Comments are welcome

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 him the crucial question: When did Peru screw up?[2]

Actually, since the first half of the 1960s, 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 1960s, 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 went 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?

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.

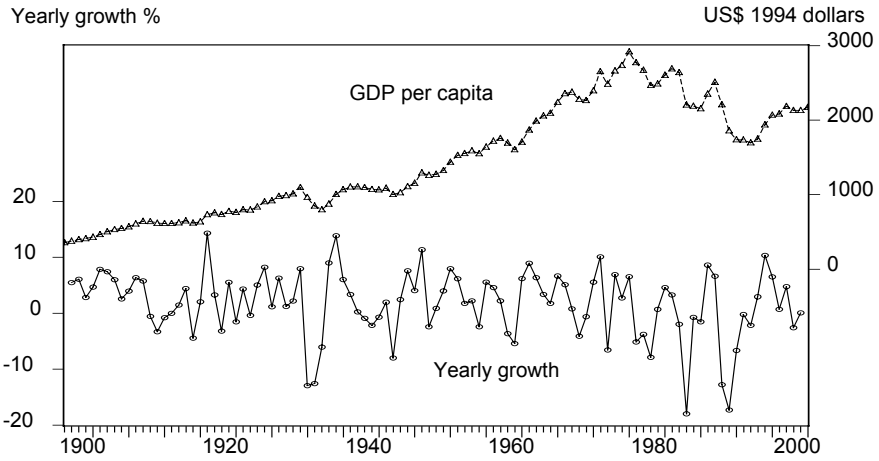
One might think that a possible explanation of our first question comes exactly from the fact that he had endured an erratic economic policy orientation.

The paper is organized as follows. In Section 1 we present some empirical regularities of the growth process in Peru. Then in Section 2 we discuss the quality and availability of the data used. In Section 3 we performed a standard growth accounting exercise. In Section 4 we evaluate Pritchett's claim that most public investment is overvalued and therefore distorts TFP calculations. In Section 5 we attempt to explain the factors that explain TFP growth. Finally, Section 6 presents our conclusions.

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.

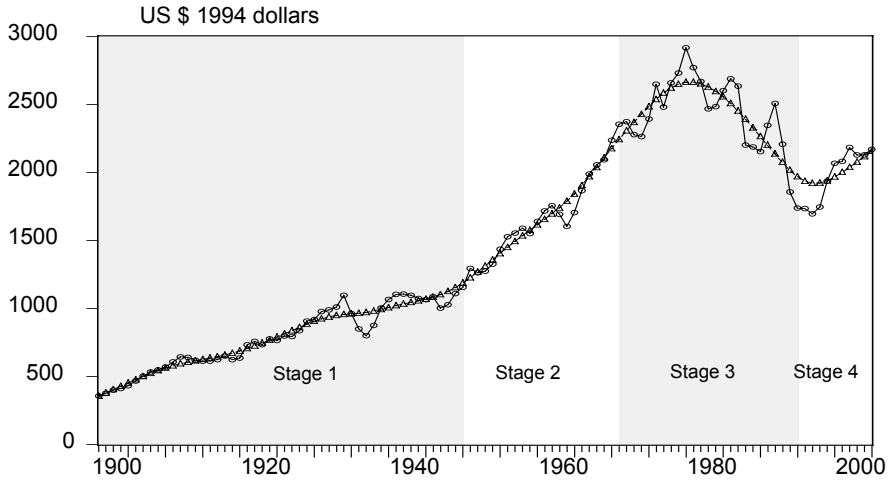
Figure 1: Evolution of Peru's GDP Per Capita and Yearly Growth Rates 1896-1999



By the end of the 60s 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.

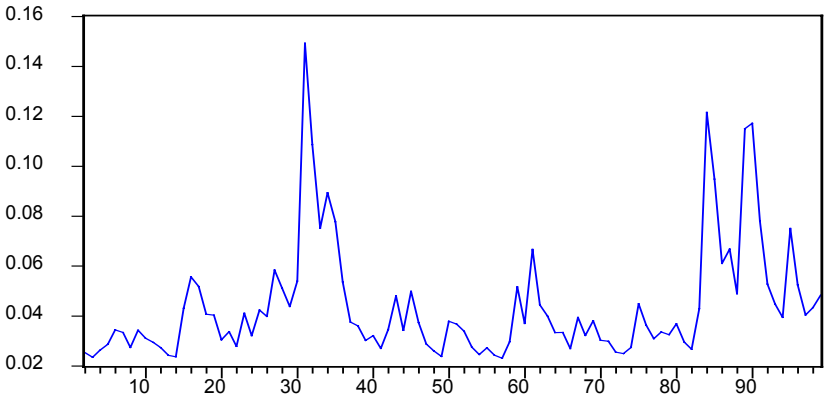
According to this brief account it seems that the Peruvian economy has gone through four stages during the twentieth century, as it is shown in Figure 2. The end of the Second World War, that is 1945, marks the end of a first period of moderated growth and the beginning of a second period with a much 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.[3]

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



From the two figures shown above, it is apparent that the 1900-1980 period looks a lot more stable than the 1980-2000 period. Indeed, if we run a GARCH model of the variance of GDP per capita we find that the period after 1980 has been much more volatile than the previous 70 years, once we take out the effect of the Great Depression.

Figure 3: Conditional variance of GDP per capita
1896-2000



[3] We deliberately chose not to identify the stages by statistical means. Even though, in Appendix 1 we present statistical evidence supporting the sub-periods chosen.

One question that arises from this fact is whether this increasing volatility is purely exogenous or endogenously explained by policy decisions. One could expect that in the case of a commodity exporter economy that is constantly buffeted by terms of trade shocks the GDP will fluctuate accordingly. It is important to recall that one of the characteristics of the Peruvian exports was its diversity. This allowed the economy to withstand commodity-specific external shocks.

However, the sources of volatility are much wider in extent than just terms of trade. That is, the policies adopted, the world interest rate, the availability of external financing and, of course, the way that all these crises are managed are maybe much more important than just the terms of trade.

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 Odria'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 the 60s 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 (SOEs), 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 its 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 SOE sector and to eliminate the job stability laws and other regulations affecting the incentives to invest. The few reforms introduced by Belaunde were dismounted by Garcia, who in 1985 tried to resuscitate the spirit of the Velasco's government. It goes without saying that Garcia's administration ended with a colossal fiscal deficit, which reached 8% of total GDP between 1987 and the first half of 1990[4] and an impressive inflation rate which was above 1,000% during three consecutive years (1988, 1989 and1990). The ratio of exports to total GDP plummeted to its lowest level and GDP 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.

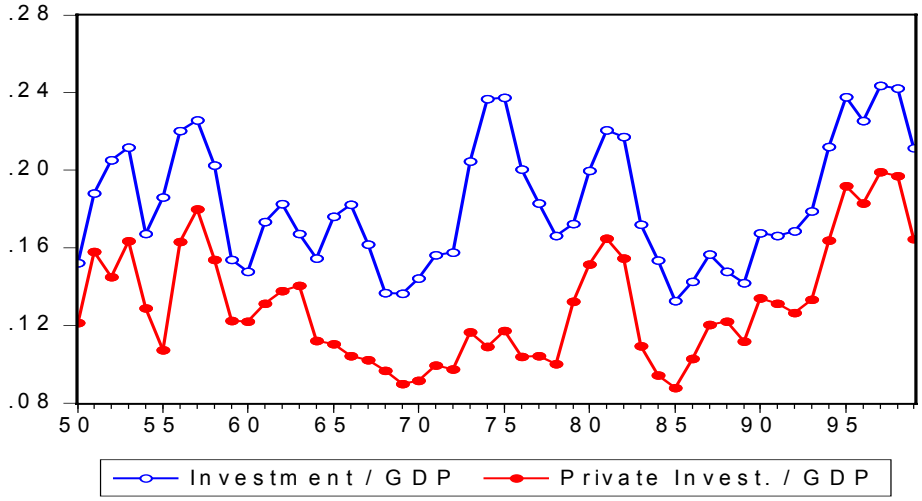
In 1990 a new phase of economic growth begins, with the reforms implemented by the new administration conducted by President Fujimori. These reforms did away with practically all the obstacles to private investment that had been introduced during the Velasco and Garcia administrations. A vast privatization 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

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

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 hit an economy unwilling to keep the pace of reforms and with a government more concerned to be re-re-elected by all means.

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 4: 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 4, 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 5: Private Investment as a Percentage of Total Investment
Peru 1950-1998

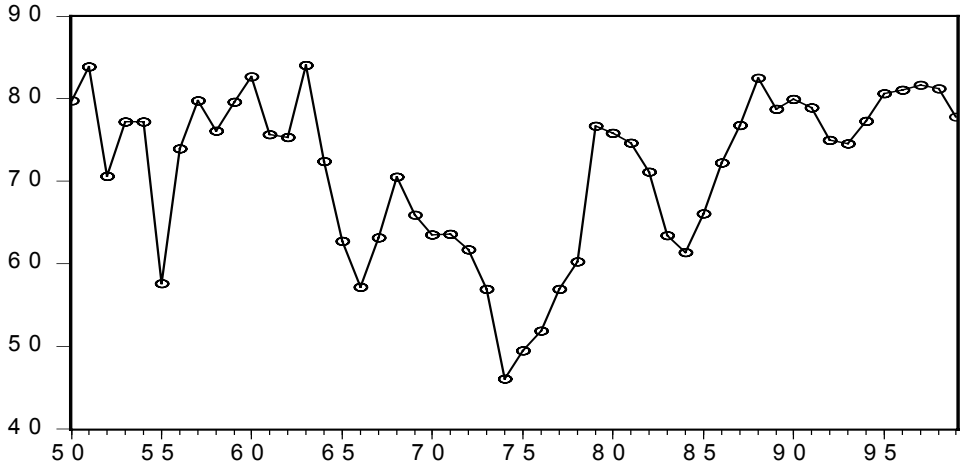


Figure 5 shows that between 1950 and 1965 private investment accounted for nearly 80% of total investment. The relative importance of private investment began to decline during the second half of the 1960's reaching a floor of 45% in 1974, and after a temporary recovery between 1975 and 1978 it definitively found a new stable level in the 1990's of around 80%

Perhaps the easiest way to understand how the incentives to invest have changed during the last 40 years is to relate the behavior of the ratio of physical capital to human capital to its relative prices. As we do not have good proxies for the relative price of capital with respect to labor, and most of the physical capital is imported, we used the real exchange rate. The real exchange rate will be measuring the price of (tradable) capital relative to non-tradables (wages, among others).

Although the relationship is not tight at the beginning of the sample, Figure 6 shows a very good fit for the last 25 years. What is important is that the relative prices were biased towards the accumulation of physical capital between 1960 and 1980. The liberalization process first and then the collapse of the exchange rate regime changed completely the picture in the private sector. The other part of the story comes from a significant decrease in public expenditure (in particular public investment) from 1975 onwards (see Figure 7).

Figure 6: Physical Capital to Human Capital Ratio and Real Exchange Rate

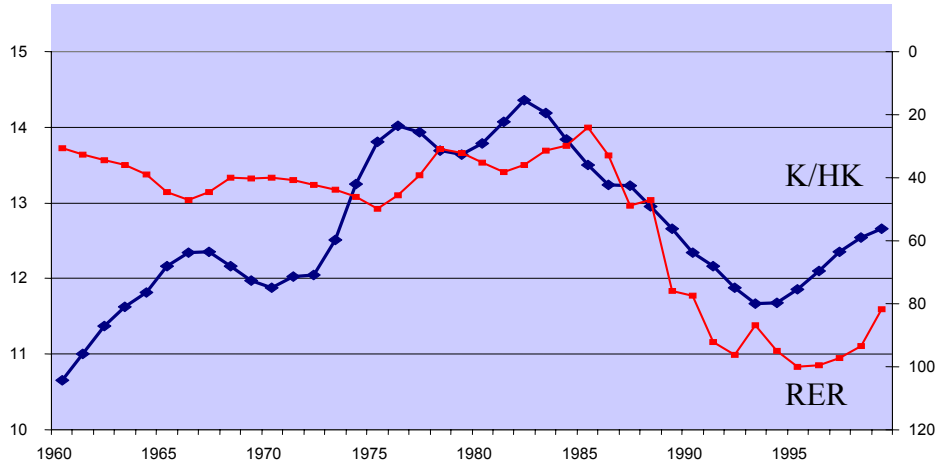
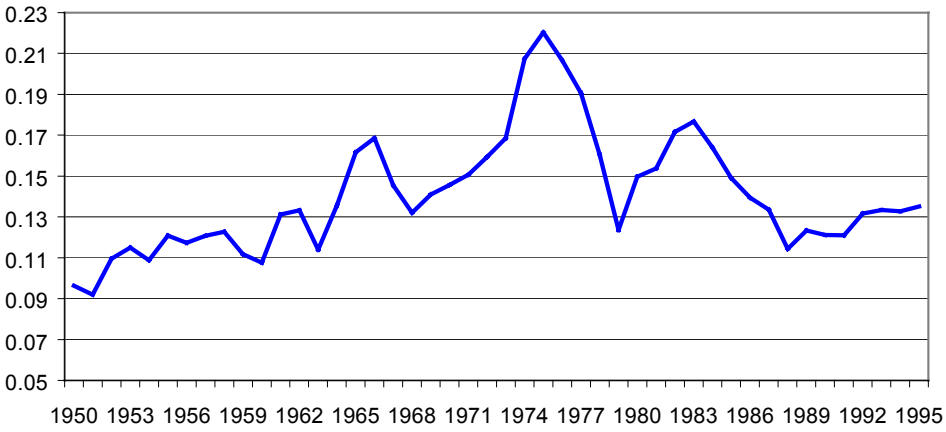
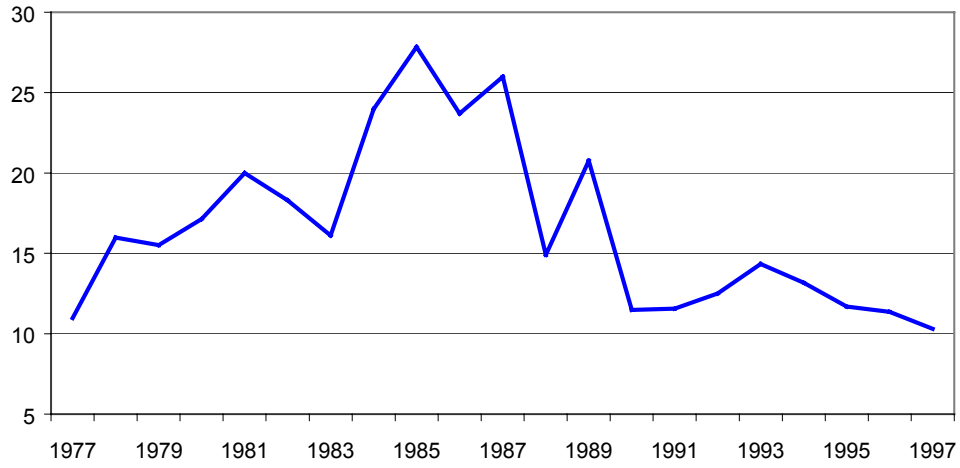


Figure 7: Public Expenditure
(% of GDP)



In addition it is important to mention that the level of effective protection changed quite substantially along this period. The liberalization process initiated at the beginning of the 1980s was reversed in 1983-1984 as the economy went into a severe recession. The GDP fell more than 12% and the government decided to stop the process. Moreover, in the 1985-1990 administration, import duties were raised and the list of prohibited items grew bigger as the crisis mounted. Therefore, part of the decrease in physical capital accumulation is also due to this reversal of the level of protection. In Figure 8 we show the behavior of a very poor proxy, the ratio of import duties to imports.

Figure 8: Implicit Import Duties
(Duties as a percentage of imports)



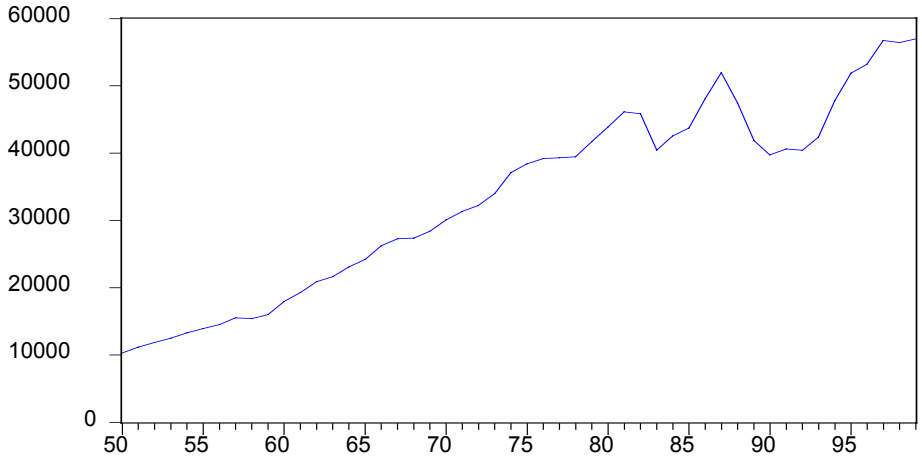
II. Data and Methodology

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 9: Gross Domestic Product
US $millions

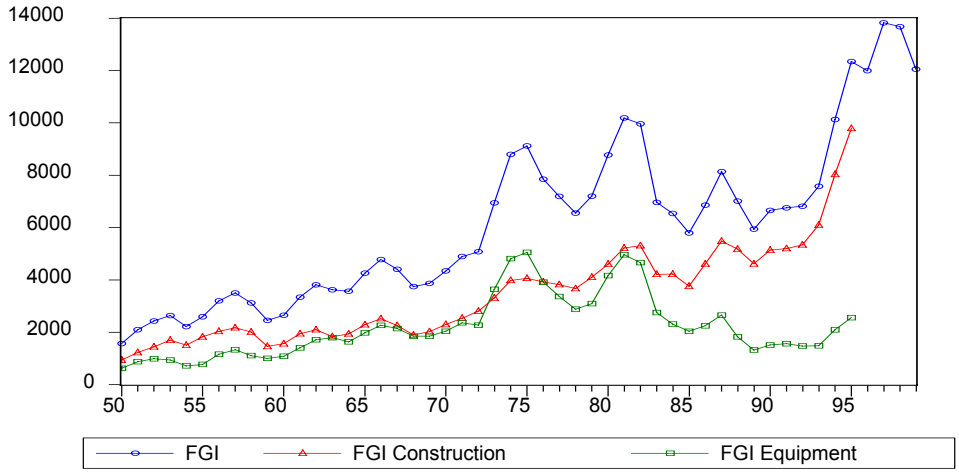


Fixed Gross Investment

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.

The share of public investment was also calculated using constant prices. The source is the Central Bank of Peru. However, the private investment figures include the investment outlays of public enterprises. Most of the public enterprises were privatized in the 1990s.

Figure 10: 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[5]

So, 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:

[5] There are 3 different fixed investment series: (i) the World Bank, (ii) Summers and Heston, and (iii) the Central Bank of Peru. The first two used the official series that were recently revised entirely by the Central Bank. The problem with those figures is not just a matter of wrong base prices but a complete recalculation of the figures as the committee in charge of the revision found many errors in the previous calculations. The new administration of the National Institute of Statistics has found even more problems with the National Accounts and they have announced that a new revision is coming.

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

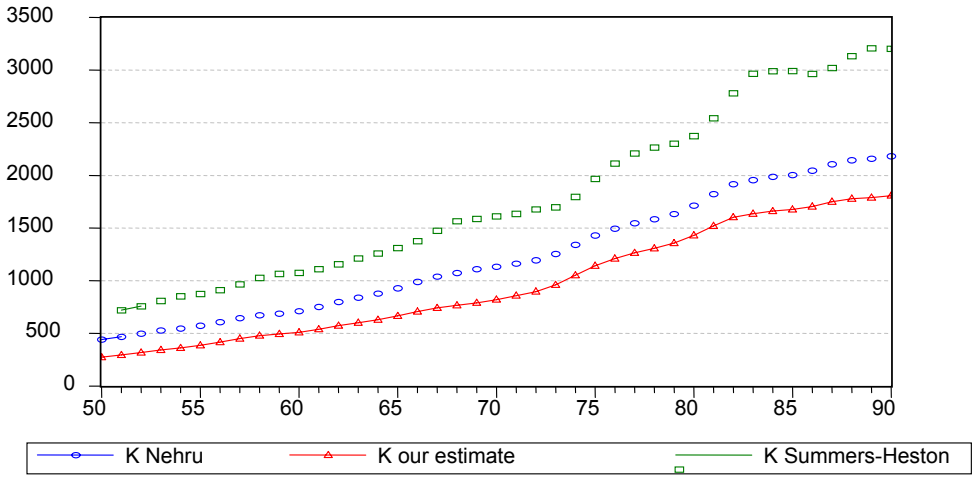
where: δ is the depreciation rate
K_0 is the initial capital stock.

We used a depreciation rate of 6% for machinery and equipment and 3.5% for construction[6]. 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.[7] 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.

In Figure 11 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 11: Capital Stock Series

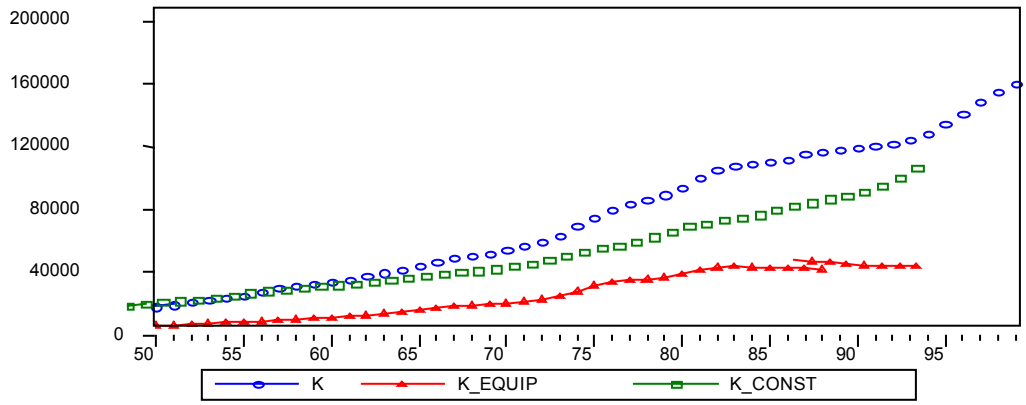


To shed some more light on what has happened with the capital stock series we present estimates of machinery, and equipment and construction (see Figure 12). Both components had a similar trend up to the 1980s. Since then, the capital in machinery and equipment has fallen while the trend in construction 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.

[6] 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.

[7] See Barro and Sala-I-Martin (1995) for a thorough explanation.

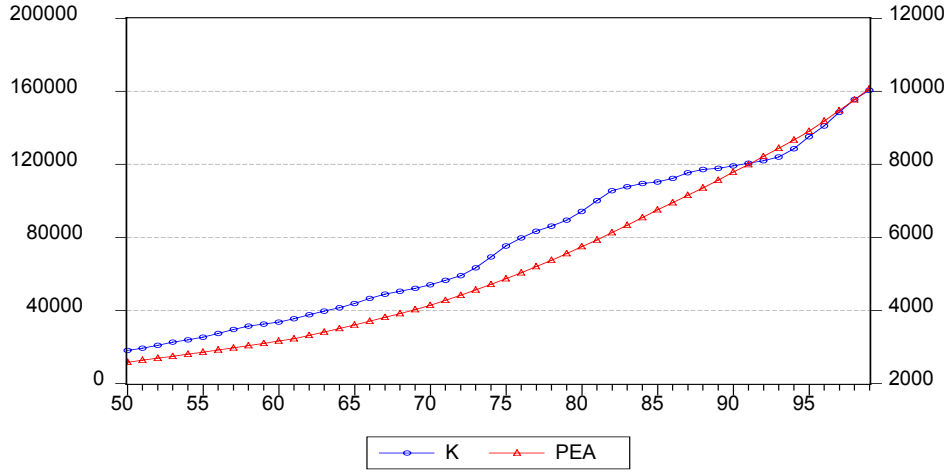
Figure 12: Our Disaggregated Capital Stock Series
US $ millions



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.

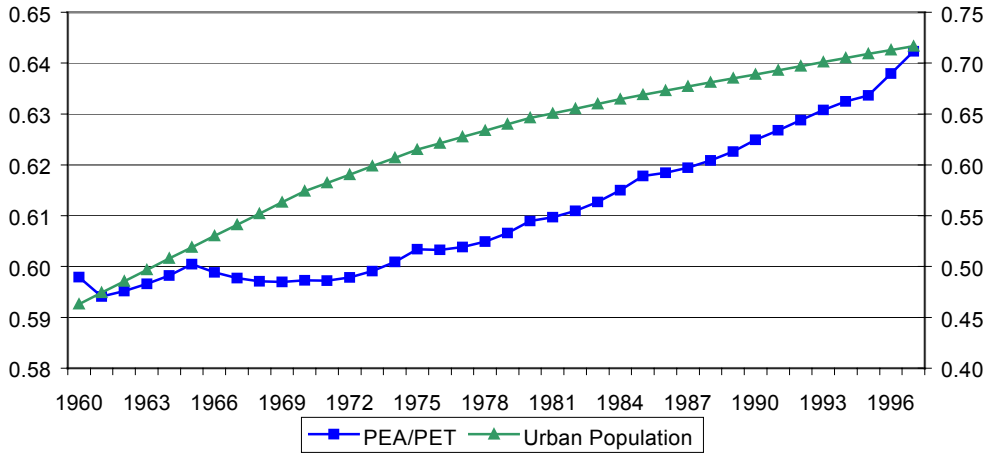
Figure 13: Labor Force and Capital Stock



During the last 50 years, the average growth rate of the PEA was 2.8% (see Figure 13). 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 14). There are two factors interplaying.

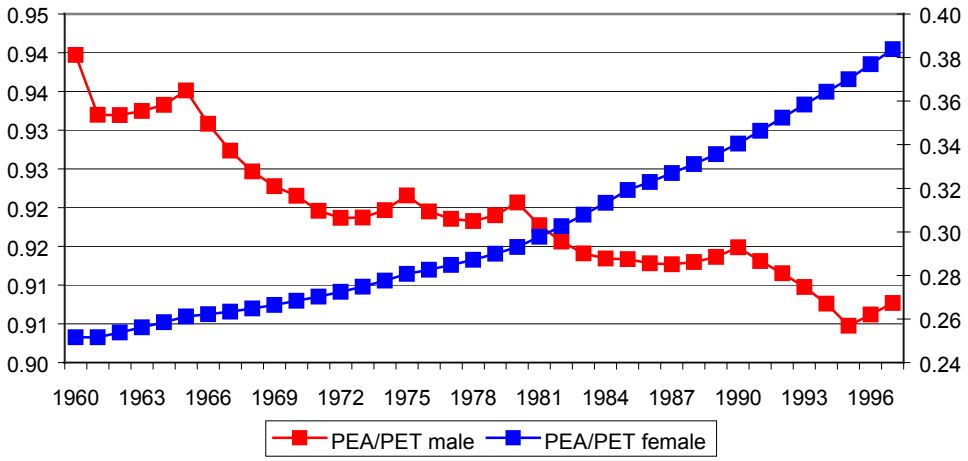
The first driving force behind the increase in the labor participation ratio was the sustained migration toward urban areas. The migration towards main cities was promoted by General Velasco during the early 70s and reinforced by the low returns on the agricultural activities after the failed agrarian 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 14: Labor Participation Ratio and Urban/Rural



The second driving force has been the steady growth of the female participation ratio (see Figure 15). 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 15: 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 12). 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.[8]

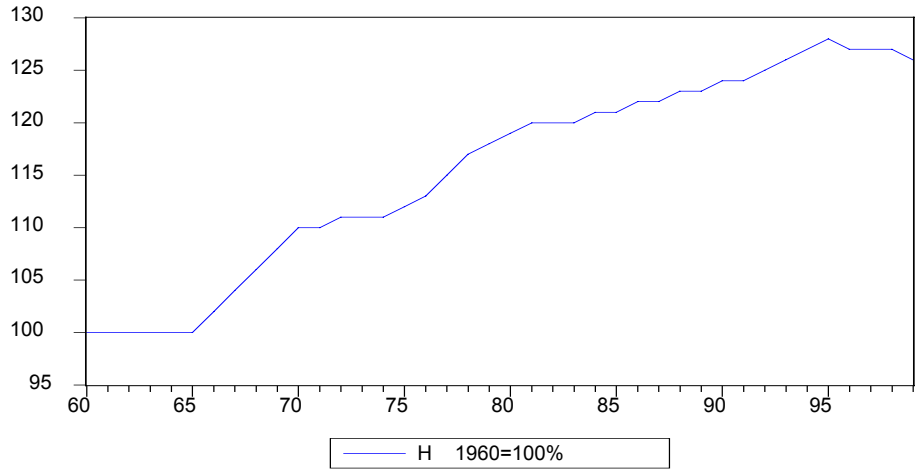
[8] See Chacaltana (2000) for a detailed study.

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.

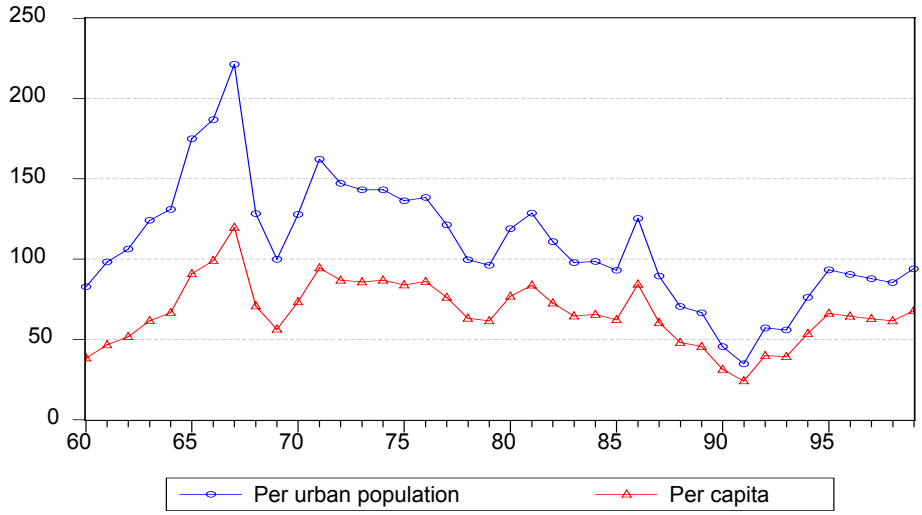
Figure 16: Human Capital Quality Index



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.[9]

[9] Even though Peru is within Latin America one of three economies with the highest levels of educational attainment it is also one of the three economies with the lowest levels of educational quality. However, there are no long term series of these quality indicators to adjust the series properly. See World Bank (2001).

Figure 17: 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:

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

Taking logs and differentiating with respect to time we have:

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

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:

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

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[10]. We encounter a single cointegration vector with an estimate of α=0.441.[11] However, the results are not robust to sample changes.

Therefore we will perform the growth accounting exercise with our first estimation of α=0.441 and with the typical value for α=1/3. Our estimated values for α lie below previous calculations as reported in Table 3.[12]

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

[10] 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.

[11] See Appendix 2 for details.

[12] Based on the most recent Input-Output Table (1994) we obtained an alternative value of 0.325. One big problem with the Table is that the estimated share of labor in total income does not take into account the unpaid workers. This will biased upwards the value of alpha. Therefore we corrected these figures imputing the average salary per sector to all unpaid workers of each sector. However, we must say that this value of 0.325 should be taken as a lower bound as the most probable situation is that the salary of those registered as unpaid workers is lower than the salary of those registered as paid workers.

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 disaggregate the 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. 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. 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**

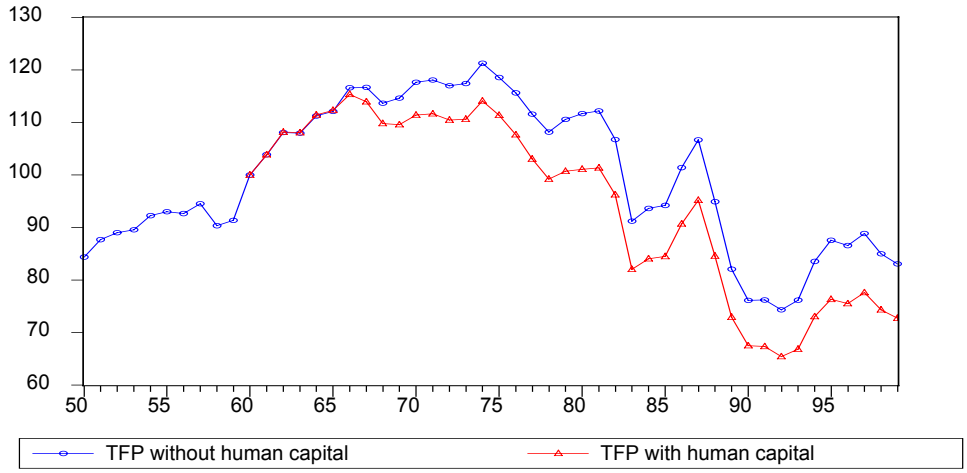
Once we did the correction of the labor force using a human capital index we found in Table 6 that the new TFP growth rates are smaller than before. The main difference is that when we account for the human capital accumulation, the contribution of the labor factor is greater. The net contribution of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

If we look at year-by-year figures, the years where output decreases and inputs increases are those at the height of the economic crises: the 1982-83 debt crisis and the 1988-1990 hyperinflation periods.

Figure 18: Total Factor Productivity
Using Total Physical Capital



Given that these numbers were 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 (α=0.33) for all the possibilities. The basic message that comes out of these calculations is that our initial results hold.

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 7: Alternative TFP calculations
Average growth rates (%)

	α=0.44				α=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.

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.

There are three competing hypotheses behind these results: sub-utilization, misallocation or bad reporting of inputs. The sub-utilization hypothesis only could be liable of cyclical movements of the TFP but not of the clear negative trend.[13] Another possible explanation is informality. One can argue that some factor accumulation

[13] The relevant data to compute a proper TFP measure without the cyclical component due to a variable capacity utilization rate is not available.

within this sector has not been properly measured and therefore distorts the TFP calculations. One major problem with this is the lack of series to support (or reject) this claim. However, one can suppose that, due to the crisis, labor migrates from the formal to the informal sector. Hence, if we include the informal sector in our computation of the growth rate of labor, the puzzle will not vanish as inputs will be increasing much quickly. The other explanation is a severe lost of productivity due to misallocation of inputs. Due to highly distorted incentives or restrictions to mobilize factors across sectors, a given level of inputs generates less output and therefore the TFP is lower. 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. 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.[14]

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.

There is still another way to interpret a decreasing TFP which we cover in the next section. The idea is simple. If the valuation method of the inputs is faulty, the measure of TFP will be faulty as well.

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, 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 found 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:

[14] This claim is supported by Lora (2002) report on competitiveness of the Peruvian economy.

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 close 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 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

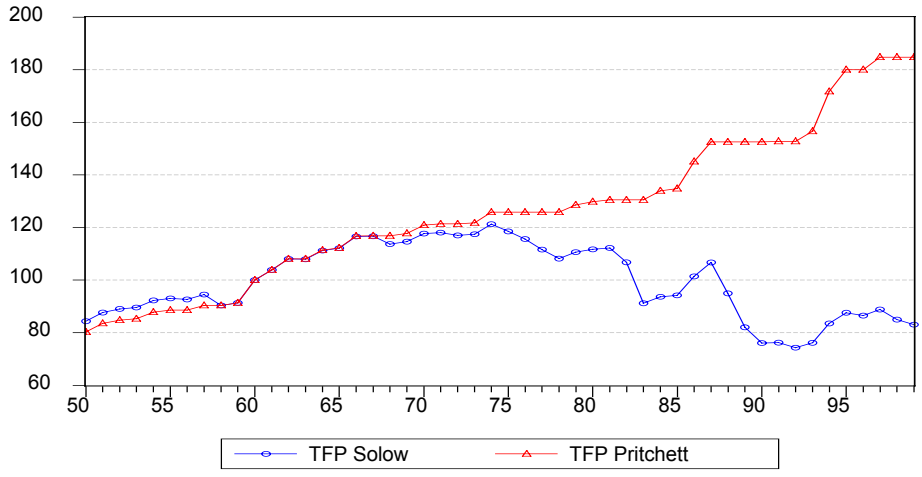
Adjusting just the physical capital stock with educational capital in the TFP calculation

	Observed factor accumulation	Observed TFP (Solow)	If TFP=0%		
			TFP (Pritchett)	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.

Figure 19: TFP Solow vs. Pritchett



In any case, if we took these results seriously and compare them with our previous estimates using the Solow model (see Figure 19) 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.

A final exercise we performed was to suppose that the public investment was the major culprit of the negative TFP. We assumed that it depreciated 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 original exercise.[15] 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.

It is possible to explain the decline in TFP by adverse external shocks, bad policies, or something along those lines? In the next section we attempt to answer this question.

V. Explaining TFP

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 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 is the consequence of (i) good policies, (ii) just plain good luck, or (iii) a good institutional stance.

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

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

Where MF, EF, and IF are macro, external, and institutional 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, the real exchange rate, and the external debt burden. For the last variable we used the ratio of public external debt to GDP.

The real exchange rate might be used as a proxy for the relative price of imported capital to domestic consumption goods, variable used in Chumacero and Fuentes (2002).

An additional variable that we used is the structural reform index computed by Morley, Machado and Pettinato (1999) extending the work of Lora (2001). The sample available for the series goes from 1970 to 1999. 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 policy changes.

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

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 a Fisher 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. One could expect that a better institutional framework of an economy may have positive impact on investment and carry out a higher TFP.

In Figure 20 we show the time series of the most representing variables that we used in this econometric exercise.

Table 11: Unit Root Tests for Selected Variables

	Test for Unit Root in Levels		***Test for Unit Root in First Differences***	
	1 lag	**2 lags**	**1 lag**	**2 lags**
TFP	-1.35	-1.00	-4.81*	-4.47*
Inflation	-1.72	-1.98	-4.42*	-4.15*
Public Debt / GDP	-2.23	-2.05	-4.52*	-4.10*
Openness	-2.07	-1.80	-5.69*	-4.21*
Terms of Trade	-2.52	-1.17	-7.45*	-4.84*
Foreign Interest Rate	-1.42	-1.27	-4.30*	-3.20**
Real Exchange Rate	-0.91	-1.52	-2.64*	-2.72*
Latin America GDP	-3.16	-2.20	-6.70*	-4.70*
El Niño	-5.23*	-4.28*	-7.90*	-6.43*

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

Our interest is to understand the factors that explain the behavior of TFP. Naturally, our first approach was to test for cointegration among these variables. 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; the only exception was the El Niño indicator, so we exclude it from our estimations.

As we are dealing with a very limited sample, even if we found a cointegration relationship, the error correction model associated with that estimation would imply too many parameters. So, we decided to use a simple Engle-Granger methodology.

In Table 12 we report the regressions for TFP explained by the (log) inflation rate, the terms of trade, the real exchange rate, the foreign real interest rate, the degree of openness (exports plus imports as a percentage of GDP)[16], a measure of debt burden, our Polity index, the structural reform index, and the Latin American GDP growth rate.

Table 12: Explaining TFP

	(1)	(2)	(3)	(4)
C	157.80***	113.47***	161.35***	130.59***
Log(Inflation)	-1.82*	2.18*	-2.26*	-3.21***
Openness	-0.49	1.08***		
Terms of Trade	0.17**		0.09*	0.20***
Real Exchange Rate	-0.35***		-0.24**	-0.32***
Foreign Interest Rate	-1.03*	-1.75**	-1.16*	-1.81***
Public Debt/GDP	-0.37***	-0.80***	-0.45***	
Latin America Growth	0.05			
Polity			0.21	
Structural Reform index			-28.50	
Sample	1970-99	1970-99	1970-99	1962-99
Included obs.	30	30	30	38
R-squared	0.94	0.77	0.94	0.87
Durbin-Watson	1.29	0.82	1.20	0.96

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

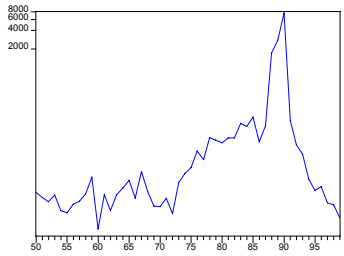
We try four alternative specifications. In the first equation we include all macro and good/bad luck factors. The results indicate that high inflation rates, high level of public indebtness, and an undervalued real exchange rate are the wrong policies to improve TFP. This seems reasonable as Peru went 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).[17]

The effect of external shocks is quite important as both the foreign interest rate and the terms of trade are statistically significant; the Latin American growth rate enters with the right sign but is not statistically significant. We tried with the world growth rate but the results did not change.

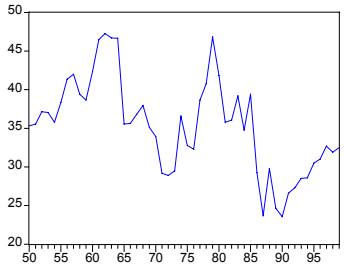
[16] See Edwards (1997).

[17] We tried another usual indicator of bad policies, the black market premium, but as this variable is too highly correlated with inflation (0.40), it did not help to identify other periods of bad policies.

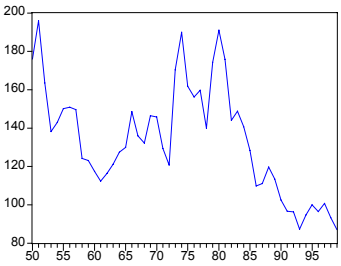
Figure 20: Selected Variables



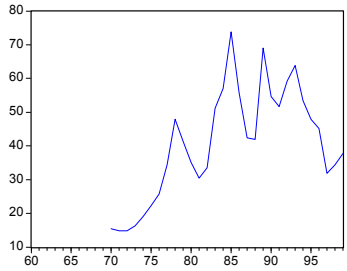
Inflation (log scale)



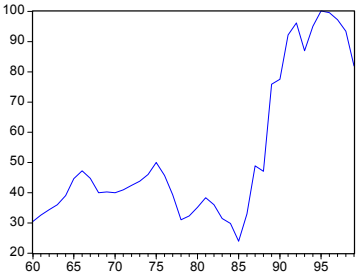
Openness



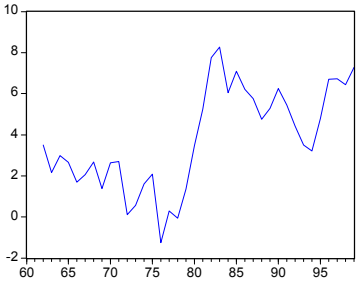
Terms of Trade



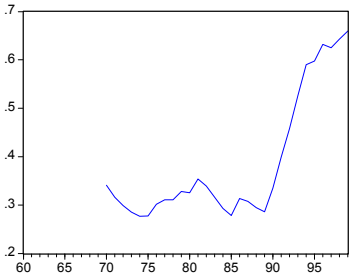
Public External Debt/GDP



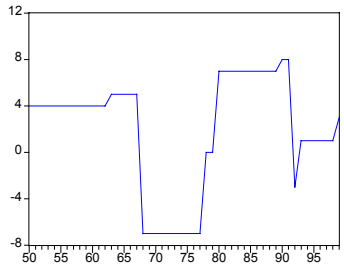
Real Exchange Rate



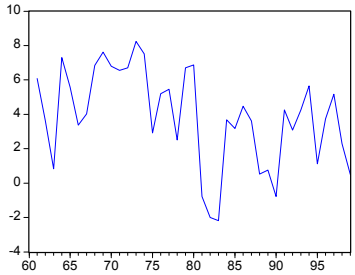
Real Foreign Interest Rate



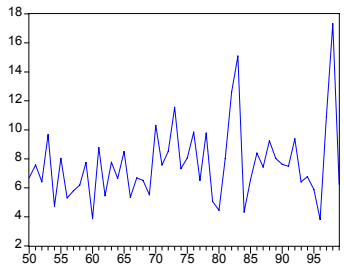
Structural Reform Index



Polity



Latin America GDP growth rate



El Niño

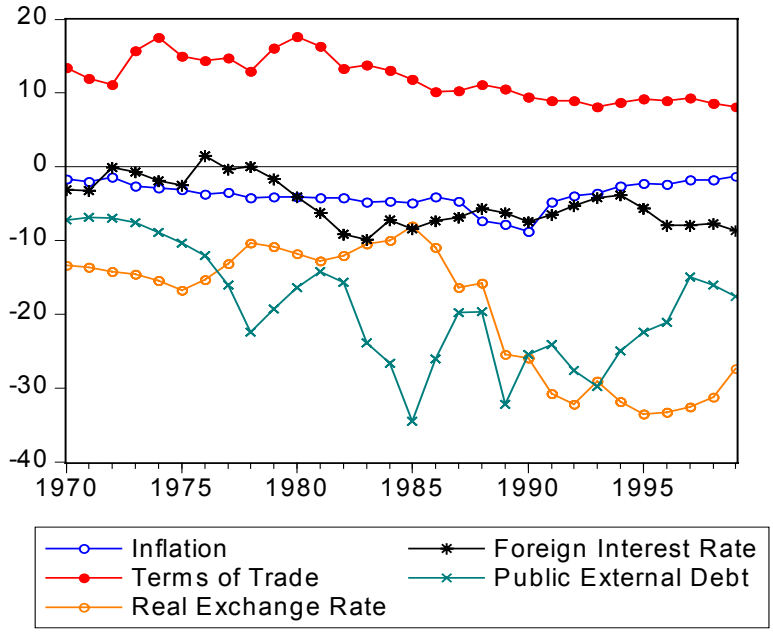
One puzzling result is that openness has the wrong sign and is not statistically significant. The reason is a simple problem of multicollinearity with terms of trade and real exchange rate. To prove this we estimate equation 2 without those variables and the results where are expected. A larger degree of openness improves TFP and the rest of results remained the same.

In equation 3 we tested the importance of the institutional factor and the structural reform indicator. However, the result where quite disappointing as the structural reform appeared with the wrong sign and was not statistically significant, whereas the Polity index has the right sign but it was not statistically 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 has been declining most of the time, the positive relationship with this index is an indicator of the weakness of our institutional framework.

Just to have a small robustness check we run the equation without the external debt variable in order to cover an additional decade and the results of equation 4 show that the coefficients are about the same and the cointegration relationship is still present.

In order to compare which factors are more important on TFP we present the contribution of each variable to TFP (see Figure 21). The results indicate that terms of trade, the real exchange rate and the ratio of public external debt to GDP are the main contributing factors, whereas inflation and the real foreign interest rate come in second place. In other words, even though external factors might play a crucial role in TFP, there is plenty of room for domestic policy to improve TFP conditions. However, results should be taken with a grain of salt as some explanatory variables are correlated and therefore their individual impact could be masked in another variable.

Figure 21: Effect on TFP



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 by means of a cointegration equation. This exercise has been carried out with a selected set of variables grouped in three categories: macro factors, good/bad luck, and institutional 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 12).

The fact that institutional factors or the structural reform index do not seem to matter in the data should not be taken as a confirmation that those are not important. The fact that Peru is an economy in which external factors are fundamental should be an additional incentive to be on the right track. We are a fragile economy and therefore we have to keep a preventive approach to external crises. They might come from a deterioration of the terms of trade, and increase of the cost of external financing, or a global slowdown.

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.

As a final thought we could see these last 50 years as a constant struggle between groups willing to put sector-specific incentives and the government. In this struggle, we have shifted from one side to the other of the economic policy pendulum. We have

moved from high tariffs and subsidized exchange rates to the opposite. The main characteristic of the economic policy it has been by far its volatility and unpredictability. Rules are short-term rules. Laws are short-term laws. Even we keep changing our constitution as if it were our New Year resolutions.

The unpredictability of our economic policies and political regimes brings out myopic and opportunistic behavior from whoever has a bit of decision power. Even though the to-do list is quite long the focus should be put on improving the incentives mechanism in order to avoid large misallocation of inputs and narrowing the width of possible economic policy decisions. Why not try that for a change?

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Appendix 1

Even when we could have easily come up with statistical evidence supporting the sub-periods chosen in the paper, we deliberately chose not to identify the periods by statistical means. We picked those sub-periods that could better reflect the major changes that occurred in the last 100 years in the economic history of Peru. The post-WWII period was interrupted in 1968 by a military coup. The1988-1990 hyperinflation of was another major factor affecting the trend.

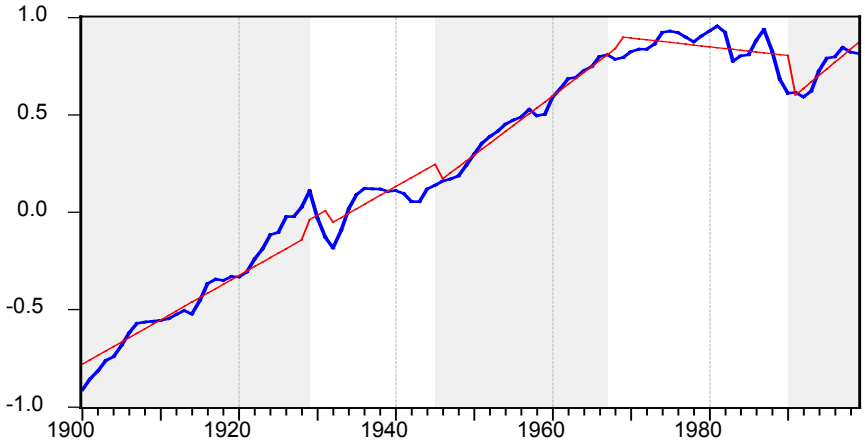
Here we show the econometric results of a linear specification taking into account these sub-periods and a intercept change dummy for the Great Depression.

Dependent Variable: LGDP_PC
Method: Least Squares
Sample: 1900 1999

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.780293	0.020897	-37.34060	0.0000
DUM1945*@TREND	0.007516	0.002404	3.126194	0.0024
DUM1968*@TREND	-0.034814	0.003314	-10.50486	0.0000
DUM1990*@TREND	0.038030	0.009608	3.958209	0.0001
@TREND	0.022814	0.000809	28.20244	0.0000
DUM1945	-0.442695	0.131587	-3.364277	0.0011
DUM1968	2.431597	0.232674	10.45068	0.0000
DUM1990	-3.659017	0.904465	-4.045503	0.0001
DUM1930	0.080874	0.043495	1.859416	0.0662

R-squared	0.983979	Mean dependent var	0.249668
Adjusted R-squared	0.982570	S.D. dependent var	0.545527
S.E. of regression	0.072021	Akaike info criterion	-2.338019
Sum squared resid	0.472024	Schwarz criterion	-2.103554
Log likelihood	125.9010	F-statistic	698.6209
Durbin-Watson stat	0.543624	Prob(F-statistic)	0.000000

GDP per capita and piece-wise linear trend



Appendix 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	Critical Value 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	Critical Value 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	-0.156686	-3.233907
	(0.16525)	(0.20894)	(0.33044)

Log likelihood 493.4480

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