth (third column). In fact, our IV estimation framework yields an exact decomposition in which the first column can be obtained by simply adding the other two. Furthermore, table 10 allows us to trace unambiguously the statistical significance of growth effects to one or other channel (or both). Since we are primarily interested in analyzing what drives productivity, we first concentrate the explanation of the results in the TFP equation. Later we elaborate on the results of the other two equations to complement the analysis.

Besides the conditional convergence and cyclical reversion control variables, which have the expected signs and are statistically significant in the TFP regression, the results concerning policy-related institutional variables show that the level of openness (structure-adjusted) and the quality of institutions have both positive effects on the growth rate of TFP and the inflation rate has a negative effect.

Trade might affect growth through different channels. Trade might allow countries to specialize in those sectors of comparative advantages creating efficiency gains due to a better use of the factors of production. Trade might also allow firms to exploit sectors with economies of scale by expanding the size of the domestic market. Trade could also reduce anti-competitive practices of domestic firms and limit the incentives that firms might have to conduct rent-seeking activities. In our results, the effects of openness on growth are channeled primarily through TFP growth. Note that the coefficient for the openness variable is found to be positive also in the other two regressions but it is not significant in the factor growth regression. The result suggests that the primary vehicle of the impact of openness on economic growth is through increased dynamic efficiency.

The inflation rate is a proxy for the quality of monetary and fiscal policy. High inflation rates signal an unstable macroeconomic environment that might hamper economic growth. Our results show that the mismanagement of macroeconomic policies appears associated with lower productivity growth which is detrimental to economic growth.

The effects of the quality of institutions on development have received much attention in recent years. Acemoglu, Johnson and Robinson (2001) show that institutions (proxied by mortality rate of colonial settlers) have a strong causal effect on income levels. Rodrik (2002) and Sachs (2003) found similar results using the same proxy. Barro and Sala-i-Martin (1995) used the measure of rule of law from the ICRG variables and found that it has a positive and significant effect on the growth rate of output. None of these analyses, however, provide a clear indication of the channel by which institutions affect the level of income or the growth rate. In our analysis, the coefficient for institutional quality is shown to be positive in the TFP growth regression and also in the GDP per capita growth regression. Therefore, these results suggest that if better institutions have positive effects on the growth rate, the effects are likely to be channeled primarily through productivity growth.

So far, our comments have been focused on the level of openness, the inflation rate and the quality of institutions because these were the variables that were shown to have a significant impact on TFP growth (our primary variable of interest). In what follows we complement the analysis by exploring the results from the other variables in the regressions.

The coefficient for education is shown to be positive in all the regressions (although marginally significant, at the 15 percent level, only in the factor growth regression). The role of human capital on long-run growth has been stressed in the endogenous literature of economic growth. Human capital has a direct role as a factor of production and it is also important for innovation as well as for the absorption of foreign technology. Empirically, however, proxies for human capital have not always been robust in growth regressions. Barro and Sala-i-Martin (1995), for example, use the average years in secondary and higher schooling for males aged 25 and over, albeit recognizing that not all types of educational attainment have a significant impact on economic growth. Running a set of alternative econometric growth models, Loayza, Fajnzylber and Calderón (2002) found that their proxy for human capital, the gross secondary-school enrollment, has a positive and significant impact on growth in about half of their regressions. Our results suggest that perhaps the main channel through which the level of human capital affects economic growth is through its direct impact on factor accumulation.

The life expectancy variable is found to have positive and significant effects on the output growth regression and on the factor growth regression. Life expectancy is a proxy for good health and is normally found to have a strong positive relation with growth (see Barro and Sala-i-Martin, 1995 and De Gregorio and Lee, this volume). According to our results, this positive effect might arise through the factor accumulation channel.

Besides our openness variable, which is a proxy for the general level of trade restrictions in the country, we model specifically the effect of imports of capital goods and equipment on economic growth. Imports of capital goods and equipment with superior technology can increase the efficiency of the production process and thus induce higher growth rates. In our results, however, this variable enters with a positive (although not significant) coefficient only in the factor growth regression which implies that there might be only a direct effect associated with the accumulation of foreign physical capital and not an indirect effect associated to the higher level of technology that is embodied in such goods. It is possible, however, that the efficiency of technologies from imported capital is captured already by our openness variable. Note that when the imports of capital goods variable enters only by itself, the coefficient is positive and significant in both the factor growth regression and the TFP growth regression.

A good financial system facilitates risk diversification and channels resources to finance productive activities. Access to credit is key for the development of investment projects and, therefore, we should expect a positive association between financial depth and factor accumulation. Although we found a positive coefficient between our proxy of financial depth and the growth rate of factor accumulation, our results are not strong enough to confirm that this association is statistically significant.

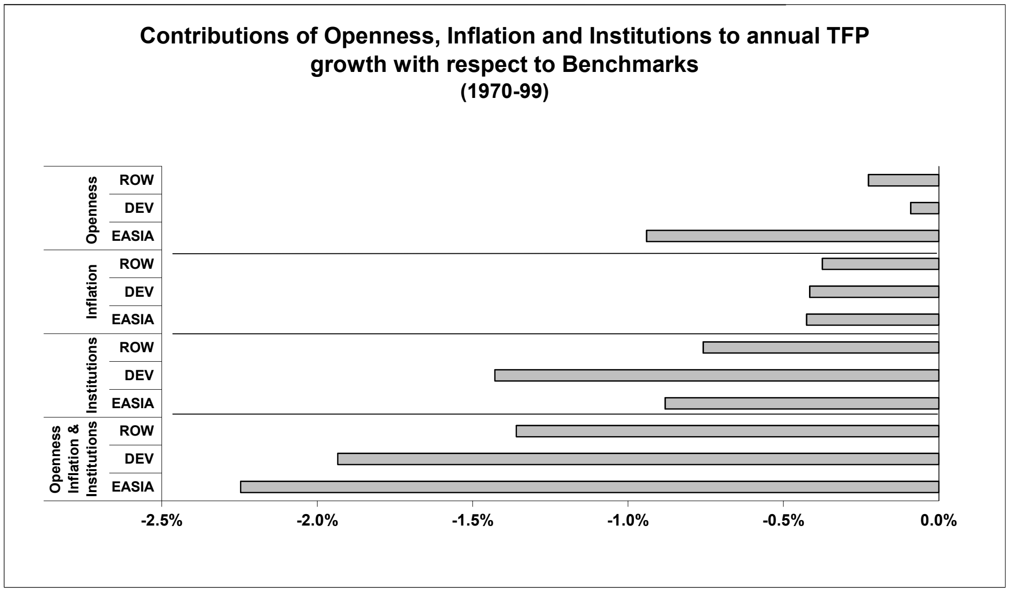
The results for government consumption are the same as when the variable enters the three regressions by itself. There is a negative effect on factor growth and on output growth and a positive (but not significant) effect on TFP growth. This implies that the negative effect on output growth is most likely the result of crowding out effects on private activity rather than of disruptions in productivity.

Finally, similar to the inflation rate, the black market premium is used as a proxy for poor economic policy possibly in anticipation of crises. From our results, while the inflation rate appears to be associated with lower productivity, repressed exchange rates seem to be related with lower factor accumulation.

How can we apply these findings to the case of failing TFP growth in Latin America? To answer this question we use the estimated equation of TFP growth in table 10 to determine the role of the explanatory variables in explaining the TFP growth gap of Latin America relative to the benchmarks, which was shown to be the key for its relative performance in growth per capita over the past forty years.

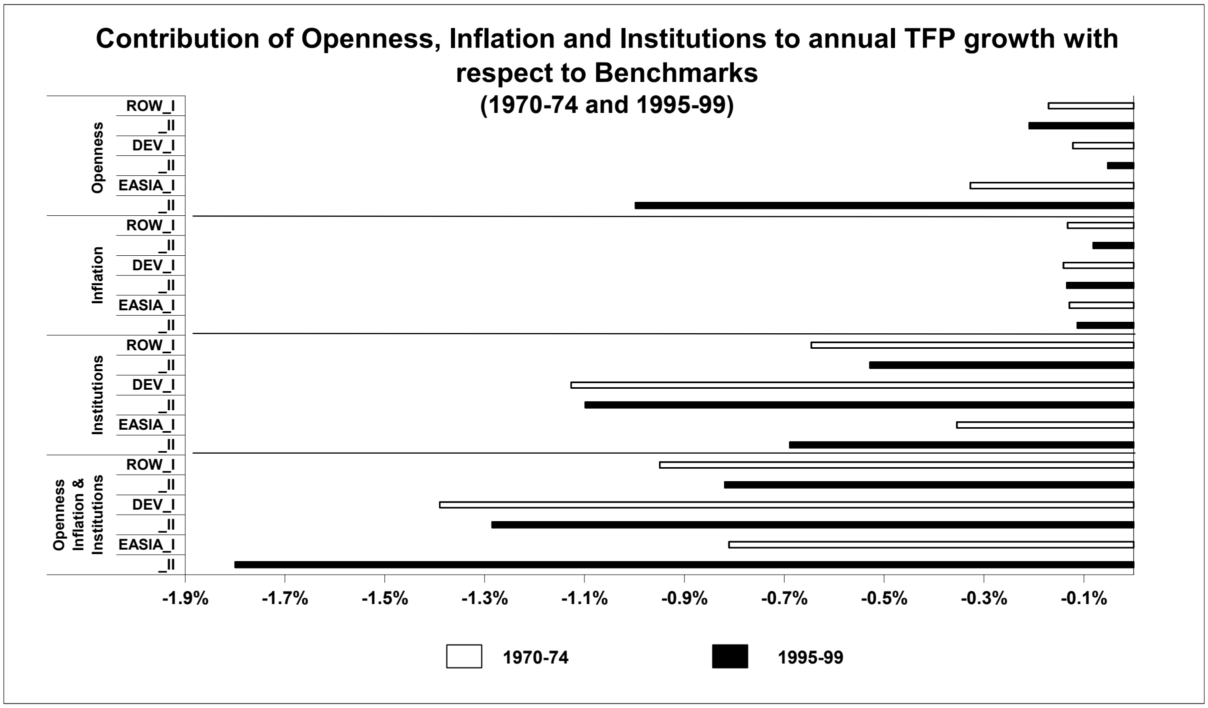
Figure 12 shows the contributions of the three variables that appear to have a statistically significant effect on TFP growth in the long-run (openness, inflation and institutions) to the gap in TFP growth between Latin America and the benchmarks during the 1970-99 period. According to the model, the relatively worse performance of Latin America with respect to all the other regions was the result of insufficient openness, macroeconomic mismanagement (proxied by the inflation rate) and worse institutions. When Latin America is compared with the rest of the world and the developed countries, the main factor was the worse institutional quality of the region. When the comparison is done with East Asia, however, the main factor was lack of openness. It is worth mentioning that the model is able to explain most of the observed gaps in TFP growth between Latin America and the comparators during the selected period. Specifically, the model (which includes openness, inflation, the quality of institutions, the convergence factor and the cyclical factor) explains 98% of the observed gap with respect to the rest of the world, 88% of the observed gap with respect to East Asia, and 74% of the observed gap with respect to the developed countries.

Figure 12



The above results are averages over the period 1970-99. However, how is the situation evolving over time?. In order to answer this question, we repeat the exercise shown in figure 12 but consider the two extreme sub-periods: 1970-74 and 1995-99. Figure 13 shows the case. There is a shortfall in openness, macroeconomic mismanagement (inflation) and institutions with respect to all benchmarks in both subperiods. It is interesting to note, however, that the relative disadvantage arising from openness is more pronounced in the second period than in the first one (except when compared with the Developed countries). The relative disadvantage from macroeconomic management, however, is less pronounced in the second period with respect to all the regions, and the relative disadvantage from institutions is less pronounced in the second period (except when compared with the East Asian countries).

Figure 13



Overall, Latin American shortfalls have been reduced except with respect to the East Asian countries. It is important to note that behind these shortfalls in TFP growth there is a significant improvement in the variables that explain productivity in the region. In fact, according to our model, the average annual contribution of openness, inflation and institutions to TFP growth during the 1995-99 period was 1.13% higher than the average annual contribution of these variables during the 1970-95 period. This represents a significant improvement in the capacity (policy and institutional-based) of the region to generate TFP growth. Unfortunately, this improvement was not enough to eliminate Latin America's productivity shortfalls with respect to the comparators.

V. Final Remarks

In this paper we have provided an overview of the growth experience of Latin America during the last four decades. At first glance, the typical country in Latin America appears to have made good progress overall (increasing income per capita) but fallen into a low growth pattern during the 1990s, failing to regain the dynamism of the golden 1960s and 1970s. We find that this message is profoundly misleading. We argue that growth performance ought to be evaluated in relation to growth opportunities. When growth in Latin America is compared to relevant benchmarks derived from growth in the rest of the world, which controls for world technology shocks, we find that the typical country in Latin America has grown more slowly over the period and that the 1990s is actually the best decade. Countries in Latin America had sub-par growth in the 1960s and 1970s; relative to that, growth in the 1990s was an improvement.

The factor that stands out to explain these growth gaps with benchmarks is total factor productivity, as opposed to factor accumulation. Differences in growth rates of labor participation or the accumulation of capital (human in the form of labor skills and physical in the form of capital per worker) typically pale in comparison with the gap opened by lagging productivity improvements, or reversals, in the typical Latin American country. In turn, this productivity failure can be traced to distortions in the workings of the economy that drive aggregate efficiency below the technological frontier.

The analysis of the gaps in income per capita between the typical Latin American country and the benchmarks also leads to a failure in total factor productivity. Relative to the typical developed country, income per capita declined from 37% in the 1960s to 24% in the 1990s. The main problem is not education: if labor skills were the only difference the typical country in the region would have Spain's income (80%) and improving. Physical capital intensity is significantly sub-par but is broadly in line with the available returns to investment: better financial conditions may help but income per capita would at most increase to 31%, not even enough to recover what was lost in the period. By contrast, closing the productivity gap would have a direct static effect on income and an indirect effect on investment due to higher returns that would bump income per capita at least to 59%, a level above Portugal or Greece.

This policy focus on total factor productivity is further confirmed by contrasting the structure of production factors in Latin America with what could be expected under normal development. We find that the current structure of the aggregate production function in Latin America is normal, which we interpret as meaning that there is no anomalous relative shortfall in labor skills or physical capital that calls for policy priority. In fact, the collapse of productivity over time can be interpreted as an adjustment that eliminated excess productivity (relative to too little human and physical capital). While the policy priority in the 1960s could have been factor accumulation to exploit high productivity, right now policy attention ought to be directed to productivity.

We find that the key policy instruments to address failures in total factor productivity are openness with the rest of the world, quality of macroeconomic policies, and the quality of institutions. Shortfalls in these aspects go a long way in explaining the opening gaps in productivity and, consequently, in overall growth. We find that macroeconomic stability and institutional gaps are gradually closing but the gap in openness is not, which suggests that an effort in accelerating economic integration is high priority.

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Table 6: Descriptive Statistics (1970-1999)

Description	Obs	Mean	Std. Dev	Min	Max
Growth rate of GDP per capita	438	0.018	0.028	-0.083	0.124
Growth rate of TFP	438	0.001	0.022	-0.074	0.067
Growth rate of factors	438	0.017	0.014	-0.017	0.078
Initial GDP per capita (in logs)	438	8.177	0.962	6.152	9.854
Cyclical reversion in productivity: initial productivity gap relative to trend (in logs)	438	0.009	0.068	-0.217	0.242
Education: average years of sec and higher schooling in male pop with 25+ (in logs)	420	0.383	0.885	-3.101	1.895
Life expectancy at birth, years (in logs of [years/100])	438	-0.440	0.173	-1.059	-0.220
Openness: structure-adjusted	426	0.029	0.388	-0.537	2.713
Inflation (in log of [1 + infla/100])	429	0.185	0.406	0.003	3.543
Black market premium (in log of [1+bmp])	438	0.152	0.374	-0.105	4.767
Credit to private sector / GDP (in logs)	426	-1.090	0.785	-3.953	0.712
Government consumption / GDP (in logs)	425	-1.965	0.381	-3.133	-0.950
Imports of machinery and equipment / GDP (in logs)	438	-3.092	0.657	-5.486	-0.468
Growth rate of terms of trade	410	0.000	0.041	-0.328	0.301
First principal components of ICRG variables	417	0.000	2.064	-4.133	3.075

Table 7: Correlations (1970-1999)

	GRGDPPC	GRA	GFAC	LGDPPC	CYCLEA	LSHYRM	LLIFEE	OPEN	LINFLA	LBMP	LCREDIT	LGOV	ICRG	GTOT	LMACHIN
GRGDPPC	1														
GRA	0.870	1													
GFAC	0.608	0.137	1												
LGDPPC	0.187	0.143	0.146	1											
CYCLEA	-0.054	-0.302	0.377	0.028	1										
LSHYRM	0.161	0.160	0.065	0.804	-0.171	1									
LLIFEE	0.246	0.148	0.255	0.856	-0.068	0.775	1								
OPEN	0.213	0.159	0.173	0.006	-0.057	0.006	0.033	1							
LINFLA	-0.262	-0.220	-0.171	-0.117	-0.110	-0.069	-0.081	-0.183	1						
LBMP	-0.347	-0.269	-0.263	-0.272	-0.035	-0.210	-0.265	-0.126	0.420	1					
LCREDIT	0.224	0.143	0.220	0.680	-0.002	0.582	0.643	0.228	-0.214	-0.411	1				
LGOV	-0.037	0.053	-0.160	0.387	0.022	0.255	0.229	0.014	-0.089	-0.052	0.289	1			
ICRG	0.268	0.284	0.082	0.829	-0.069	0.745	0.700	0.169	-0.238	-0.376	0.662	0.490	1		
GTOT	0.086	0.093	0.024	0.088	-0.063	0.078	0.132	0.024	-0.089	-0.095	0.104	0.004	0.133	1	
LMACHIN	0.187	0.142	0.147	0.167	-0.058	0.147	0.182	0.703	-0.164	-0.118	0.220	0.248	0.301	0.093	1

Table 8: Individual Effects

	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP
Log of Initial Level	-0.0031	-0.0026	-0.0005	-0.0095	-0.0087	-0.0008	0.0053	0.0016	0.0037	0.0041	0.0011	0.0031	0.0001	-0.0014	0.0015
	(1.33)	(2.27)**	(0.26)	(3.96)**	(7.88)**	(0.41)	(4.28)**	(2.67)**	(3.81)**	(3.34)**	(1.85)*	(3.09)**	(0.06)	(1.58)	(1.03)
Cyclical Reversion	-0.0578	0.0563	-0.1141	-0.0555	0.0582	-0.1137	-0.0671	0.0459	-0.1131	-0.0758	0.0438	-0.1196	-0.0600	0.0502	-0.1102
	(2.78)**	(5.45)**	(7.16)**	(2.80)**	(6.36)**	(7.25)**	(3.36)**	(4.73)**	(7.23)**	(3.92)**	(4.57)**	(7.89)**	(2.93)**	(5.17)**	(6.89)**
Policies															
Education	0.0100	0.0054	0.0046												
	(3.87)**	(4.22)**	(2.30)**												
Life Expectancy				0.0968	0.0685	0.0283									
				(7.19)**	(11.05)**	(2.66)**									
Openness							0.0194	0.0091	0.0103						
							(6.08)**	(5.86)**	(4.14)**						
Imports of Machinery and Equipment										0.0083	0.0033	0.0049			
										(4.27)**	(3.48)**	(3.25)**			
Credit to Private Sector													0.0088	0.0053	0.0035
													(3.60)**	(4.59)**	(1.83)*
Obs	420	420	420	438	438	438	423	423	423	438	438	438	419	419	419
R2	0.20	0.20	0.26	0.25	0.32	0.29	0.28	0.28	0.28	0.27	0.24	0.29	0.22	0.26	0.25

	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP	GDPPC	FACTOR	TFP
Log of Initial Level	0.0059	0.0025	0.0034	0.0042	0.0015	0.0027	0.0024	0.0004	0.0021	-0.0049	0.0004	-0.0053	0.0052	0.0016	0.0036
	(4.16)**	(3.71)**	(3.08)**	(3.27)**	(2.34)**	(2.69)**	(1.75)*	(0.54)	(1.91)*	(1.51)	(0.26)	(2.14)**	(4.05)**	(2.58)**	(3.63)**
Cyclical Reversion	-0.0683	0.0457	-0.1139	-0.0734	0.0455	-0.1189	-0.0788	0.0425	-0.1213	-0.0516	0.0518	-0.1034	-0.0646	0.0455	-0.1101
	(3.27)**	(4.58)**	(7.07)**	(3.70)**	(4.61)**	(7.67)**	(4.02)**	(4.37)**	(7.96)**	(2.46)**	(5.03)**	(6.42)**	(3.16)**	(4.63)**	(6.95)**
Policies															
Government Consumption	-0.0065	-0.0075	0.0009												
	(1.66)*	(3.99)**	(0.31)												
Inflation				-0.0149	-0.0015	-0.0134									
				(2.75)**	(0.56)	(3.16)**									
Black Market Premium							-0.0263	-0.0114	-0.0149						
							(3.97)**	(3.48)**	(2.89)**						
Institutions															
First Principal Components of ICRG										0.0060	0.0004	0.0056			
										(3.21)**	(0.41)	(3.93)**			
External Factors															
Terms of Trade Shocks													0.0630	0.0217	0.0414
													(1.84)*	(1.32)	(1.56)
Obs	418	418	418	416	416	416	438	438	438	367	367	367	416	416	416
R2	0.22	0.25	0.25	0.24	0.20	0.29	0.25	0.22	0.29	0.22	0.21	0.30	0.30	0.21	0.26

t-statistics in parentheses
Year controls not shown
** Significant at 5 percent level; * Significant at 10 percent level

Table 9: Sensitivity Effects*

	TFP-effect / FACTOR-effect
Policies	
Education	0.852
Life Expectancy	0.413
Openness	1.132
Imports of Machinery and Equipment	1.485
Credit to Private Sector	0.660
Government Consumption	--
Inflation	8.933
Black Market Premium	1.307
Institutions	
First Principal Components of ICRG	14.000
External Factors	
Terms of Trade Shocks	1.908

*Calculated as the ratio of the estimated coefficient from the TFP regression over the estimated coefficient from the FACTOR regression. See table 8

Table 10: Multivariate Regression Analysis

	GDPPC	FACTOR	TFP
Log of Initial GDPPC	-0.0146	-0.0086	-0.0060
	(3.49)**	(4.45)**	(1.77)*
Cyclical Reversion	-0.1077	0.0064	-0.1141
	(2.47)**	(6.75)**	(6.89)**
Policies			
Education	0.0030	0.0022	0.0008
	(0.94)	(1.59)	(0.31)
Life Expectancy	0.0752	0.0557	0.0195
	(4.51)**	(7.23)**	(1.44)
Openness	0.0116	0.0038	0.0078
	(2.21)**	(1.55)	(1.82)*
Imports of Machinery and Equipment	-0.0013	0.0014	-0.0027
	(0.42)	(1.03)	(1.11)
Credit to Private Sector	-0.0016	0.0005	-0.0021
	(0.57)	(0.35)	(0.90)
Government Consumption	-0.0080	-0.0082	0.0002
	(1.64)*	(3.45)**	(0.05)
Inflation	-0.0117	-0.0004	-0.0113
	(2.08)**	(0.16)	(2.47)**
Black Market Premium	-0.0138	-0.0086	-0.0052
	(1.71)*	(2.29)**	(0.79)
Institutions			
First Principal Components of ICRG	0.0047	0.0007	0.0040
	(1.82)*	(0.57)	(1.93)*
External Factors			
Terms of Trade Shocks	0.0006	-0.0109	0.0115
	(0.02)	(0.72)	(0.43)
Obs	348	348	348
R2	0.35	0.43	0.35

t-statistics in parentheses
Year controls not shown
** Significant at 5 percent level; * Significant at 10 percent level

Appendix A : Groups of Countries and Data Sources

Groups of Countries:

Latin America and the Caribbean: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela.

Rest of the World: Australia, Austria, Belgium, Benin, Botswana, Cameroon, Canada, Cote d'Ivoire, Cyprus, Denmark, Egypt, Fiji, Finland, France, Germany, Ghana, Greece, Hong Kong, Hungary, Iceland, India, Ireland, Israel, Italy, Japan, Kenya, Korea, Madagascar, Malawi, Malaysia, Morocco, Netherlands, New Zealand, Norway, Pakistan, Papua New Guinea, Phillipines, Portugal, Senegal, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syria, Thailand, Togo, Tunisia, United Kingdom, United States, Zimbabwe.

Developed: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, United States.

East Asia: Hong Kong, Korea, Malaysia, Singapore, Thailand.

Data Sources:

GDP	Penn World Tables 5.6, Easterly and Levine (2001), and World Dev. Indicators
Capital	Penn World Tables 5.6, Easterly and Levine (2001), and World Dev. Indicators
Labor force	World Development Indicators
Years of education	Barro and Lee data base
Life expectancy	World Development Indicators
Openness	Authors construction using WDI data
Inflation	Global Development Finance and World Development Indicators
Black Market Permium	Easterly and Levine (2001)
Credit to private sector	World Development Indicators
Government consumption	World Development Indicators
Imports of machinery	UN Commodity Trade Statistics Database
Terms of Trade	Global Development Finance and World Development Indicators
Institutional variables	International Country Risk Guide (ICRG)

Appendix B: Measures of TFP

The labor and capital data employed in the growth accounting exercises of this paper refer to the inputs that are "available" in the marketplace rather than the inputs "effectively used" in the economy. In this Appendix we explain how this is consistent with a broad definition of total factor productivity. Consider the following production function:

$$(1) \qquad Y = K_u^{\alpha} \cdot (h_u \cdot L_u)^{1-\alpha} \cdot A_u$$

where K_u and $h_u L_u$ are the capital and labor inputs effectively utilized in the production process and A_u the corresponding observed productivity. Denoting the levels of available capital and labor inputs as K and hL respectively (L being unskilled labor and h its average skill level), we can use the following expressions:

$$K_u = K \cdot \frac{K_u}{K} \quad ; \quad L_u = L \cdot \frac{L_u}{L} \quad ; \quad h_u = h \cdot \frac{h_u}{h}$$

to rewrite equation (1) as follows:

$$(2) \qquad Y = \left(K \cdot \frac{K_u}{K} \right)^{\alpha} \cdot \left(h \cdot \frac{h_u}{h} \cdot L \cdot \frac{L_u}{L} \right)^{1-\alpha} \cdot A_u$$

In growth rates, equation (2) becomes:

$$(3) \qquad (\hat{Y}) = \alpha \cdot (\hat{K}) + \alpha \cdot \left(\widehat{\frac{K_u}{K}} \right) + (1-\alpha) \cdot (\hat{h}) + (1-\alpha) \cdot \left(\widehat{\frac{h_u}{h}} \right) + (1-\alpha) \cdot (\hat{L}) + (1-\alpha) \cdot \left(\widehat{\frac{L_u}{L}} \right) + (\hat{A}_u)$$

From this expression, it can be seen that the growth rate of output depends on the growth rate of the available inputs and skills $(\hat{K}), (\hat{L}), (\hat{h})$, the growth rate of the utilization of these inputs and skills $(\widehat{K_u / K}), (\widehat{L_u / L}), (\widehat{h_u / h})$, and the growth rate of productivity $(\hat{A}_u)$.

The productivity variable in this specification is not affected by changes in factor utilization rates. This productivity variable only reflects changes in aggregate "technology" springing either from changes in efficiency at the micro level or from changes in the efficiency of the overall economic environment in which the production takes place. We like to think about efficiency, however, in a broader sense, taking into account the additional output that would be obtained if available inputs that are not channeled into the production process were utilized. We view idle input resources as a form of inefficiency and want to measure it accordingly. To achieve this, we want to measure total factor productivity relative to potential output under full utilization of inputs available in the marketplace.

For example, consider two economies, A and B, with the same endowments and technology. Country A, however, exhibits a larger unemployment rate. We like to think country A as being less efficient than country B because it produces less with the same amount of available resources. Growth accounting exercises based on the amount of inputs used (rather than the amount of inputs available) will conclude that the productivity of both countries is the same, therefore, failing to capture this type of inefficiency. The productivity variable will only capture this inefficiency if the growth accounting exercises are based on the amount of inputs available. To see this, consider the following production function:

(4) $$Y = K^{\alpha} \cdot (h \cdot L)^{1-\alpha} \cdot A$$

Here, K and hL represent the levels of inputs of capital and labor "available" in the economy. Expressing equation (4) in growth terms and solving for the growth rate of productivity gives:

(5) $$\left(\hat{A}^*\right) = \left(\hat{Y}\right) - \alpha \cdot \left(\hat{K}\right) - (1-\alpha) \cdot \left(\hat{h}\right) - (1-\alpha) \cdot \left(\hat{L}\right)$$

Finally, using equation (3) to substitute for $\left(\hat{Y}\right)$ in this expressions gives:

(6) $$\left(\hat{A}\right) = \left(\hat{A}_u\right) + \alpha \cdot \left(\widehat{\frac{K_u}{K}}\right) + (1-\alpha) \cdot \left(\widehat{\frac{h_u}{h}}\right) + (1-\alpha) \cdot \left(\widehat{\frac{L_u}{L}}\right)$$

Expression (6) shows that the growth rate of productivity $\left(\hat{A}\right)$, depends on the growth rate of "technological" change $\left(\hat{A}_u\right)$, and the growth rates of factor utilization of capital $\left(\widehat{K_u / K}\right)$, labor$\left(\widehat{L_u / L}\right)$, and skills $\left(\widehat{h_u / h}\right)$. Therefore, for example, if an economy exhibits an increase in the rate of unemployment, that is $\left(\widehat{L_u / L}\right)$<0, this will be captured as a lower productivity growth $\left(\hat{A}\right)$.

Understandably, there are changes in the utilization of inputs along the economic cycle. Economies tend to use more or less inputs depending on which phase of the cycle they are. Therefore, it would be misleading to judge an economy as less efficient just because it is in a lower part of the cycle. The issue of factor utilization becomes important only if there are differences in long-run trends. Consequently, in our growth accounting exercises we use 10-year averages to smooth out changes in the utilization of inputs due to the cycle.

Following equation (6), we used data on employment and labor force to measure the size of the contribution of the utilization of labor $(1-\alpha)\cdot\left(\hat{L_u/L}\right)$, on the growth rate of productivity $\left(\hat{A}\right)$. We show that in general this contribution is rather small (see figure B.1). An immediate implication of the smallness of these contributions is that the results and conclusions of this paper, which is based on the analysis of decade averages, do not change qualitatively if we adjust for the rate of unemployment.

Figure B.1