

Peru: Markets, Government and the Sources of Growth

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Motivation

The recent history of most Latin American countries is tainted by sour reminders that “past times were better”, as the old saying goes. The last 50 years have been rather disappointing for many countries as they ended up in the turn of the century with almost the same income per-capita as in the early 50s. Peru has been no exception to the rule, as shown in one of Mario Vargas Llosa’s best known novels, when the main character poses himself the crucial question: When did Peru screw up?²

Actually, since the first half of the 1960’s, the Peruvian economy has moved back from being one of the most promising developing countries, both in terms of growth and social development, to a stagnated economy, which is struggling to find a new path of sustained growth.

It is true that the average income in Peru, in terms of Gross Domestic Product (GDP) per capita, was only one tenth of the same indicator in the United States during the first half of the 1960’s, a figure that is well below other Latin American countries like Argentina and Uruguay during the same period. However, this figure was equivalent to 45% of Japan’s GDP per capita and 3.5 times the same indicator in South Korea. In 1999, according to the World Bank’s Statistics, Peru’s average income was roughly 6% the GDP per capita in the United States and Japan, and 25% of the same indicator in South Korea. This means that while United States has grown 68% faster than Peru, in per capita terms, between 1965 and 1999, Japan and Korea did it 6 and 12.5 times faster, respectively.

The first question of this study is consequently what has gone wrong with the Peruvian economy during the last 40 years, in order to perform so badly. The Peruvian economy not only was unable to maintain the 3% yearly rate of growth of GDP per capita between 1950 and 1965 -somewhat above the Latin American average of 2.3%- but later it started a long period of decline, contracting at a yearly rate of 0.8% between 1966 and 1990. If Peru had only grown at the same pace with the world average, that is a yearly rate of 2%, GDP per capita at the end of the year 2000 would have been 90% higher than its actual level.

The second question is why a country like Peru, with a relatively large supply of natural resources (minerals, fishing, forests and fertile valleys in the coast), and a stock of human capital - which in 1960 was superior to most of the East Asian Countries -excepting Japan- has not been able to find its way towards a path of high and sustained growth, similar to that of other countries, specially in South Eastern Asia, in spite of having experimented with nearly the whole range of the world’s existing economic policies in market economies ?

Actually, Peruvian governments since 1960 have moved from an extremist view of the ECLAC’s recipes for protectionism and pro-Keynesian activist fiscal and monetary policies with General Velasco (1968-1975) and Garcia (1985-1990), to free trade and non activist policies with Belaunde (1980-1985) and Fujimori (1990-2000).

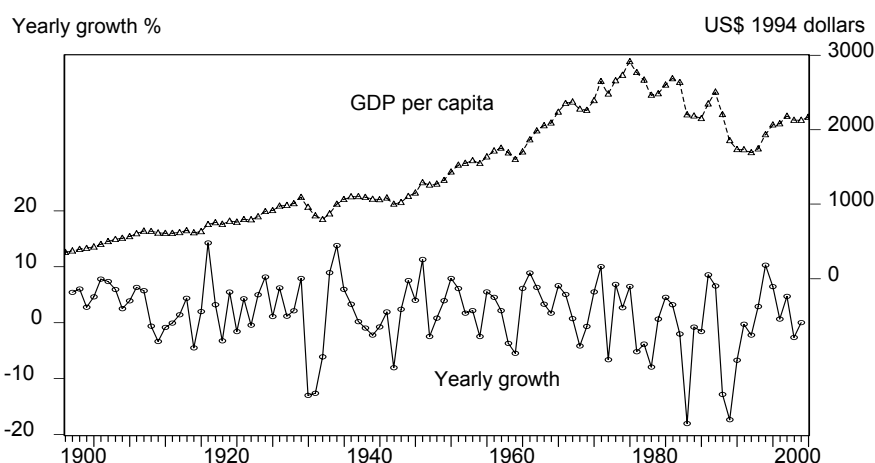
² ¿En qué momento se había se había jodido el Perú? Is the question posed by Zavalita in Mario Vargas Llosa’s *Conversación en la Catedral*, 1969.

One might think that a possible explanation of our first question comes exactly from the fact that he had endured an erratic economic policy orientation.

I. Empirical Regularities

According to the data for the 1896-1995 period, provided by Seminario and Beltrán (1998), and the extended data worked by Seminario (2001) until the year 2000, the Peruvian economy grew at a relatively stable pace between 1896 and 1965, which was only interrupted by brief periods of crisis during 1930-1933, 1942, 1947 and 1958-1959, due to foreign demand shocks (see Figure 1 below). The average yearly growth of GDP per capita was 2.7% for the whole 1896-1965 period. Even though, there was a slight increase in the growth pace, from 2.4% between 1896-1945, to 2.9% between 1946 and 1965.

Figure 1: Evolution of Peru's GDP Per Capita and Yearly Growth Rates 1896-1999



Since 1966 on the Peruvian economy began to decline, and the gradual slowdown in the rate of growth finally turned into a frank deterioration in the observed GDP per capita between 1976 and 1990. Actually, after growing at an average yearly rate of 1.5% between 1966-1975, GDP per capita declined at a yearly rate of -2.2 % between 1976-1990. During the whole 1966-1990 period, GDP per capita deteriorated at a yearly rate of 0.8%. Finally, in 1990 the Peruvian economy recovered from two decades of stagnation, and entered into a new path of sustained growth that ended with the financial crisis of 1998. Actually, GDP per capita grew at a yearly rate of 3.9% between 1991 and 1997, but this rate declined to only 0.3% between 1998 and 2000.

According to this brief account it seems that the Peruvian economy has gone through four stages during the twentieth century, as it is shown in Figure 2. The end of the Second World War, that is 1945, marks the close of a first period of moderated growth and the beginning of a second period with a much more vigorous economic activity, which ends during the first half of the 1960's. Afterwards we have a third period tainted with economic decay and high inflation, beginning in 1966 and ending

in 1990 and finally, a fourth period which main feature is the revival of economic growth.

**Figure 2: Stages in Peru's Economic Development
1896-2000**

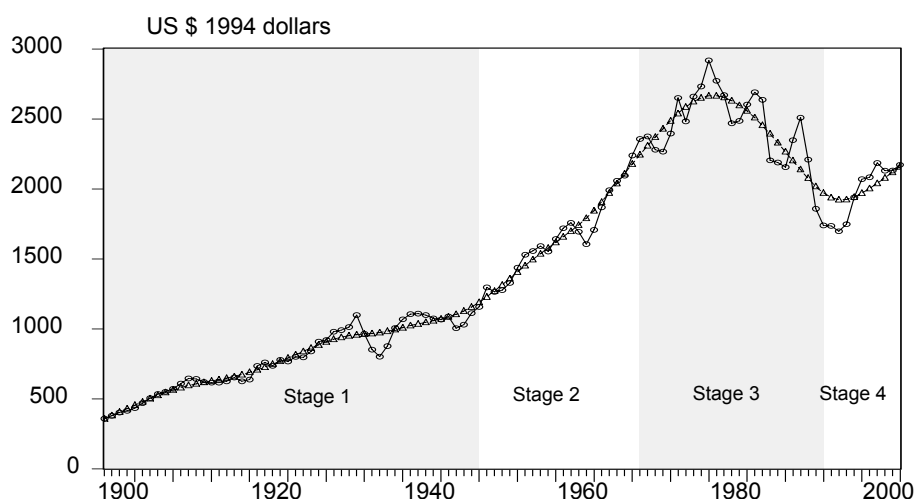


Table 1 contains a brief description of how the economy and the economic policies evolved since 1950, that is, when the Central Bank began to estimate the National Accounts. This table shows clearly a first phase of sustained economic growth between 1950 and 1965, which coincides with a period of free markets and export oriented economic policies, with a very small presence of the public sector in total consumption and investment. These are the policies that distinguished the Odría's and Prado's governments, as well as the Junta Militar that ruled Peru between 1962 and 1963. The figures on Table 1 show a growing ratio of exports to GDP, a relatively high ratio of investment (which however started to decline somewhere between 1961-1965), low fiscal deficit and a high private sector share in total investment. Actually, GDP per capita during this period grew at an average yearly rate of 2.8% and the annual inflation was around 10%, one of the lowest rates for Latin America in those times.

**Table 1:
Main Macroeconomic Indicators of the Peruvian Economy 1951-2000**

Periods	GDP per capita	Exports/GDP	Gross Fixed Investment/GDP	Private Sector Share in Gross Fixed Investment	Fiscal Superavit (Deficit)/GDP	Inflation Rate (yearly average)
1951-1955	3.02	11.58	21.32	77.52	0.48	9.36
1956-1960	2.59	13.25	20.79	79.18	-0.43	10.76
1961-1965	2.88	14.75	18.14	73.66	-0.74	11.28
1966-1968	-0.74	13.86	17.58	63.05	-2.30	14.48
1969-1975	2.28	11.62	18.37	56.44	-2.52	11.28
1978-1980	0.20	11.88	18.71	64.41	-3.91	55.29
1981-1985	-3.59	12.15	19.55	68.39	-4.10	111.99
1986-1990	-6.55	10.12	16.34	77.96	-5.53	1294.43
1991-1995	4.51	12.27	19.56	77.68	-3.30	37.22
1996-2000	0.77	14.90	22.35	80.42	-1.83	5.73

In 1966 the Peruvian economy entered into a second phase, which this time corresponds to a general economic decline that will last during the following 24 years. This phase coincides with a new succession of governments with interventionist and protectionist economic policies, beginning with Belaunde's first term in 1963 and ending with García in 1990. In spite of the fact that Belaunde's populist measures started in 1963 its consequences were visible only in 1966, when the high fiscal deficit and balance of payment deficit obliged the Central Bank to announce a 45% devaluation in 1967. Belaunde was overthrown in 1968 by a socialist oriented Military Junta, conducted by General Velasco, which intended to replace the private sector with State Owned Enterprises, as well as Cooperatives and other kinds of labor managed enterprises.

Velasco's pressures to complete his program of reforms led the economy to a profound economic crisis tainted with huge deficits in the balance of payments and the fiscal budget. It is worthwhile to mention that during this period most foreign firms were nationalized, private capital was banned from the agriculture and fishing sectors, as well as in the public utilities sector. Most foodstuffs were subjected to price controls, and severe restrictions were applied to the foreign exchange market and foreign trade. The subsequent economic crisis incited an internal rebellion conducted by General Morales Bermudez, who finally replaced Velasco in 1975. Morales Bermudez's government did as much as possible to remedy the huge economic imbalances inherited from the Velasco's administration. However, the new administration reforms were restricted to the macroeconomic sphere, and the whole range of microeconomic distortions affecting the incentives to save and invest, were left almost untouched.

Table 1 shows the decline of private sector share in total investment between 1966 and 1980, and how this ratio struck against the bottom during 1969-1975 which corresponds to Velasco's administration. It is also between 1966 and 1980 that the ratio of exports to GDP suffers a strong deterioration, and the same happens with the fiscal budget. It is not surprising to see how GDP per capita remained stationary during the second half of the 1970's while the inflation rate was climbing relentlessly.

The Peruvian economy was not only unable to recover during the 1980's but finally plunged into her worst crisis during the twentieth century. Actually, the Belaunde's second term administration introduced some adjustments such as the liberalization of the current account and the capital account, and the elimination of price controls. However, his administration was not able to privatize the huge State Owned Enterprise sector and to eliminate the job stability laws and other regulations affecting the incentives to invest. The few reforms introduced by Belaunde were dismantled by García, who in 1985 tried to resuscitate the spirit of the Velasco's government. It goes without saying that García's administration ended with a colossal fiscal deficit, which reached 8% of total GDP between 1987 and the first half of 1990³ and an impressive inflation rate which was above 1,000% during three consecutive years (1988, 1989 and 1990). The ratio of exports to total GDP plummeted to its lowest level and GDP

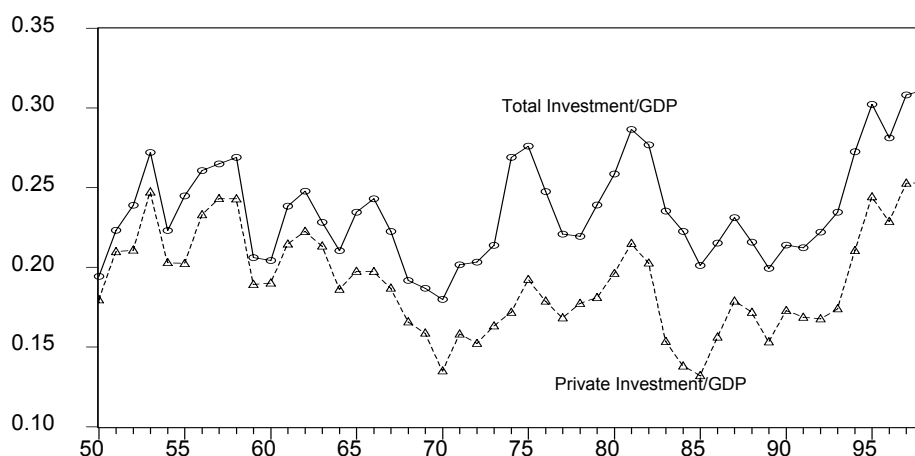
³ This figure refers to the deficit of the whole public sector, that is Central Government (including Social Security and municipalities) and State Owned Enterprises.

per capita, which had already declined at a yearly rate of 3.6% during the Belaunde's administration, fell at a stronger rate of 6.6% during Garcia's tenure.

In 1990 a new phase of economic growth begins, with the reforms implemented by the new administration conducted by President Fujimori. These reforms did away with practically all the obstacles to private investment that had been introduced during the Velasco and Garcia administrations. A vast privatization program was implemented along with a redefinition of the intervention of the public sector in the Peruvian economy. Table 1 show how the ratio of exports to GDP increases during this period, and the same happens with the Investment ratio and the share of the private sector in total investment, while fiscal deficit and inflation decline dramatically. As a consequence of these reforms, the Peruvian economy was able to enter into a new path of sustained economic growth, growing at a yearly rate of 3.9% between 1991 and 1997. This blissful period ended in 1998 when the international financial crisis showed there were still some urgent reforms to be implemented.

Now that we know when the Peruvian economy did screw up, let's try to see why it happened. Fernandez-Baca and Seinfeld (1995) estimated a Solow's neutral progress model for the Peruvian economy and found that one third of the 2.8% percent of average growth of GDP per capita between 1950 and 1968 was explained by the accumulation of physical capital, while the remaining two thirds were explained by technological progress. On the contrary, there was a negative technological progress during the following 22 years, that is between 1969-1990, with a yearly decay of -1.5% in the total factor productivity that explains the decline in GDP per capita at a yearly rate of -1.2%. Quite surprisingly, the capital-output ratio (K/Y) showed a slight increase from 2.8 to 3.1 during the first period 1950- 1968 and it almost doubled, during the second period (1968-1990), going up from 3.1 to 5.9.

**Figure 3: Total and Private Investment as Percentage of GDP
Peru 1950-1998**



In spite of all the criticism that have been addressed to Solow's model this naïve calculation shows that something wrong has happened with an economy where the total capital stock increased two times faster than gross domestic product. This phenomenon seems to be connected with the decay of private investment that started

in the second half of the 1960's which was temporarily reverted in the second half of the 1970's and was definitively overcome in the 1990's. As it can be seen in Figure 3, total investment as a percentage of GDP increased during the 1970's, while private investment declined. It was only in the 1990's that the ratio of private investment to GDP recovered the levels it had attained during the 1950's and the first half of the 1960's.

This contrast between the evolution of private and total investment is explained by the growth of public investment, due to the expansion of the sector of state owned enterprises.

**Figure 4: Private Investment as a Percentage of Total Investment
Peru 1950-1998**

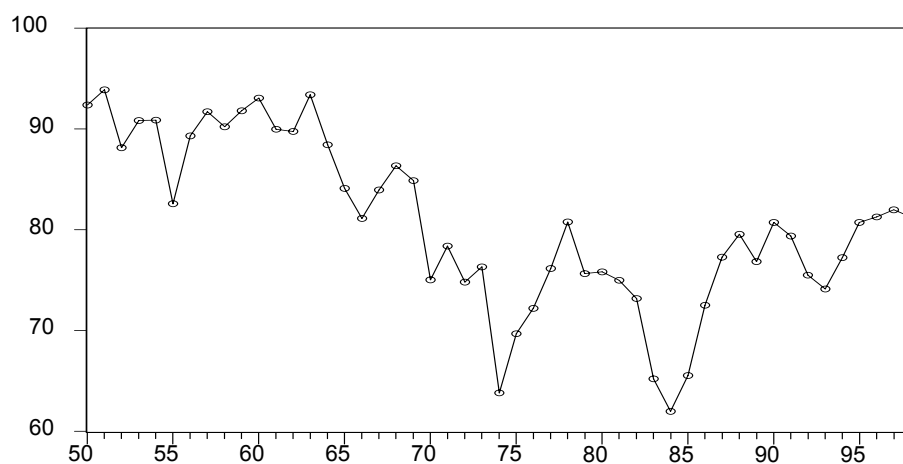


Figure 4 shows that between 1950 and 1965 private investment accounted for nearly 90% of total investment. The relative importance of private investment began to decline during the second half of the 1960's reaching a floor of 63% in 1974, and after a temporary recovery between 1975 and 1978 it definitively found a new stable level in the 1990's of around 80%

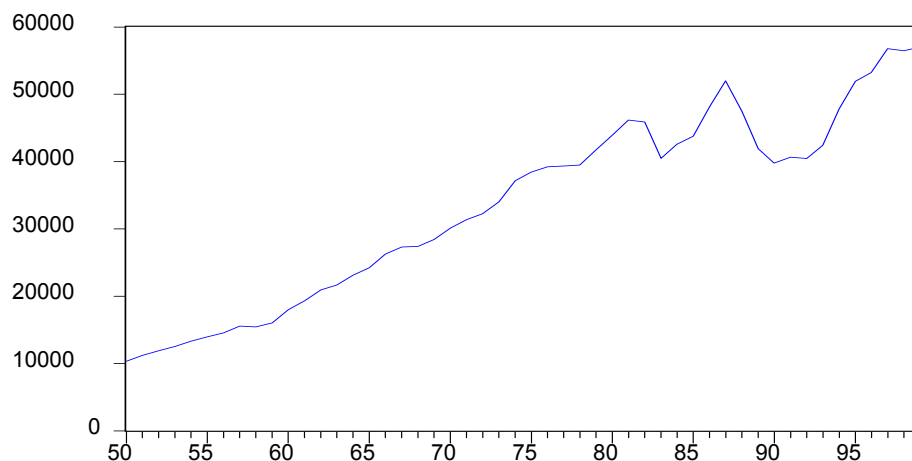
II. Data and Methodology

The data that we used in this study come from three main sources: (a) the World Bank Economic Growth Database (WB), (b) the Central Bank of Peru (BCRP), (c) the National Institute of Statistics (INEI). A fourth source was private estimations constructed by Arlette Beltrán and Bruno Seminario (BS) from Universidad del Pacifico. In this section we want to highlight the process of constructing the main variables used in the growth accounting exercise. All variables are expressed in 1995 dollars and cover the period from 1950 to 1999.

GDP

We constructed a GDP series expressed in 1995 dollars using the data provided by the Central Bank. In this case we work with the BCRP data that is expressed in 1994 soles, as the BCRP series are the only ones that include the estimates using the new 1994 base.

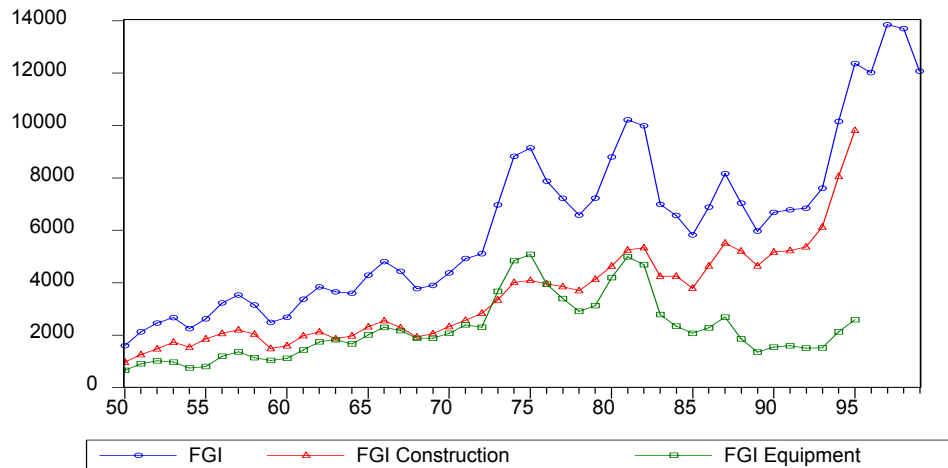
**Figure 5: Gross Domestic Product
US \$millions**



Fixed Gross Investment

As before, we used data from the BCRP. However, the first observations came from INEI as the other series was incomplete. We disaggregate this data in (a) construction and (b) machinery and equipment. The shares of this two types of investment as a percentage of GDP were similar in the WB and BS databases, but the level of GDP was overestimated. So, we adjusted the series according to the new GDP series that we constructed.

**Figure 6: Fixed Gross Investment
US\$ millions**



Capital Stock

One major hurdle was the lack of an official series of capital stock for Peru. Nehru and Dhareshwar (1993) estimated a capital stock series, which was later updated by Bonilla and Calvo (1998) and Fajnzylber and Lederman (1999). However, the three studies constructed capital stock series using an inadequate fixed investment series, rendering an overestimated capital stock.

We constructed an estimate using the method described in Nehru and Dhareshwar (1993) applied to our fixed gross investment series. The capital stock is estimated using the perpetual inventory method:

$$K_t = (1 - \delta)^t \cdot K_0 + \sum_{i=0}^{t-1} (1 - \delta)^i I_{t-i} \quad (1.)$$

where: δ is the depreciation rate
 K_0 is the initial capital stock.

We used a depreciation rate of 6% for machinery and equipment and 3.5% for construction⁴. The overall depreciation rate is 4.5%. These depreciation rates are within the limits of previous studies that go from 2.5% in Seminario and Beltrán (1998) up to 7% in Vallejos and Valdivia (1999).

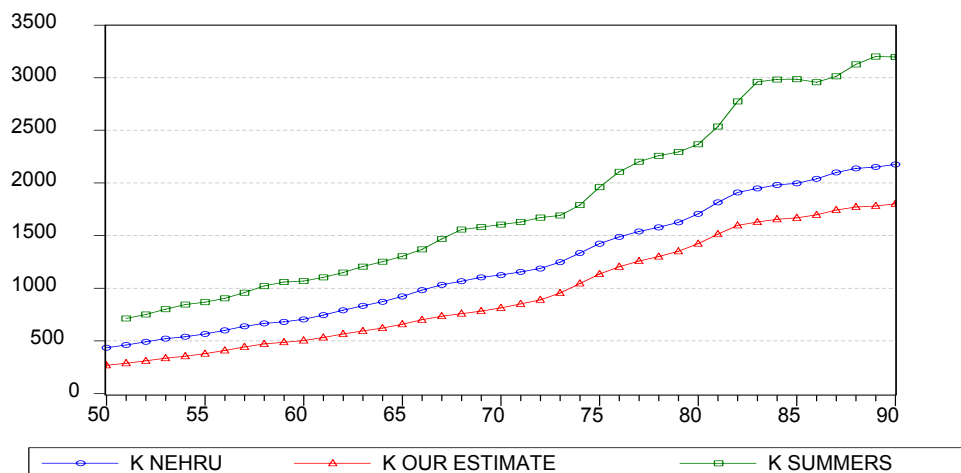
Our estimate for the initial capital stock came from the fact that in the steady state of the Solow growth model $K_0 = I_1 / (g + \delta)$, where g is the GDP growth rate.⁵ The level of the initial capital stock does not bias the final result as once one move back enough in history (1900) the effect of the initial capital stock in the current capital stock is almost negligible.

⁴ These rates imply a lifetime of 28.5 (16.66) years for construction (machinery and equipment). The disaggregated data on investment in machinery and equipment and construction is only available up to 1994.

⁵ See Barro and Sala-I-Martin (1995) for a thorough explanation.

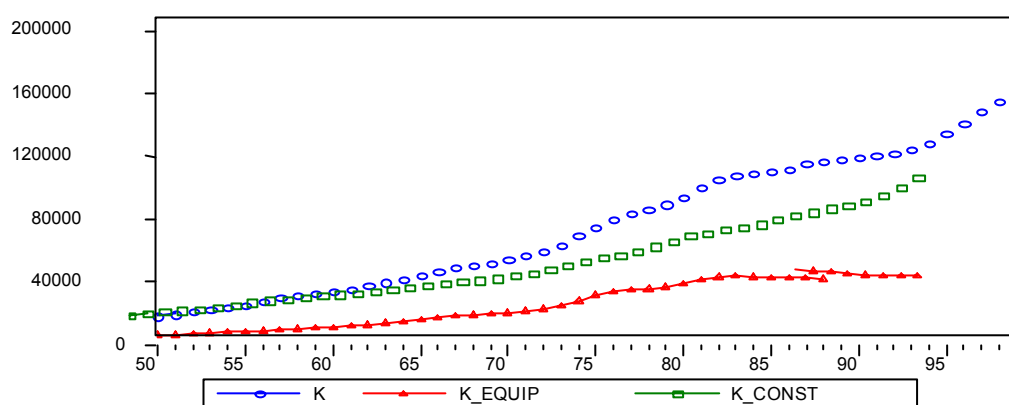
In Figure 7 we compare our estimated capital stock series with the Nehru and Summers and Heston data. Our estimates are in line with a recent study of IPE (2001) which also used the series with the new 1994 base.

Figure 7: Capital Stock Series



To shed some more light on what has happened with the capital stock series we present estimates of machinery, and equipment and construction (see Figure 8). Both components had a similar trend up to the 1980s. Since then, the capital in machinery and equipment has fallen while the trend in construction has been steeper. This could be explained by a larger commitment of the governments to public infrastructure (roads, schools, housing projects, etc) and by a real estate boom in the 1990s.

Figure 8: Our Disaggregated Capital Stock Series
US \$ millions

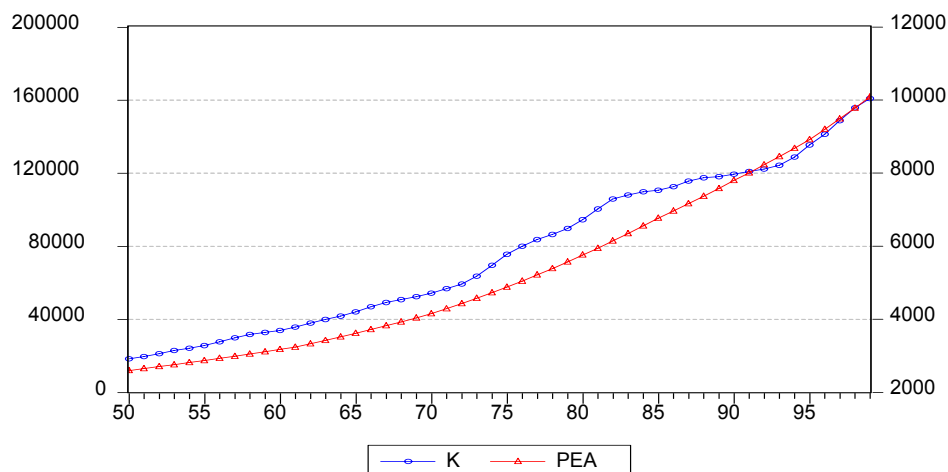


Labor Force

Due to lack of information of hours worked, we had to choose between the economically active population (PEA) and the number of workers, the difference between these two series is the unemployed population. Although the number of workers is a more adequate approximation of the number of hours worked, the official

series is only available for the last decade. Therefore, we chose to use the PEA that is available for the whole sample with a greater degree of accuracy.

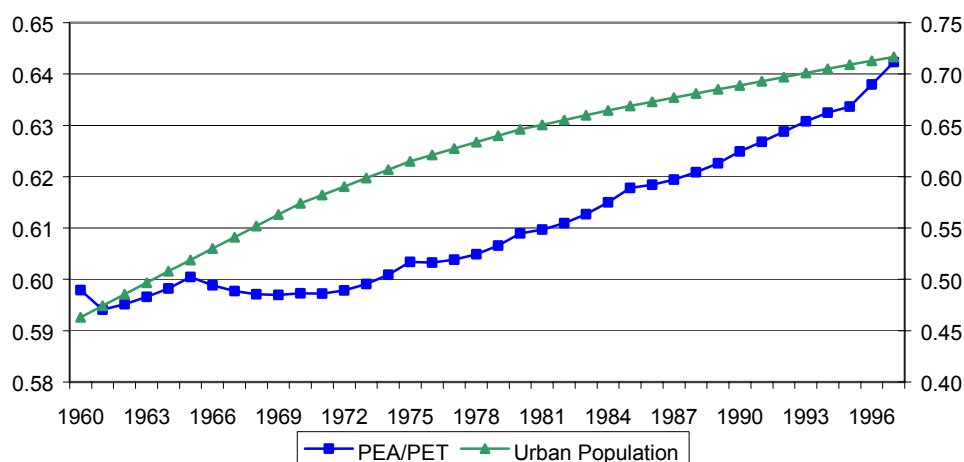
Figure 9: Labor Force and Capital Stock



During the last 50 years, the average growth rate of the PEA was 2.8% (see Figure 9). The rapid growth of the PEA is not only explained by an increase in the population but also by a steady increase in the labor participation ratio since 1960 (see Figure 10). There are two factors interplaying.

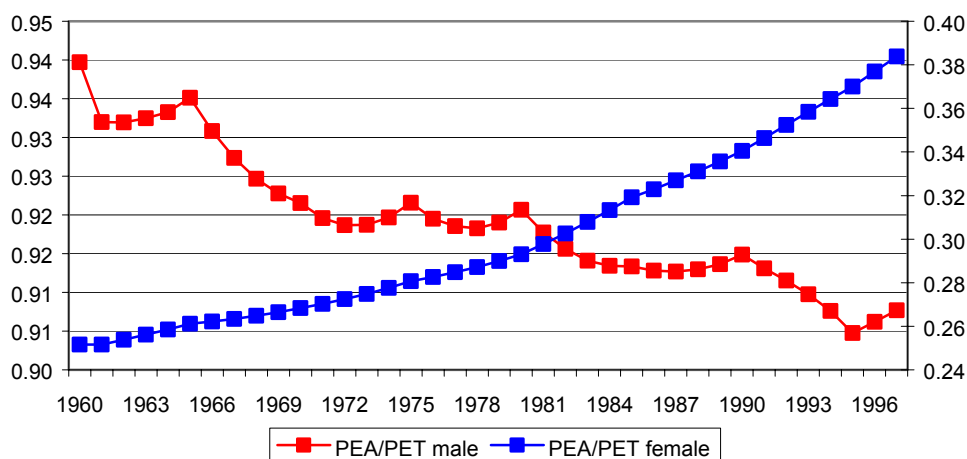
The first driving force behind the increase in the labor participation ratio was the sustained migration toward urban areas. The migration towards main cities was promoted by General Velasco during the early 70s and reinforced by the low returns on the agricultural activities after the failed agrarian reform implemented in the late 60s. Once the rural population moved to urban areas it was forced to seek market activities to earn a living.

Figure 10: Labor Participation Ratio and Urban/Rural



The second driving force has been the steady growth of the female participation ratio (see Figure 11). This could be explained by both the need to earn a market wage once they moved from the rural area to the city and the increase in the job opportunities available for women. This second factor has outweighed the first one since the 80s.

Figure 11: Labor participation rates by gender



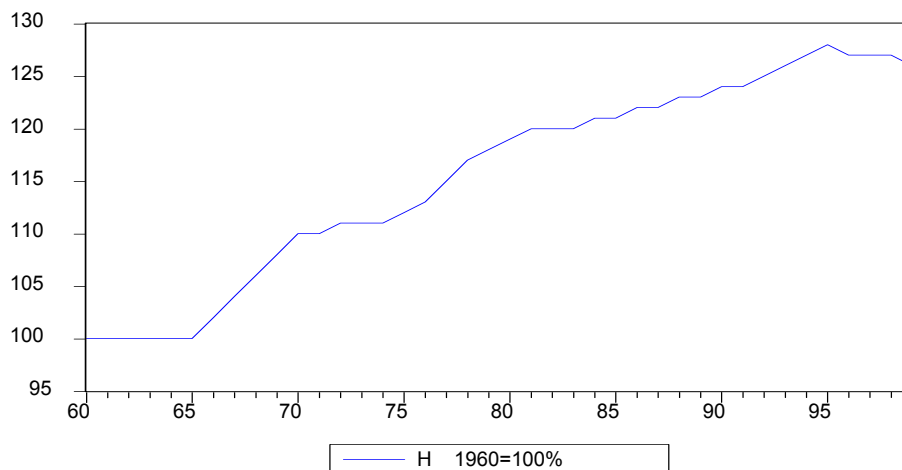
One additional fact that calls for an explanation is the small variability of the labor input compared to capital (see Figure 9). The hours-worked series could fluctuate because firms adjust in the intensive and/or the extensive margin. They could add an additional shift in the midst of an expansion hiring more workers or just asking their former workers to add some extra-hours. We only observe small fluctuations in the extensive margin, but we cannot infer from that what has happened in the intensive margin. Furthermore, that information is inconclusive as most of the transitions in the labor market are from employment to under-employment rather than to unemployment.

One would have used the unemployment rate to adjust the PEA, but this would not have almost any impact. In Peru, the unemployment rate is quite stable, as in its calculation all the informal workers are not accounted as unemployed workers. So, most of the cyclical variation in the employment could be explained as movement from formal to informal jobs. In line with the lack of detailed data on labor markets, a separate measure of formal and informal workers is only available for the last 5 years, thus we will use the PEA figures.

Human Capital

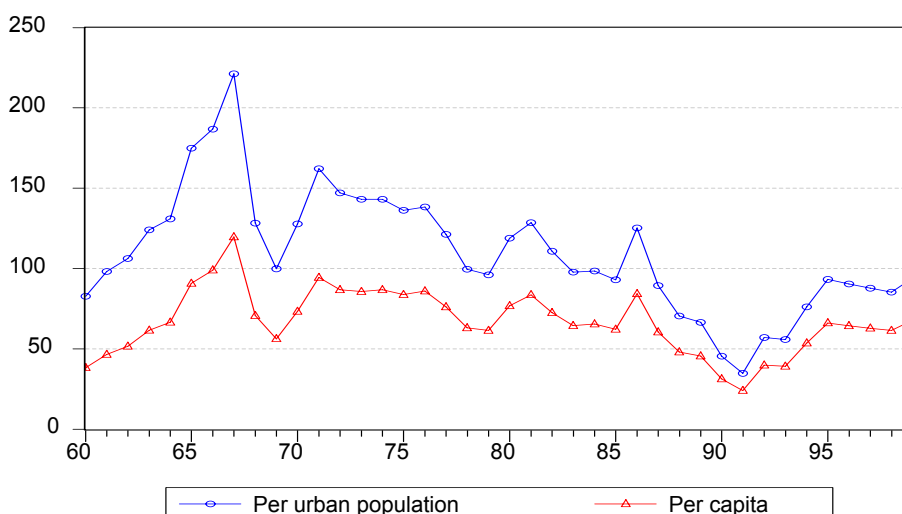
There are two ways to measure the quality of the labor force. A first method follows Barro and Lee (2000) and consists of adjusting the labor force using the average years of schooling. The second method used by Barro and Lee (2000) is to adjust using the average wage by educational level. In our case, we could not use the second method as we only have 10 years of available data at that level of disaggregation. Even though, we have information of the composition of the population older than 15 years (similar to the PEA) by education attainment level and the years of average schooling for each of these levels and by gender. So, we turned to the first method and compute an index of average years of schooling of the labor force.

Figure 12: Human Capital Quality Index



The first thing to notice is the decreasing growth rate of the human capital index along the last 40 years. Moreover, in the last five years, the index fell down for the first time. This fact should not come as a surprise as the educational expenditure per capita has shown a decreasing trend since the late 60s. Only in the 1990s this trend was reversed but surprisingly coincides with the period of a fall in the human capital index.

Figure 13: Education Expenditure per capita



III. Description of Growth Accounting Exercise

A standard growth accounting exercise is performed to identify periods in which factor accumulation has been low and periods in which TFP growth has been low. From this analysis we could try to find some alternative answers within the context of a neoclassical growth model.

Production function

Consider that the production of an economy can be represented by a Cobb-Douglas production function. Let Y_t denotes the output level, A_t the technological parameter, K_t the stock of physical capital, H_t the quality of human capital, L_t the employment and α (which is constant) the share of capital in the total production, and assume constant returns to scale. Then:

$$Y_t = A_t K_t^\alpha (H_t L_t)^{1-\alpha} \quad \text{where } 0 < \alpha < 1 \quad (2.)$$

Taking logs and differentiating with respect to time we have:

$$g_y = g_A + \alpha g_K + (1 - \alpha)(g_H + g_L) \quad (3.)$$

where g_x is the growth rate of variable x . In order to have an estimate of TFP growth we express the previous equation in the following form:

$$g_A = g_y - \alpha g_K - (1 - \alpha)(g_H + g_L) \quad (4.)$$

Clearly, we first need an estimate of the share of capital to obtain the desired result.

Estimation of α

There are two alternative methods to estimate the share of capital. The first method is to calculate α from the national income accounts computing the ratio of the capital income plus depreciation with respect to the GDP. The problem with this method is that the data provided by INEI does not seem to be much reliable. According to INEI's National Accounts, the capital share had a surprisingly stable value of 0.33 between 1950 and 1977. However, since 1978 the capital share has shown a steady growth reaching a value of 0.55 in 1994, the last year for which this statistics was calculated. Given that the capital-labor ratio has not increased since 1978, but it has actually decreased since 1983, we can presume that this upsurge in the capital share is the consequence of a change in INEI's methodology of calculation rather than a modification in the way capital and labor are combined. An independent estimation carried on by IPE (2001) obtained a capital share of 0.64 for the 1991-1999 sample.

A second method is to estimate the production function considering it as a long term relationship among GDP, physical capital and labor. For this estimation we need to

assume that we are at the steady state and therefore the TFP is constant. Without lack of generality we can normalize it to one.

As all series were I(1) we used Johansen and Juselius (1988) cointegration method to find an estimate of α ⁶. Table 2 reports that we encounter a single cointegration vector with an estimate of $\alpha=0.441$. However, the results are not robust to sample changes and therefore we will perform the growth accounting exercise with this estimation and with the typical value for $\alpha=1/3$. Our estimated values for α lie below previous calculations as reported in Table 3.

Table 2: Cointegration with 1 type of capital

Series: LOGY LOGK LOGL				
Sample(adjusted): 1952 1999				
Unrestricted Cointegration Rank Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	
			5 Percent	1 Percent
None **	0.454990	46.12138	34.91	41.07
At most 1	0.220115	16.98769	19.96	24.60
At most 2	0.099946	5.054439	9.24	12.97
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value	
			5 Percent	1 Percent
None **	0.454990	29.13370	22.00	26.81
At most 1	0.220115	11.93325	15.67	20.20
At most 2	0.099946	5.054439	9.24	12.97
Normalized cointegrating coefficients (std.err. in parentheses)				
LOGY	LOGK	LOGL	C	
1.000000	-0.441153 (0.16525)	-0.156686 (0.20894)	-3.233907 (0.33044)	
Log likelihood	493.4480			

*(**) denotes rejection of the hypothesis at 5% (1%) significance level

Table 3: Estimations of α in previous studies

Studies	α	Estimation Method
Vega-Centeno (1989)	0.55	
Vega-Centeno (1997)	0.65	From Elías (1993)
Seminario and Beltrán (1998)	0.40	Johansen-Juselius, Stock & Watson
Calvo and Bonilla (1998)	0.76 and 0.71	Johansen-Juselius
Vallejos and Valdivia (1999)	0.69	
IPE (2001)	0.64	Johansen-Juselius

⁶ An alternative method used in the literature is to use OLS estimates of the production function. The problem with this method is that does not take into account the potential endogeneity bias that will affect the estimate of α . Moreover, an OLS estimate does not use the long term relationship that might be present in the data as one would expect.

Estimating the TFP growth

Once all the variables involved in the calculation of TFP growth were computed, we performed several growth accounting exercises. First we present baseline estimates that we correct for the quality of the labor force, and then we use a disaggregation of capital stock.

In Table 4 we report the average growth rates for the five decades since 1950 of GDP, total capital stock (and its components) and the labor force. It is remarkable the decline in the GDP growth rate until the 90s, when a new period of rapid growth began, but at a much slower pace than in the 50s or 60s.

**Table 4: Output, capital and labor
Average growth rates (%)**

	GDP	Capital	Machinery and Equipment	Construction	Labor
1951-1960	5.74	6.42	6.23	6.47	2.04
1961-1970	5.33	4.85	6.38	3.98	2.73
1971-1980	3.89	5.73	6.61	5.00	3.33
1981-1990	-0.68	2.39	0.32	3.65	3.09
1991-1999	4.17	3.38	-1.17*	4.44*	2.90
1950-1999	3.66	4.54	3.62	4.70	2.82
1960-1999	3.15	4.08	2.98	4.27	3.01

(*) Average for 1991-1995.

In Table 5 we show the results of TFP growth using the simplest case. Surprisingly, the TFP declined within the 1970s and 1980s, and only recovered in the 1990s. Moreover, the average TFP growth for the last 50 years has been almost zero, with a marked decline in the 1980s that was only partially recovered in the 1990s.

**Table 5: TFP baseline model
Average growth rates (%)**

	GDP	Contribution of		
		Capital	Labor	TFP
1951-1960	5.74	2.83	1.14	1.77
1961-1970	5.33	2.14	1.53	1.66
1971-1980	3.89	2.53	1.86	-0.50
1981-1990	-0.68	1.06	1.73	-3.47
1991-1999	4.17	1.49	1.62	1.06
1950-1999	3.66	2.01	1.58	0.08
1960-1999	3.15	1.80	1.68	-0.33

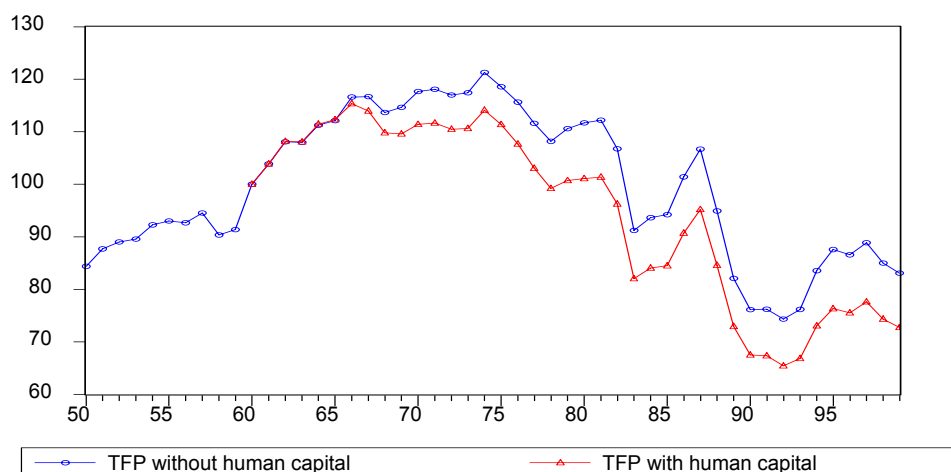
Once we did the correction of the labor force using a human capital index we found in Table 6 that the new TFP growth rates are smaller than before. The main difference is that when we account for the human capital accumulation, the contribution of the labor factor is greater. The net contribution of education is 0.34% of higher annual GDP growth.

Table 6: TFP with human capital
Average growth rates (%)

	GDP	Contribution of		
		Capital	Human Capital	TFP
1961-1970	5.33	2.14	2.07	1.11
1971-1980	3.89	2.53	2.30	-0.94
1981-1990	-0.68	1.06	1.92	-3.66
1991-1999	4.17	1.49	1.77	0.91
1960-1999	3.15	1.80	2.02	-0.66

But the most striking feature is the downward trend of TFP, since the late 1960s that we observe in Figure 14. One simple question is how we explain why TFP falls. This comes as shocking as we are accustomed to think about TFP as the extra gain in output that we can get from inputs due to how we combine them. So, for example, if we improve our technical skills we will get more output with the same inputs. Latin America is a region in which technical progress comes from importing technology or training our labor force with new skills. The number of patents is almost insignificant. Maybe a plausible explanation of TFP falls is an overwhelming mismatch of job skills and job characteristics. Another reason that may reinforce the first factor is that the agrarian reform of the late 1960s provoked a large decline in productivity and profitability in a country in which half of the PEA worked in the agricultural sector by that time. However, the fall is too steep and calls for an additional explanation.

Figure 14: Total Factor Productivity
Using Total Physical Capital



Given that these numbers were very suspicious, we tried alternative calculations to test the robustness of our initial results. We report in Table 7 these alternative estimations. The first two columns are our baseline estimations with and without including the effect of human capital in the labor factor. A first set of alternative calculations is to disaggregate two types of physical capital: machinery and equipment and construction. Another set comes from using a more typical value for the share of physical capital ($\alpha=0.33$) for all the possibilities. The basic message that comes out of these calculations is that our initial results hold.

Table 7: Alternative TFP calculations
Average growth rates (%)

	$\alpha=0.44$				$\alpha=0.33$			
	One Type of K		Two Types of K		One Type of K		Two Types of K	
	No H	H	no H	H	no H	H	no H	H
1951-1960	1.77	NA	1.78	NA	2.24	NA	2.25	NA
1961-1970	1.66	1.11	1.67	1.12	1.89	1.24	1.90	1.24
1971-1980	-0.50	-0.94	-0.43	-0.87	-0.24	-0.77	-0.19	-0.72
1981-1990	-3.47	-3.66	-3.50	-3.70	-3.54	-3.78	-3.56	-3.80
1991-1999	1.06	0.91	2.98*	2.62*	1.11	0.93	2.95*	2.52*
1950-1999	0.08	NA	0.47	NA	0.27	NA	0.64	NA
1960-1999	-0.33	-0.66	0.15	-0.24	-0.22	-0.62	0.24	-0.22

(*) Average for 1991-1995.

In addition to these results, we present in Table 8 previous estimates of TFP that have been done for Peru. As we can see our estimates are not that far from previous calculations.

Table 8: Previous estimations of TFP
Average growth rates (%)

Period	Vega-Centeno (1989)	Fernández-Baca & Seinfeld (1995)	Vega-Centeno (1997)	Seminario and Beltrán (1998)	Calvo and Bonilla (1998)	Vallejos and Valdivia (1999)	IPE (2001)
1950-1959	1.5	1.6	1.1	1.0		2.7	1.5 ⁽⁷⁾
1960-1969	2.0	1.3	1.3	2.5		1.7	1.4 ⁽⁸⁾
1970-1975	2.1	1.4	-0.6	1.8		-0.6 ⁽⁴⁾	-0.8 ⁽⁹⁾
1976-1980	0.0	-1.7	-1.0	-1.3			
1981-1985	-1.3	-3.9	-1.4	-3.6		-4.0 ⁽⁵⁾	-3.9 ⁽¹⁰⁾
1986-1990	1.89 ⁽¹⁾	-7.3	-3.4	-3.7			
1991-1995			-0.4 ⁽²⁾	3.4	1.8 ⁽³⁾	1.8 ⁽⁶⁾	1.0 ⁽¹¹⁾
1996-2000							
Total 1950-2000							-0.1

(1)1986-88; (2)1991-96; (3)1993-1996; (4)1970-80; (5)1980-90; (6)1991-98; (7)1951-60; (8)1961-70; (9)1971-80; (10)1981-90; (11)1991-00

One crucial similarity lies across all these estimations: Peru has endured long periods in which TFP growth has been negative. Basically since the early 1970s the TFP has been coming down steadily with two brief periods of TFP growth. Of course, it is hard to imagine how an economy could manage to destroy knowledge or go backwards in terms of technical progress. Thus, we did an additional exercise along the line of work of Pritchett in which TFP cannot fall.

IV. TFP à la Pritchett

Pritchett (1997, 1999) argues that the typical way of computing a measure of public capital stock may not allow us to reflect the true value of the public capital stock. All the empirical studies on economic growth calculate the capital stock as the cumulated and depreciated present value of investment flows. However, it is hard to believe that in the great majority of developing countries the government's cost of investment coincides with the true value of public capital. This point is crucial if we are convinced that the actual explanation for slow growth is that government investment did not create productive capital, instead of arguing that government investment was too small.

Therefore, we may find that even though public capital could represent a sizeable positive externality to private capital, it may be very difficult to create this kind of capital in the public sector. This could be one of the main reasons why concessions of public infrastructure should be fostered instead of expecting that government will do the job.

Pritchett suggests a method to approximate the size of the distortion between the cost of investment and the value of capital. The method consists of three steps:

Step 1: Calculate the growth of TFP as in the traditional growth accounting exercise.

Step 2: Assume that "true" TFP growth available for the country could be anything between $[0,1]$. Zero is an obvious lower bound as negative TFP growth is hard to justify, and 1% is the average in the OECD countries. This assumption may produce inconsistencies with the observed factor accumulation. We only report the results with the assumption of zero TFP growth as it is much closer to the observed TFP growth in Latin American countries.

Step 3: Scale back the rate of factor accumulation to be consistent with the observed rate of growth or output per worker and the assumed TFP. In this way we will have an estimate of the implied factor accumulation.

This exercise assumes that it is hard to imagine an economy with negative growth rates of TFP. How could an economy become less technologically able? How does an economy forget the knowledge accumulated through the years?

Pritchett suggests that a different explanation should come from the fact that economies are valuing investment without taking into account the quality (productivity) of that investment. One could think of all the "white elephants" that most of Latin American economies build in the 60s and 70s, or roads that do not withstand the first season of heavy rains. Therefore, a more compelling story is that reductions in TFP growth come from the fact that we are overvaluing investment, when the true was that there has been a lower capital accumulation.

The results reported in Table 9 below, assume that there is no contribution of human capital in the calculation of TFP growth, while those reported in Table 10 do include this factor's contribution.

Table 9: Results of Calculations of Actual and Implied Factor Accumulations

Adjusting just the physical capital stock without
educational capital in the TFP calculation

	Observed factor accumulation	Observed TFP (Solow)	TFP (Pritchett)	If TFP=0% Implied factor accumulation	Implied/ Observed (%)
1951-1955	6.98	1.98	1.98	6.98	100.00
1956-1960	5.87	1.56	2.52	3.69	62.85
1961-1965	5.41	2.33	2.35	5.36	99.06
1966-1970	4.30	1.00	1.51	3.14	73.03
1971-1975	6.86	0.17	0.80	5.42	78.98
1976-1980	4.59	-1.16	0.64	0.50	10.96
1981-1985	3.24	-3.13	0.75	-5.56	0.00
1986-1990	1.55	-3.80	2.56	-12.87	0.00
1991-1995	2.56	2.93	3.42	1.44	56.41
1996-1999	4.41	-1.28	0.67	0.01	0.15
1950-1999	4.58	0.09	1.74	0.83	48.14
1961-1999	4.11	-0.35	1.61	-0.33	39.82

Table 10: Results of Calculations of Actual and Implied Factor Accumulations

Adjusting just the physical capital stock with
educational capital in the TFP calculation

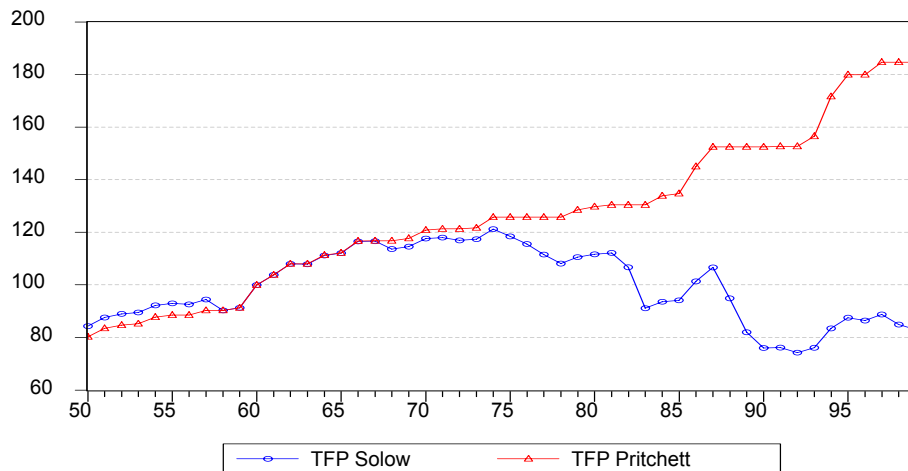
	Observed factor accumulation	Observed TFP (Solow)	TFP (Pritchett)	If TFP=0% Implied factor accumulation	Implied/ Observed (%)
1961-1965	5.41	2.36	2.38	5.36	99.06
1966-1970	4.30	-0.13	0.88	2.00	46.59
1971-1975	6.86	0.01	0.70	5.29	77.07
1976-1980	4.59	-1.89	0.38	-0.56	0.00
1981-1985	3.24	-3.32	0.65	-5.74	0.00
1986-1990	1.55	-4.01	2.47	-13.14	0.00
1991-1995	2.56	2.57	3.19	1.15	45.02
1996-1999	4.41	-1.17	0.70	0.19	4.21
1961-1999	4.11	-0.68	1.44	-0.70	38.25

A small ratio of implied to observed factor accumulation should be understood as an evidence that the “true” story of the economy was a poor investment decision instead of a deterioration in their technological progress. The evidence for Peru shows that the 1980s were a period in which most of the public investment was poorly allocated. Not far from that evidence are the late 1970s and the last 5 years of the Fujimori’s government.

As in our previous calculations, human capital improvement does not stand as a major factor explaining TFP growth. There is very little difference between the estimates of TFP with or without taking into account this factor.

In any case, if we took these results seriously and compare them with our previous estimates using the Solow model (see Figure 15) the difference is startling. By the late 60s the difference started to grow steadily. This coincides with the period of major public investment projects as the gas pipeline. The difference between these two TFP estimates is our measure of how inadequate had been public investment decisions in the past 40 years. It is hard to imagine that the entire decline is explained by adverse shocks, bad policies, or something along those lines.

Figure 15: TFP Solow vs. Pritchett



A final exercise was to suppose that the public investment was the major culprit. We assumed that it will depreciate fully in the first year. This is just a way to assume that public investment contribution to capital formation is slim. The results are basically the same as our previous exercise.⁷ The ratio of implied to observed factor accumulation was about 50% for the 1950-1999 period and 43% for the 1960-1999 period, compared to 48% and 40% reported in Table 9. This should not come as a surprise as the most likely candidate to overvalue investment is the public sector.

⁷ The detailed tables are not reported as the estimates were very similar, but are available upon request.

V. Explaining TFP growth

Even though the previous exercises allow us to have different measures of TFP growth it does not tell us which the main driving forces behind TFP growth are. However, we can think of competing stories. We would like to test which hypothesis is supported in the data. We followed Jadresic and Zahler (2000) and performed a similar exercise for the Peruvian data. Those authors suggested that one can think of three different hypotheses: the TFP growth is the consequence of (i) good policies, (ii) just plain good luck, or (iii) a good institutional stance. We may include a fourth one in which government policies are broken up into macroeconomic and social policies.

The econometric exercise consists of estimating an equation for TFP growth based on a list of variables that may encompass these four possible explanations.

$$TFP_t = \beta_0 + \beta_1 MF_t + \beta_2 EF_t + \beta_3 IF_t + \beta_4 SF_t + \varepsilon_t \quad (3)$$

Where MF, EF, IF, and SF are macro, external, institutional and social factors, respectively. Macroeconomic factors represent variables that capture the different macro policy decisions. Among the macroeconomic factors we might include the following variables: inflation rate, inflation variability, degree of openness, and access to external financing. For the last variable we used the ratio of foreign exchange reserves to imports.

An additional variable that we used -but we have to do some more work to enlarge the sample available for that series- is an structural reform index computed by Morley, Machado and Pettinato (1999) extending a previous work by Lora and Barrera (1997). The sample available for the series goes from 1970 to 1995. We planned to extend this series at least ten more years. We cannot use the simplifying assumption that there were no changes prior to 1970 as in the 1960s there were a major tax reform, a land reform, among other crucial changes.

We used the terms of trade and the real interest rate of the US economy to capture positive or negative shocks coming from abroad. We include two definitions of terms of trade that come from a recent work at the Peruvian Central Bank done by Tovar and Chuy (2000) in which an alternative index is computed instead of the standard Paasche index. In addition we control for foreign GDP growth using Latin American, US and World GDP growth as proxy variables. We linked external factors as “good or bad luck” shocks.

Another “good or bad luck” variable is the El Niño phenomenon that recurrently hits Peru. The phenomenon consists on a warming of the ocean which in turn provokes large changes in the weather conditions. In the coast, heavy rains typically affect infrastructure, crops and fishing, and in the southern part of the country, severe droughts disrupt all agricultural activities. Instead of using a dummy variable for the years in which the phenomena was intense we used the Southern Oscillation index computed by the US National Oceanic & Atmospheric Administration (NOAA). However, we compute the standard deviation of this index as our proxy given that the intensity of the phenomenon depends on the relative variability of the temperatures.

The institutional factors are represented by an index called Polity. This composite index has been taken from the Polity IV project directed by Marshall and Jaggers (2000) who update a database on political regime characteristics for several countries done by Jaggers and Gurr (1995) called Polity III. The Polity index combines two indexes AUTOC and DEMOC. The AUTOC index measures the degree of institutionalized autocracy whereas the DEMOC index measures the degree of institutionalized democracy. Both indexes are computed taking into account different aspects of five variables: (i) the competitiveness of executive recruitment, (ii) the openness of the executive recruitment, (iii) the constraints on chief executive, (iv) the regulation of participation, and (v) the competitiveness of participation.

In order to account for social factors we included government expenditure on education per capita, and we could have included school enrollment (especially tertiary education) or the life expectancy at birth.

In Figure 16 we show the time series of the most representing variables that we used in this econometric exercise.

Our interest is to understand the factors that explain the dynamic behavior of the TFP growth. Naturally, our first approach was to test for cointegration among these variables looking to estimate an error correction model that will capture this dynamic relationship. In order to do so, we checked for unit roots in the variables through Dickey-Fuller tests that we report on Table 11. All variables are stationary in first differences.

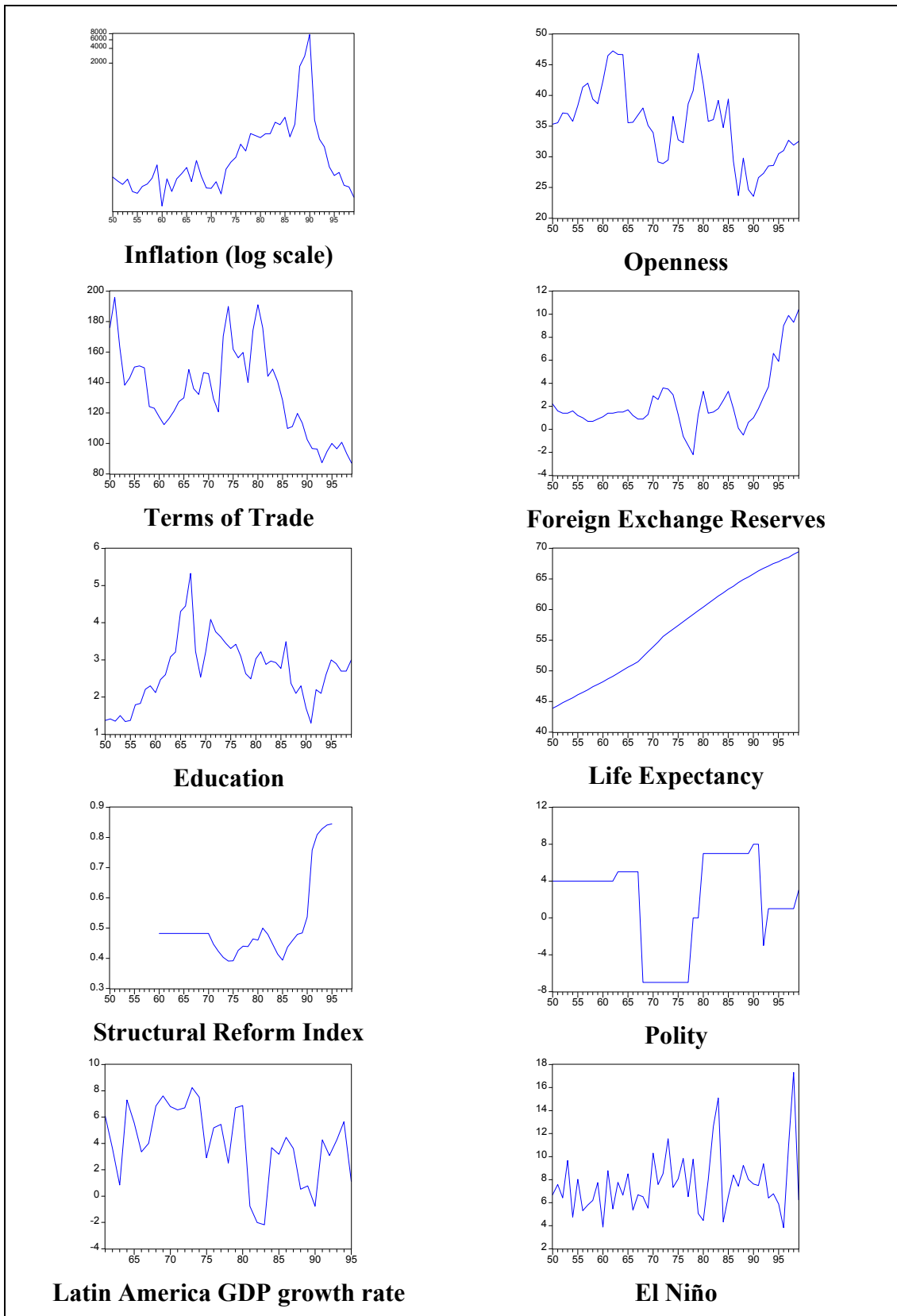
Table 11: Unit Root Tests for Selected Variables

	<i>Test for Unit Root in Levels</i>		<i>Test for Unit Root in First Differences</i>	
	1 lag	2 lags	1 lag	2 lags
TFP	-1.35	-1.00	-4.81*	-4.47*
TFP adjusted	-0.90	-0.64	-4.50*	-4.20*
Inflation	-1.72	-1.98	-4.42*	-4.15*
Openness	-2.07	-1.80	-5.69*	-4.21*
Terms of Trade	-2.52	-1.17	-7.45*	-4.84*
Foreign Reserves	-0.44	-0.42	-4.39*	-3.63*
Education	-2.38	-2.19	-5.58*	-5.03*
Life Expectancy	-1.29	-2.18	-1.81	-1.62
Latin America GDP	-2.29	-1.98	-3.47*	-3.04*
El Niño	-5.23*	-4.28*	-7.90*	-6.43*

(*) Rejection of unit-root hypothesis significant at 1 percent

However, we are dealing with a very limited sample so that even if we found a cointegration relationship, the error correction model associated with that estimation would imply too many parameters for such a narrow sample. So, we decided to use the stationary variables and estimate a regression using OLS that will mimic an error correction model but without taking into account the lags.

Figure 16: Selected Variables



In Table 12 we report the regressions for TFP growth (with and without adjusting by the quality of labor) explained by the (log) inflation rate, the terms of trade, the degree of openness (exports plus imports as a percentage of GDP), a measure of financial constraints that we try to capture with the ratio of foreign exchange reserves as months of imports, our Polity index and the structural reform index, the standard deviation of the El Niño index, the Latin American GDP growth rate, and (log) life expectancy at birth.⁸

The results indicate that inflation is the most robust explanatory variable. This seems reasonable as Peru went from low levels of inflation to a hyperinflation process (1988-90) that is just the mirror image of fiscal and monetary mismanagement. We also try with the inflation variability and the results were similar. This variable could also capture the level of policy uncertainty that could be a fundamental explanation as in Manuelli (2001).

The ratio of foreign reserves to total imports was marginally insignificant in all our estimations. The sign is correct but it seems that the variable either does not capture the importance of the external financing constraint in the economy or the impact is limited.

One of the most typical variables used to explain TFP growth is the degree of openness (Edwards, 1997) and terms of trade. In all of our preliminary estimations those variables were not significant and appeared with the wrong sign. One possible explanation is that historically increases in the openness of the economy have been related with positive shocks in the terms of trade. Years of high commodity prices increase our primary exports, which are the bulk of our total exports, but this is only observed in those periods in which a terms of trade positive shock coincide with an increase in the openness ratio. So, we tried a non-linear component such as *openness*terms of trade*. This variable was significant and positively correlated with TFP growth when we used the 1961-1997 sample, but it was not robust to a different sample.

Table 12: Explaining TFP Growth

	TFP without adjusting By the quality of labor		TFP adjusting By the quality of labor	
C	0.121**	0.056*	0.121**	0.051
LOG(Inflation)	-0.022***	-0.014***	-0.023***	-0.015***
Reserves/Imports	0.003	0.008	0.003	0.008
Terms of Trade *Openness	0.618	1.057*	0.662	1.134*
Polity* Structural Reform	0.010**	-	0.010**	-
Polity	-	0.003***	-	0.004***
Education expenditure	0.031	0.028	0.030	0.028
El Niño	-0.008**	-0.005*	-0.008**	-0.005*
Latin America Growth	0.005	0.006**	0.005	0.006**
Sample	1970-95	1961-97	1970-95	1961-97
Included obs.	26	37	26	37
R-squared	0.75	0.69	0.74	0.68
Durbin-Watson	2.06	1.86	2.03	1.78

Note: Coefficients are significant at 10% (*), 5% (**), or 1% (***), respectively.

⁸ We could not use this last variable as does not satisfy the requirement of stationarity.

The Polity index has the right sign and is significant. We argue that this variable tries to capture the positive impact of an institutional setup that guarantees that the executive decisions are taken having into account a broad group of individuals instead of to a few vested interest groups. Given that TFP growth has been declining most of the time, the positive relationship with this index is a clear indicator of the weakness of our institutional framework.

We also include tentatively the structural reform index. This is important as we need to disentangle the effect of structural reforms and the efforts to bring inflation down. However, we have not been able to extend appropriately this series back to 1960s. But this is in our future research agenda. When we include it within a limited sample 1970-1995, this variable was positive but statistically not significant. Then, we tried a mixed interaction between structural reform and the Polity index, as the former did not capture the extent of second generation reforms or a solid institutional framework in which first generation reforms could trigger a sustained TFP growth. This composite variable was positive and significant.

The per capita public expenditure on education was never a significant factor explaining TFP growth. The reason behind this result could be that those outlays are directed to R&D expenses only marginally, and therefore this variable is not correlated with our human capital index.⁹ Most of those expenses go to primary and secondary schooling and education infrastructure. Maybe a more significant variable could be school enrollment in tertiary education or the urbanization ratio as alternative proxies.

In addition, one of the problems of an economy characterized by high levels of underemployment is that a large proportion of people work in activities in which they do not have training to do so. These mismatches will generate that even highly educated workers might have low levels of productivity.

The last two variables included in the regression were the standard deviation of the El Niño index and the GDP growth rate of Latin America. The first variable was negative and statistically significant across all the possible specifications that we tried. However, the latter variable was only significant for the long sample specification. We also tried with US and World GDP growth rates but the results were much stronger with the Latin American data.

One final exercise was to calculate the relative contribution of each of these factors to TFP growth. As we mentioned above, education has played almost no role. The large share of inflation could be interpreted not only as the devastating effect of the hyperinflation period but also that a lot of effort has been done in bringing the inflation down. That type of effort has not been visible in other aspects of the economy. The still ongoing domestic debate on the urgency of structural reforms (tax, tariffs, pensions, privatizations, etc) indicates the lack of commitment of all past governments about these issues.

⁹ The recent BID (2001) annual report on competitiveness shows that Peru spent 0.06% of GDP in R&D in 1997.

Table 13: Contributing Factors to TFP Growth

	Constant	Macro Factors	Good/Bad Luck	Institutional Factors	Social Factors	Other	Total
<u>Contribution to productivity growth</u>							
1960-1969	5.09	-3.38	-0.32	0.85	0.20	-1.39	1.05
1970-1979	5.09	-4.57	0.83	-2.25	0.05	0.03	-0.81
1980-1989	5.09	-8.48	-2.19	2.81	-0.04	-0.08	-2.88
1990-1999	5.09	-6.36	-1.68	1.07	0.32	2.46	0.90
<u>Changes in contribution to productivity growth</u>							
1990-99 vs 1960-69	0.00	-2.99	-1.35	0.22	0.12	3.84	-0.15
1990-99 vs 1970-79	0.00	-1.80	-2.51	3.32	0.27	2.43	1.71
1990-99 vs 1980-89	0.00	2.12	0.51	-1.74	0.36	2.54	3.78

VI. Concluding remarks

The growth accounting exercise carried on in section 3 shows the deep changes that Peru's TFP has undergone during the past four decades. After having a positive and significant technological progress during the 1950's and 1960's, with a yearly rate of TFP growth slightly below 2%, the Peruvian economy went through two decades of marked decline, as shown by a negative technological progress which reached a yearly rate of TFP contraction of -3.8% during the 1980's.

What happened to the Peruvian economy? Or, rephrasing the big and fundamental Zavalita's question: How did Peru screw up? A first approach is provided by Pritchett's method, which is focused on the quality of public investments. Following Pritchett's procedure our calculations show that investment decisions were of a quite good quality until 1965, in the sense that the observed factor accumulation coincided with the implied values. The second half of the 1960's marks the beginning of a new episode with a gradual decline in this ratio of observed to implied factor accumulation, and the situation worsens during the 1980's when this ratio falls to zero, showing that new investments were worthless.

A second approach is provided by the traditional econometric exercise which tries to find out which are the variables that explain TFP growth by means of a linear regression equation. This exercise has been carried out with a selected set of variables grouped in four categories: macro factors, good/bad luck, institutional and social factors.

The estimated coefficient corresponding to macro factors provides significant evidence to one of the hypothesis that we presented in the first chapter of this paper, that is, the relationship between the gradual deterioration of macro factors, specially those related with fiscal and monetary mismanagement during the 1970's and the 1980's, and the decline in TFP growth (see Table 13).

Institutional factors also seem to have been significant, as suggested by our preliminary hypotheses. The corresponding estimated coefficient for the 1970's, a

whole decade of military dictatorship where the rules affecting the security of property rights, and subsequently the incentives to produce and to invest, were taken in a unilateral and arbitrary manner, shows, as expected a severe turn down. The coefficient for the following period, 1980-1989, shows, as it is also expected, a major improvement, revealing how important the restoration of democratic institutions was. Unfortunately, this institutional improvement came accompanied with macroeconomic mismanagement and bad luck, and TFP declined even harder than the previous decade.

Our regression equation also provide us a hint as to why Peru has not been able to enter into a new path of sustained and significant growth during the 1990's, in spite of the important structural reforms carried on during the Fujimori's administration. Actually, the figures on Table 12 show that the improvements in macroeconomic management were offset by the deterioration of institutions, that is, by the interference the Executive in the functioning of the Congress, the Judiciary, municipalities and every other institution. According to our regression equation, if it had not been for this institutional deterioration, the yearly GDP percapita growth could have been 1.74 points above its actual level.

It is also important to mention that changes in macroeconomic management as well as institutional factors have unquestionable effects on the quality of investments, such as is suggested by Pritchett's method. A further study should concentrate in the relationship between the two methods employed in this paper to explain changes in TFP growth.

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Data Appendix

A. Macro Time Series¹⁰

Domestic Product

- o *GDP*: Gross domestic product in current international dollars (converted to international dollars using purchasing power parity rates) and Gross domestic product at market prices (in current dollars and in current local currency).
- o *GDP growth*: Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 1995 U.S. dollars.
- o *Real GDP Per Capita* dollars in constant prices (international prices, base year 1985): The measure of GDP, excluding the effect of inflation, relative to the population.
- o *GDP Per Capita growth*: Annual percentage growth rate of Real GDP Per Capita.

Population

- o *Population*: Residents of a country regardless of legal status or citizenship
- o *Population growth*: Annual percentage growth rate of the population.
- o *Urban population*: The midyear population of areas defined as urban in each country. It is measured here as a percentage of the total population.

Trade

- o *Terms of trade adjustment*: The terms of trade effect equals capacity to import with the exports of goods and services in constant prices. Data are in constant local currency.
- o *Exports of goods and services*: The value of all goods and other market services provided to the rest of the world. Data are in current U.S. dollars (BoP) and in percentage of the GDP.
- o *Imports of goods and services*: The value of all goods and other market services bought to the rest of the world. Data are in current U.S. dollars (BoP) and in percentage of the GDP.

Exchange rate

- o *Official exchange rate*: The actual, principal exchange rate determined by market forces in the exchange market. Data are expressed in local currency units relative to U.S. dollars. It is an annual average.
- o *Real effective exchange rate index*: $\text{CPI}(\text{local})/(\text{CPI}(\text{US}) \times \text{Official Exchange Rate})$.
- o *Black market premium*: Official exchange rate to parallel exchange rate ratio.

¹⁰ Global Development Finance & World Development Indicators

Prices

- o *Consumer price index (1995=100)*: Consumer price index reflects changes in the cost to the average consumer of acquiring a fixed basket of goods and services.
- o *Inflation*: The annual percentage change in the consumer price index.

Interest rate

- o *Domestic and US real interest rate*: The deposit interest rate less the rate of inflation measured by the GDP deflator.¹¹
- o *M2 as a percentage of GDP*: Money and quasi money relative to GDP.

Government Finance

- o *Overall budget surplus*: Current and capital revenue and official grants received, less total expenditure and lending minus repayments. Data are shown including and excluding grants received by the central government.¹²
- o *Total external debt*: Debt owed to nonresidents. It is the sum of public, publicly guaranteed, and private no guaranteed long-term debt, use of IMF credit, and short-term debt. Data are in current U.S. dollars and in percentage of GDP.

Investment

- o *Gross domestic investment*: Outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Data are in percentage of GDP.
- o *Public investment*.¹³
- o *Private investment*.¹⁴

B. Micro Time Series¹⁵

- o *Capital stock (using disaggregated Investment data)*. Accumulated investment minus assets depreciation. It considers a different rate of depreciation for each kind of fixed asset.

¹¹ Global Development Finance & World Development Indicators, and Easterly, Rodriguez, and Schmidt-Hebbel "Public Sector Deficits and Macroeconomic Performance." Statistical appendix. 1994

¹² Idem

¹³ Easterly, Rodriguez, and Schmidt-Hebbel "Public Sector Deficits and Macroeconomic Performance." Statistical appendix. 1994, Guy P. Pfeffermann, Gregory V. Kisunko, and Mariusz A. Sumlinski, "Trends in Private Investment in Developing Countries: Statistics for 1970-97" and Bruno M. and W. Easterly. "Inflation Crises and Long-run Growth" Journal of Monetary Economics. 1998

¹⁴ Global Development Finance & World Development Indicators and Guy P. Pfeffermann, Gregory V. Kisunko, and Mariusz A. Sumlinski, "Trends in Private Investment in Developing Countries: Statistics for 1970-97"

¹⁵ Easterly, W. and Ross Levine, "It's not factor accumulation: stylized facts and growth models", Mimeo, World Bank and U. of Minnesota, September 1999

- o *Capital per worker*: Accumulated investment minus assets depreciation, related to the labor force. It was computed using the Summers and Heston's methodology.
- o *Capital per worker using disaggregated investment data*: This measure of capital per worker takes into account that different kinds of capital exhibit different rates of depreciation.
- o *Capital per worker using aggregated investment data*: This measure of capital per worker considers the same rate of depreciation for every kind of fixed asset.

C. Social Indicators¹⁶

- o *School enrollment (primary, secondary and tertiary)*: Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides basic skills and an elementary understanding of various subjects. Secondary education completes the provision of basic education by offering more subject- or skill-oriented instruction. Tertiary education provides an advanced research qualification.
- o *Life expectancy at birth*: It indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

D. Political Factors¹⁷

- o *Type of regime*: (1) civilian, (2) military-civilian, (3) military, (4) other.
- o *Size of military/population*: All active-duty members of a nation's armed forces (army, navy, air corps). Semi- or para-military forces are excluded.
- o *Major cabinet changes*: The number of times in a year that a new Prime Minister is appointed and/or 50% of the cabinet seats are occupied by new ministers.
- o *Major government crises*: The number of situations where the present regime is threatened to be deposed, excluding situations of revolt aimed at such overthrow.
- o *Riots*: The number of any violent demonstration or clash of more than 100 citizens involving the use of physical force.
- o *Revolutions*: The number of any illegal or forced change in the top governmental elite and any attempt at such a change.
- o *Coups d'etat*: The number of extra constitutional or forced changes in the top government. It is included only the successful coups.
- o *Guerrilla warfare*: The number of any armed activity carried on by irregular forces, which aim to overthrow of the present regime.

E. The Rule of Law

¹⁶ Global Development Finance & World Development Indicators

¹⁷ Arthur S. Banks Cross National Time-Series Data Archive

Executive recruitment¹⁸

- o *Regulation of Chief Executive Recruitment*: Refers to the extent to which a polity has institutionalized procedures for transferring executive power. (1)Unregulated (2)Designational (3)Regulated.
- o *Competitiveness of Executive Recruitment*: Refers to the extent that prevailing modes of advancement give subordinates equal opportunities to become superordinates. Three categories are used to measure this concept: (1) Selection (2) Dual executives/transitional (3) competitive elections.
- o *Openness of Executive Recruitment*: Refers to the extent to which the politically active population has an opportunity to attain the position through a regularized process. Four categories are used: (1)Closed/hereditary succession. (2)Dual executive-designation: hereditary succession plus executive selection of an effective chief minister. (3)Dual executive-election: Hereditary succession plus electoral selection of an effective chief minister. (4)Open.

The independence of executive authority¹⁹

- o *Major constitutional changes*: The number of basic alterations in a state's constitutional structure, the extreme case being the adoption of a new constitution. Constitutional amendments not having a significant impact on the political system are not counted.²⁰
- o *Monocratism*: The extent to which the chief executive ruler must take into account the preferences of others when making decisions. Distinction between patterns in which one-man rule prevails (monocratic) and those in which some kind of assent is required (concurrent). Five categories are used: (1)Pure individual executive not dependent for his position or authority on a cabinet or junta (2)Intermediate category (3)Qualified individual Executive: the executive is formally a cabinet but one member holds more authority than the other members (4) Intermediate category (5)Collective executive: the executive is formally a committee or junta, no one individual clearly dominates it.
- o *Executive Constraints (Decision Rules)*: It refers to the extent of institutionalized constraints on the decision-making powers of chief executives, whether individuals or collectivities. Any accountability groups may impose such limitations. Seven categories are used (1) Unlimited Authority (2) Intermediate Category (3) Slight to Moderate Limitations on Executive Authority (4) Intermediate category (5) Substantial Limitations on Executive Authority (6) Intermediate Category (7) Executive Parity or Subordination.

Extent of political competition and opposition

- o *Party fractionalization index formula*: The extent to which the political system enables non-elites to influence political elites in regular ways.

$$F = 1 - \sum_{i=1}^m (t_i * t_i)$$

¹⁸ Jagers, K. and T.R. Gurr, "Tracking Democracy's Third Wave with Polity III Data Journey of Peace Research. 32,1995

¹⁹ Idem

²⁰ Arthur S. Banks Cross National Time-Series Data Archive

where t = the proportion of members associated with the i th party in the lower house of the legislature.²¹

- o *The Regulation of Participation*: Participation is regulated to the extent that there are binding rules on when, whether, and how political preferences are expressed. A five-category scale is used to code this dimension: (1) Unregulated participation: there are no enduring political organizations and no systematic controls on political activity. (2) Factional or transitional: there are relatively stable political groups, which compete for political influence (3) Factional/restricted: when one group secures power it restricts its opponents' political activities (4) Restricted: some organized Political participation is permitted without intense factionalism (5) Regulated: relatively enduring political groups regularly compete for political influence with little use of coercion.²²
- o *The Competitiveness of Participation*: It refers to the extent in which alternative preferences for policy and leadership are taken into account in the political arena. (1) Suppressed competition: no significant oppositional activity outside the ranks of the ruling party. (2) Restricted/transitional: some political competition occurs outside government but the regime systematically limits its form in ways that exclude substantial groups from participation. (3) Factional competition: polities with factional or factional/restricted patterns of competition. (4) Transitional competition: transitional elements from restricted, or factional patterns to fully competitive patterns. (5) Competitive competition: stable and enduring political groups, which regularly compete for political influence. Very small parties or political groups may be restricted in the competitive pattern.²³

²¹ Idem

²² Jagers, K. and T.R. Gurr, "Tracking Democracy's Third Wave with Polity III Data" *Journal of Peace Research*, 32, 1995

²³ Idem