



BANCO CENTRAL DE RESERVA DEL PERÚ

Monetary and Fiscal History of Peru 1960-2010: Radical Policy Experiments, Inflation and Stabilization

César Martinelli* and Marco Vega**

* George Mason University

** Banco Central de Reserva del Perú and Universidad Católica del Perú

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César Martinelli* Marco Vega†

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Abstract

We show Peru's experience of chronic inflation through the 1970s and 1980s resulted from inflationary taxation in a regime of fiscal dominance of monetary policy. Hyperinflation occurred when further debt accumulation became unavailable, and a populist administration engaged in a counterproductive policy of price controls and loose credit. We interpret the fiscal difficulties preceding the stabilization as a process of social learning to live within the realities of fiscal budget balance. The credibility of policy regime change in the 1990s may be linked ultimately to the change in public opinion giving proper incentives to politicians, after the traumatic consequences of the hyper stagflation of 1987-1990.

*George Mason University, cmarti33@gmu.edu

†Banco Central de Reserva del Perú and Universidad Católica del Perú, marco.vega@bcrp.gob.pe

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1 Introduction

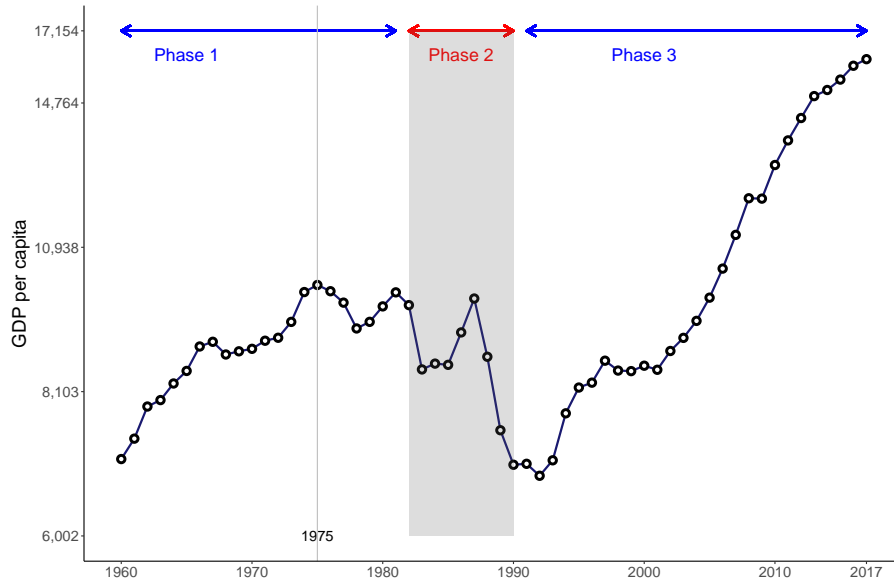
Inflation in Peru describes an extraordinary arc in the last half century, from a history of low inflation with periodic bouts of two digit inflation, to chronic, accelerating inflation since the mid 1970s, to hyperinflation in the second half of the 1980s, culminating in the successful stabilization of the 1990s. By the turn of the century, deflation more than inflation was a worry for monetary authorities. The years of chronic inflation and hyperinflation were accompanied by a precipitous decline in GDP per capita, with a steady recovery in the last twenty five years (see Figures 1 and 2). Thus, the decade of the 1980s is marked by a hyper stagflation (shaded in both figures).

In this chapter, we provide an interpretation of these historical events through the lens of the monetarist approach developed in Chapter 2. From this perspective, inflation before the stabilization of 1990 reflects the fiscal need for inflationary taxation in a regime of fiscal dominance of monetary policy. Indeed, fiscal statistics reflects recurrent cyclical fiscal deficits up until 1990 (see Figure 3). Stabilization in the 1990s corresponds to a period of monetary policy independence and fiscal moderation.

We set the stage for the analysis with two accounting exercises. First, we perform a growth accounting exercise, breaking down changes in GDP per worker in several components. The exercise shows that a massive productivity slowdown coincides with the stagflation. While unfavorable terms of trade, worse credit conditions for public debt, and unusual weather shocks contributed to the fall in GDP per worker, the productivity slowdown provides some evidence that there was a misallocation of resources as a result of the policies pursued, including extensive intervention of the state in the economy and the stop go nature of fiscal policies before 1990.

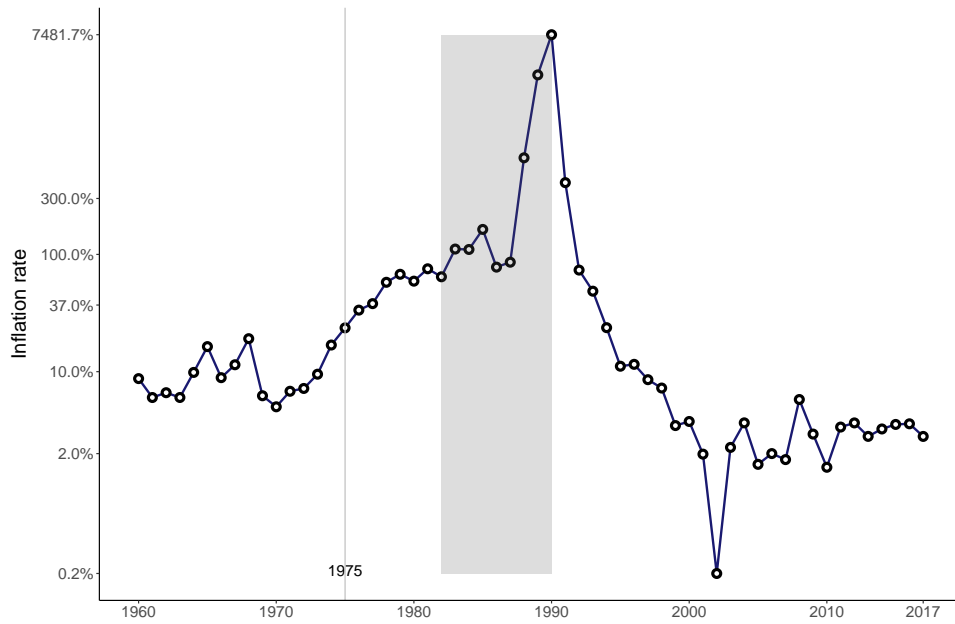
Next, we perform a fiscal accounting exercise, breaking down financing of the government in its several sources. The exercise shows that fiscal deficits were financed through inflationary taxation and through foreign debt accumulation, which overtime yield an increasing need to rely on inflation. Correspondingly, seigniorage collected by the government increased until the second half of the 1980s. Consistent with a monetarist interpretation, the stagflation period exhibited larger seigniorage and a larger flow of government financing as a percentage of GDP

Figure 1. *GDP per capita*



Note: Measured in soles of 2007. (See the Appendix for data sources for this and other figures.)

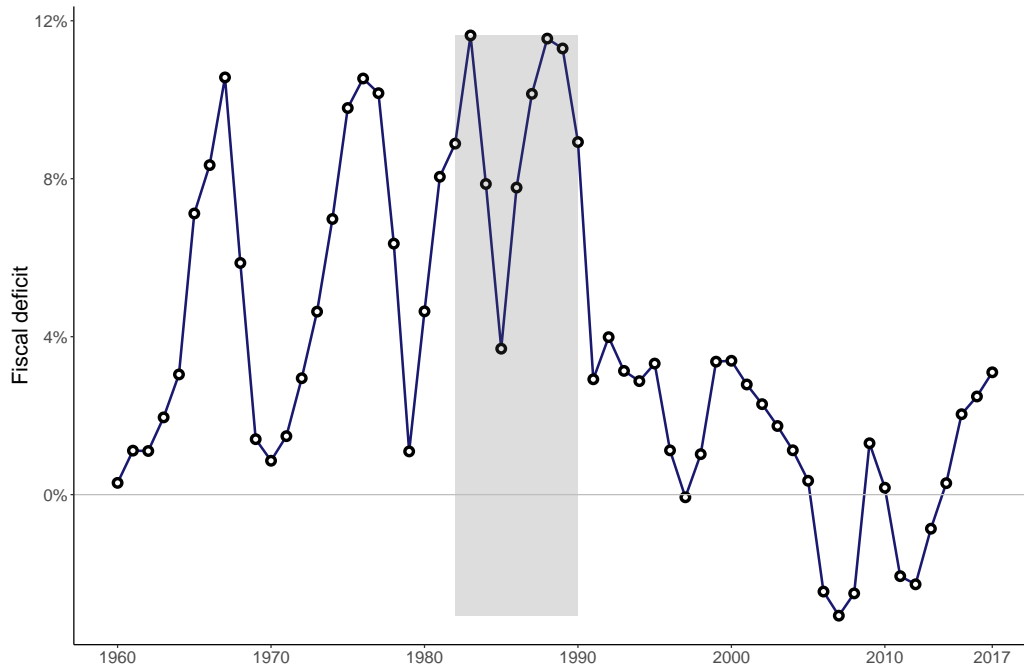
Figure 2. *Inflation*



Note: Inflation is measured in logarithmic scale.

than the preceding and the subsequent period. Stabilization in the 1990s corresponded to a fall in seigniorage to negligible levels, consistent with the interpretation of a regime change.

Figure 3. *Fiscal deficit*



Note: Fiscal deficit defined as the negative of the economic result of the non financial public sector as percentage of GDP.

We then turn our attention to the policies adopted before, during and after the stagflation, complementing the monetarist approach with an institutional perspective. We place the origin of fiscal difficulties in pent up demand for redistribution, for the provision of public services, and for public investment, against the background of a small state, with little tax collection and administration capabilities. To some extent, chronic fiscal difficulties and accompanying inflation reflect from our point of view a process of social learning to live within the realities of fiscal budget balance and the (still ongoing) development of modern monetary and fiscal institutions.

Two extreme policy experiments, in 1968-1975 and in 1985-1990, reflected a fundamental mistrust in market allocations and price incentives. There was demand both by large social groups and by intellectual elites for the government to engage in fine tuning the economy by providing “correct” incentives as opposed to those signaled by markets. The 1980s, in particular, correspond to a period of “heterodox” policies, including the attempted use of price controls and multiple exchange rates to abate inflation, with unintended, counterproductive results. The

disastrous events of the late 1980s, including the hyperinflation, may have been determinant in the change in popular attitudes regarding economic policy. Expectations turned against interventionism first as revealed by the behavior of agents in the market, then in the climate of public opinion and, last, in the plans of politicians.

The last quarter century since the stabilization has witnessed for the most macroeconomic stability. Problems other than monetary mismanagement have become focal for public opinion, notably the remarkable extent of political and judicial corruption. One can only hope that the analogy of inflation as temporary “growing pains” in the development of modern institutions extends to other areas as well.

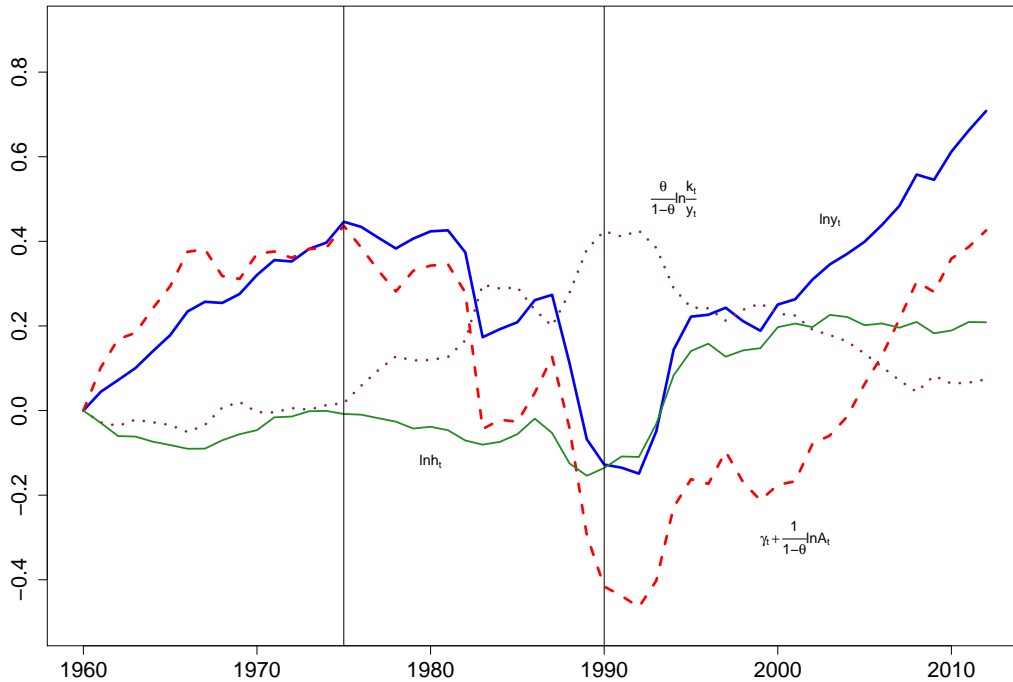
The remainder of this chapter is organized as follows. In Sections 2 and 3 we present our growth and fiscal accounting exercises. In Section 4 we discuss the onset of inflation. In Section 5 we discuss the period of high inflation and “policy follies” of the mid to late 1980s. In Section 6 we discuss the end of the high inflation period and monetary policy since. In Section 7 we turn to conclusions and challenges suggested by the Peruvian experience. We describe our data sources in an Appendix.

2 Growth accounting

It is tempting to relate directly the inflation and productivity performance evidenced in Figures 1 and 2 to the policy decisions taken by the country. From this viewpoint, the damaging policies that begat high inflation and then hyperinflation would also be responsible for the decline in productivity. To explore this viewpoint, we follow [Kehoe and Prescott \(2007\)](#) to perform a growth accounting exercise. From an aggregate Cobb-Douglas production function with share of labor θ and total factor productivity $A_t\gamma^{(1-\theta)t}$, we can derive the following expression for output per worker:

$$\ln y_t = (\gamma - 1)t + \frac{1}{1 - \theta} \ln A_t + \frac{\theta}{1 - \theta} \ln(k_t/y_t) + \ln h_t, \quad (1)$$

Figure 4. *Growth accounting: 1960-2010*



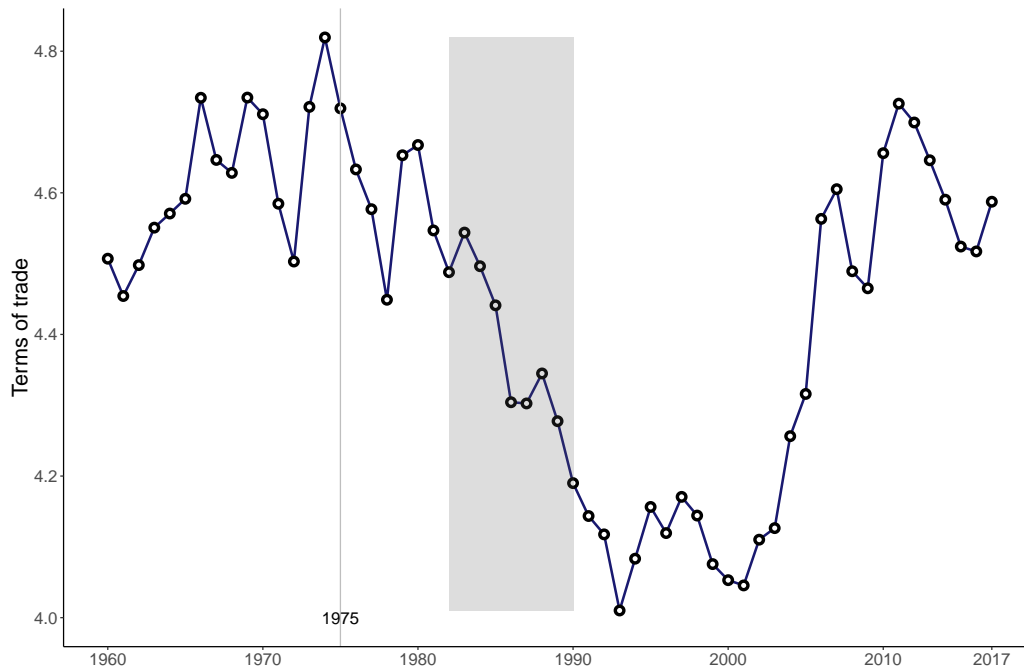
where y_t , k_t , and h_t are GDP, capital stock, and total hours worked per working-age person. The first two terms in equation 1 described the trend and stochastic productivity factors. In Figure 4 we use the decomposition given by equation 1 with data from Peru.¹

In typical depressions, like the US in 1925-1939 or Argentina in 1980-1990, the ratio k_t/y_t rises because the denominator falls sharply whereas the capital stock remains stable (see Kehoe and Prescott, 2007). Something similar happens in Peru, as observed in Figure 4. Depressions differ in the importance of productivity versus hours worked. In the case of the Peruvian depression, productivity fell way below the level at the starting point in 1960. While the contribution of total hours also fell during the recession, and like the case of Argentina in 1980-1990, the bulk of the depression is explained by the massive productivity slowdown.

The growth accounting exercise illustrated in Figure 4 supports the idea that the radical reforms of the 1970s led to a misallocation of resources behind the massive drop in total factor productivity. They could be considered as a supply shock, affecting not only the cyclical com-

¹The capital stock is from Seminario (2015); other data comes from the Total Economy Database (see the Appendix).

Figure 5. *Terms of trade*



Note: Calculated by the BCRP.

ponent of output but also its trend (as in [Aguiar and Gopinath, 2007](#)). A plausible channel is that the financing of the public sector crowded out the private sector. In the public sector, investment decisions may not have been led by efficiency considerations. Moreover, the financing of the private sector was distorted as the government put caps on interest rates and favored certain sectors. Government activity might have worsened the misallocation of resources typically observed in developing economies ([Restuccia, 2013](#)) which in turn might have been behind the productivity fall down. The stop and go nature of fiscal cycles may have affected the quality of public investment, which was subject to deep cuts during fiscal adjustments. Finally, high inflation by itself may have had consequences for productivity, since real resources were wasted as economic agents dealt with price volatility and exchange rate risk (see e.g. [Tommasi, 1999](#)).

The terms of trade series in [Figure 5](#) may advise a somewhat nuanced stance. Movements in the terms of trade for Peru reflect mineral prices determined in world markets and largely exogenous from the viewpoint of the Peruvian economy. Terms of trade for Peru took a steep decline from the mid 1970s to the early 1990s. World interest rates also hiked in the 1980s.

Thus, the hyperinflation and the deep recession of the 1980s coincided with a very adverse external environment. To the extent that an important part of production is linked to the extraction of natural resources with prices set in international markets, a declining pattern of these prices over protracted periods weakened the economy by various channels. Government revenues fell and concurrently foreign credit to the government became more expensive, which in turn dampened public investment. Private investment also suffered because of higher aggregate uncertainty and, in the case of the mining sector, lower income prospects. The fall in investment may also be linked to the fall in total factor productivity as suggested by [Castillo and Rojas \(2014\)](#).

There has been some debate about the role of bad external conditions versus bad economic policies in the Peruvian depression.² In the words of [Llosa and Panizza \(2015\)](#), bad external conditions, mistaken policies, and supply shocks like El Niño of 1982-1983 combined to create a “perfect storm.” Our empirical exercise is indicative evidence that policy responses to bad external conditions magnified the depression.

3 Fiscal accounting, public debt and seigniorage

The increased role of the state in the economy and the implementation of the structural reforms attempted by successive administrations from the 1960s on needed finance. The foremost preferred source of domestic finance was the central bank. At the time, this was perceived as a common sense solution in Peru as everywhere else (see [Goodhart, 2011](#)). In Peru, it was a customary role of the central bank to grant credit to state-owned sectorial banks with the ostensible purpose of promoting growth. These credit lines were a usual source of base money creation. Banks would then lend to private and public firms. Most of the central bank credit ended up as credit to the non-financial public sector.

The favored source of external finance was external debt, either in the form of bonds or as syndicated loans from governments, multinationals, and foreign private banks. This type of

²[Mendoza \(2013\)](#) and [Dancourt et al. \(1997\)](#) put emphasis on bad external conditions, while [Hamann and Paredes \(1991\)](#) and [Lago \(1991\)](#) put emphasis on policy mistakes. [Gonzales de Olarte and Samamé \(1991\)](#) and [Wise \(2003\)](#) attribute some of the blame for the poor performance to wide swings in economic policies.

credit was relatively cheap in the post war period; there was abundant dollar liquidity which flew towards developing economies and specially to Latin America. Peru and other countries committed what [Hausmann and Panizza \(2003\)](#) have called the “original sin” of taking debt in foreign currency instead of raising external debt denominated in their own currency. As in other cases, a determinant for the incapacity to take debt in its own currency was the relatively small size of the Peruvian economy.

To study the dynamics of public finance, we follow Chapter 2 to perform a fiscal accounting exercise. Indexed debt has not been quantitatively important in Peru³ so for the purpose of the budget constraint analysis we set it equal to zero. The budget constraint equation in Chapter 2 can be arranged in terms of flows to obtain

$$\Delta\theta_t^n + \Delta\theta_t^*\xi_t + \Delta m_t + m_{t-1} \left(1 - \frac{1}{\pi_t g_t}\right) = d_t + \theta_{t-1}^n \left(\frac{R_{t-1}}{\pi_t g_t} - 1\right) + \theta_{t-1}^* \xi_t \left(\frac{r_{t-1}^*}{\pi_t^w g_t} - 1\right). \quad (2)$$

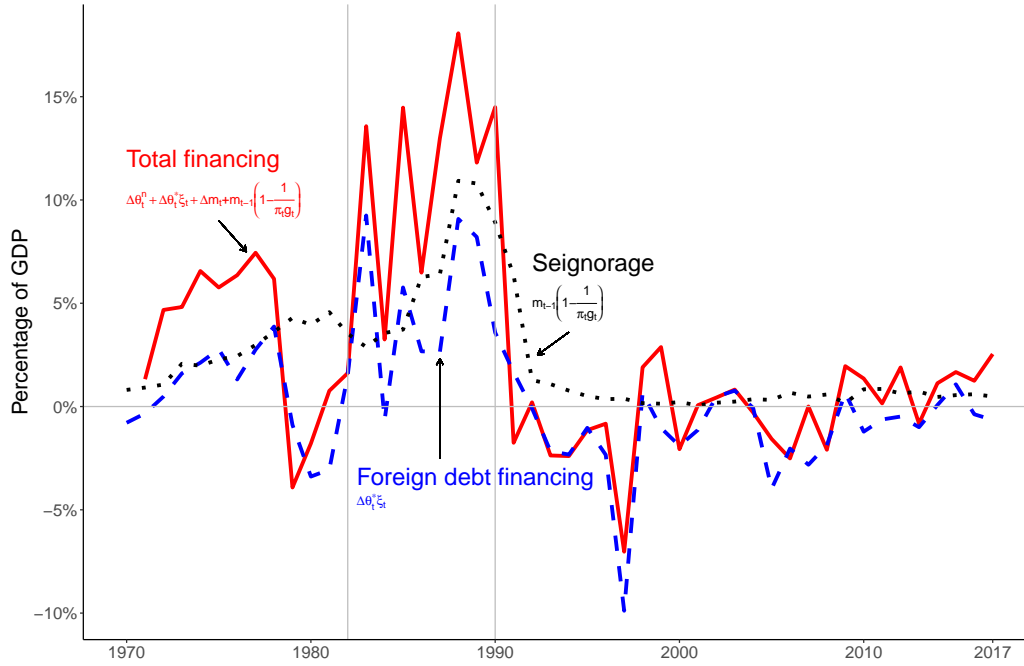
The left-hand side of equation 2 represents the *sources of finance*. $\Delta\theta_t^n$ is the change in domestic gross debt as a percentage of GDP, $\Delta\theta_t^*$ is the change in foreign gross debt as a percentage of GDP (expressed in US dollars), ξ_t is the real exchange rate, Δm_t is money creation as a percentage of GDP, and the term $m_{t-1} \left(1 - \frac{1}{\pi_t g_t}\right)$ is seigniorage, where m_{t-1} is the previous period money supply as a percentage of GDP, π_t is the gross general inflation ratio, and g_t is the gross GDP growth.

The right-hand side represents the *overall fiscal deficit*. The term d_t represents an augmented primary deficit measured as a percentage of GDP, and is the sum of the primary deficit minus implicit or explicit transfers such as privatization⁴ proceeds which became relevant in the 1990s. R_{t-1} is the gross nominal interest rates on domestic debt, r^* is the gross nominal interest rate on foreign debt and π_t^w is gross tradable inflation, so the last two terms of equation 2 are the domestic and foreign public debt interest payments. In order for equation 2 to hold exactly, the level of transfers adjusts as a residual. This residual is obtained by comparing the total government financing in the left-hand side and the fiscal deficit, that is the economic result of

³There is no reliable data prior to the 1980s about public debt issued at a constant real interest rate. Since 2002 the government issues inflation adjusted sovereign bonds but its stock has never been above 1 percent of GDP.

⁴The usual statistical methodology, however, treats privatization proceeds as financing.

Figure 6. *Government financing and selected components*

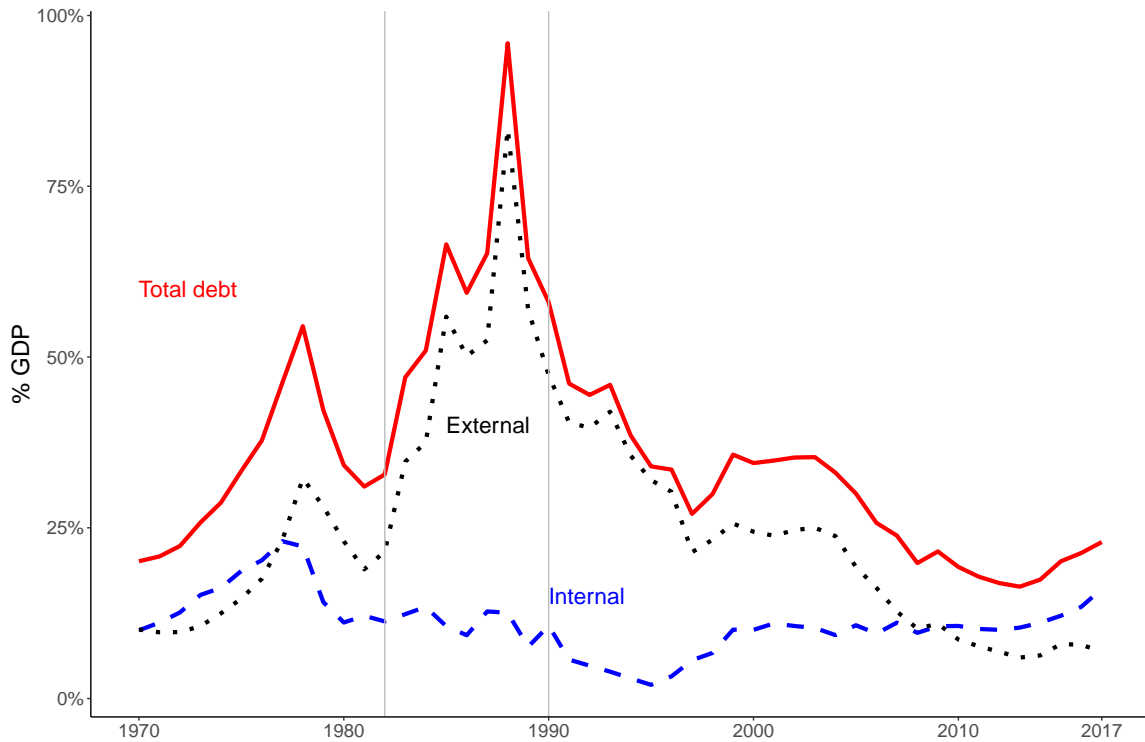


the non-financial public sector (with a sign change) which, in theory, should be the right-hand side of equation 2.

Figure 6 plots the total flow of government financing (left-hand side of equation 2) and its two most important components for the Peruvian case: foreign debt financing (slashed line) and seignorage (dotted line). During the stagflation period, the flow of government financing is both higher and more volatile than before and after. The volatility is explained in part by (i) real exchange rate volatility (see Figure A-3), affecting the valuation in soles of foreign debt financing, and (ii) the behavior of GDP. During high to hyperinflation, measuring relative prices such as the real exchange rate becomes problematic. The peaks of government financing in 1983 and 1988 correspond to falls of GDP of 11.9% and 16.8%. (In 1989, remarkably, GDP further shrinks by 14.7%.)

Before the stagflation of 1982-1990, there is a slow buildup in government financing that is broken in 1978 as a reflection of stability measures adopted at the time. All sources of government finance shrink then except seignorage which stabilized temporarily. After some

Figure 7. *Domestic and external debt as percentage of GDP*



respite in the early 1980s, seigniorage continues increasing until the late 1980s. As seen in Figure 2, this is also a period of creeping inflation, consistent with a monetarist view. After the stagflation, all sources of government financing, including seigniorage, fell sharply, consistent with the view of a regime change away from fiscal dominance around 1990.

Understanding shorter term fluctuations in the relation between inflation and seigniorage of course requires taking into account the role of expectations in the desire of the public to hold real money balances. In the mid 1980s, inflation abates temporarily during the initial phase of the heterodox plan, even though seigniorage is increasing. In the late 1990s, per contra, seigniorage starts falling while hyperinflation ensues, which seems to indicate the economy to be on the wrong side of the Laffer curve.

Figure 7 shows that domestic debt is negligible while external debt grows from about 25 percent in 1975 to a peak above 75 percent at the end the 1980s. As in the case of government

financing, short term fluctuations in external debt as percentage of GDP in the 1980s are a consequence of movements in the real exchange rate and GDP. The country was in arrears since the early 1980s, explicitly so since 1985, so there was no new foreign credit to the government. Isolating the effects of movements in the real exchange rate, public debt grew through the stagflation (see Figure A-5 in the Appendix). As argued in Chapter 2, higher debt ratios may hamper the capacity to rely on more debt financing. In a sense, there is some limit to the capacity of the government to rely on external debt. Reaching the limit implies ever more reliance on seigniorage which is the key source of inflation.

Note that the level of debt falls through the 1990s. Public debt with foreign creditors was successfully renegotiated, with considerable help from foreign governments which were eager to ease Peru back into the global financial system after the period of default of the 1980s.⁵ Given the high debt to GDP ratio, in relation to the ability of the government to collect taxes, the renegotiation of the debt appears as the linchpin of the successful stabilization effort. News about the start of the renegotiation contributed to the improvement of credibility of the stabilization program and the abatement of inflation expectations.⁶

The overall picture of government financing in Figure 6 is affected by the existence of transfers which are not fully accounted in the official data, and because of changes in the real exchange rate. Recall that transfers adjust in equation 2 as a residual. Moreover, regarding the debt service, the specific interest rates are not unique because of the various maturities and interest rates implied for each maturity.

Figure 8 plots the fiscal deficit and the total flow of government financing (left-hand side of equation 2), and Figure 9 the transfers obtained as a residual. During the 1970s and the first half of the 1980s, fiscal deficit is larger than the flow of government financing. This means that the government is financed from other sources; a key source is the credit of the financial public sector. As mentioned, the central bank would lend to state-owned banks and these banks would lend to the non-financial public sector. In essence, this lending represents domestic debt that has not been properly recorded as such, nor repaid, and therefore acts as a hidden money

⁵ See e.g. Abusada (2000).

⁶ Velarde and Rodríguez (1992b).

Figure 8. *Fiscal deficit and government financing*

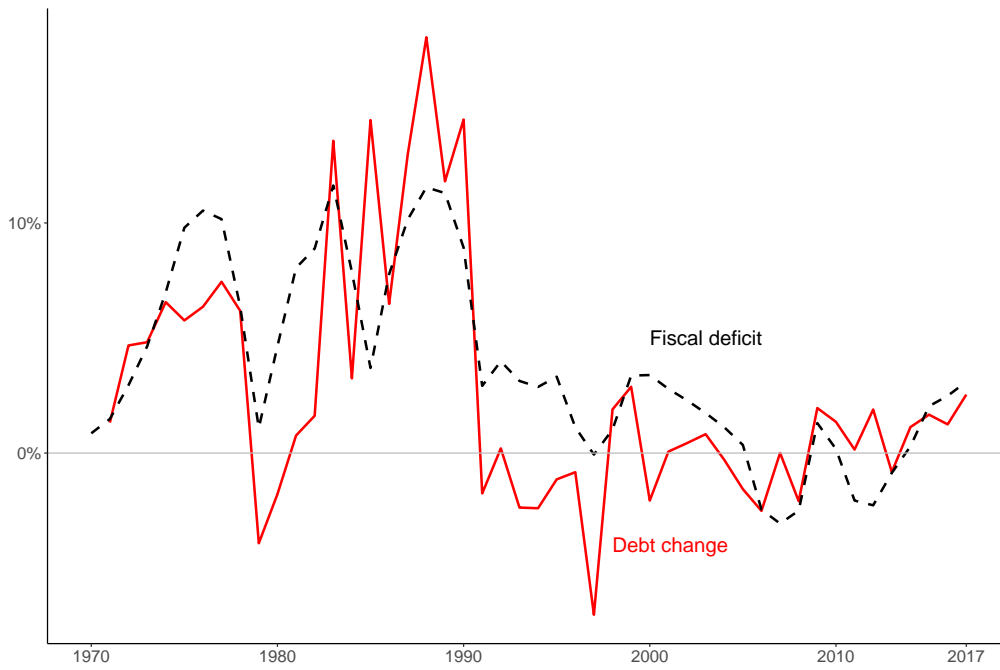
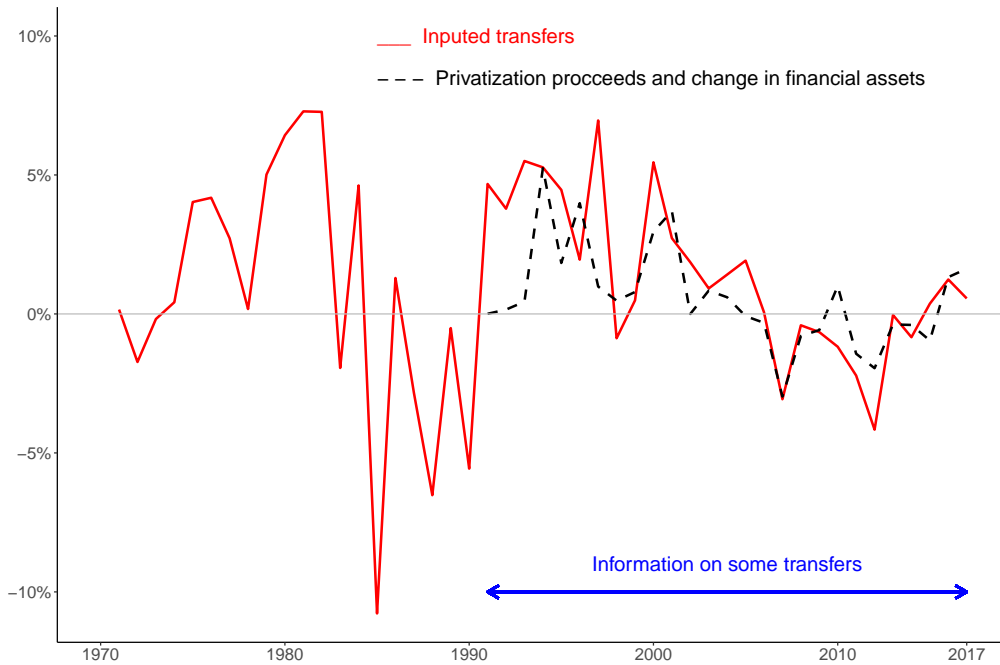


Figure 9. *Inputed transfers and privatization proceeds*



finance. If we include it in the overall debt position, total debt would have been much higher.

During the second half of the 1980s, per contra, fiscal deficit is smaller than the flow of government financing. Some of the flow of government financing reflects hidden subsidies by the central bank to imports and to credit that were not properly accounted as fiscal deficit.⁷

During the 1990s, fiscal deficit is again larger than the flow of government financing. The adjustment is made by privatization proceeds, as illustrated in Figure 9. The sell of state-owned enterprises is considered as a financing item “below the line” that implies less need of debt financing. Another important source of transfers since 1999 is a fiscal stabilization fund. We have performed a few counterfactuals regarding the level of debt, were transfers are kept at a level of zero, and using information about transfers since 1990 (see Appendix A).

4 The onset of inflation

Since independence, Peruvian economic history has been characterized by large export cycles, linked to the boom and bust of the international prices of the raw materials exported by the country. At least until the 1960s, a small group of families, know locally as the *oligarquía*, owned the most important economic assets, sometimes in association with foreign capital. The oligarchy also held considerable political clout through patronage and influence over the army.⁸

In consonance with the concentration of wealth and political power, the Peruvian state was kept small. Fiscal revenue came from easy-to-collect taxes, like import tariffs, fiscal stamps and profit taxes. Until 1964, taxes were collected and governments payments made through privately owned institutions. Official fiscal statistics were done by the Office of the Comptroller General which provided a monthly balance sheet of central government payments and cash receipts. Financial control over the decentralized agencies and public enterprises was difficult for there was no standardized accounting.⁹ Peru also lacked a tradition of government service.¹⁰ In the terms of Besley et al. (2013), Peru was a “weak state,” with a limited power to extract

⁷This is the quasi-fiscal deficit referred to Section 5.

⁸Thorp and Bertram (1978) and Bourricaud (2017) are classical references for the economic history of the country and for a social and political portrait of the country in the 1960s.

⁹This has made it difficult to extend backwards our fiscal statistics.

¹⁰See e.g. Kuczynski (1977).

revenues from its citizens on a mass scale.

In spite of the apparent immobilism of Peru's economy and politics, the country underwent important changes in urbanization and education since the 1930s. Urban population went from 10% in 1930 to 47% in 1960 (UN, 1969). Migration to the capital, Lima, from the highlands and the increase in the literacy rate deeply changed the franchise, since literacy was a requirement for voting. Reformist and radical ideas spread beyond intellectual elites, including to the upper echelons of the military. In 1963 a politician with an explicit reformist program, Fernando Belaúnde, was elected president.

Belaúnde administration (1963-1968) started an overhaul of public finance institutions, including the centralization of the financial management of the public sector in the newly created *Banco de la Nación*. The government engaged initially in a massive increase of expenditure for construction (roads and other public works) and outlays for education and health. The efforts of the administration to increase fiscal revenue were thwarted by Congress, where the opposition was in the majority. The result was a "war of attrition" between the branches of government. Efforts to attract long term debt to finance public investment may have been thwarted by a conflict with a foreign oil company, IPC. Lacking any alternative, the expansion of public spending induced the central bank to increase domestic credit. With a regime of fixed exchange rates, inflation in domestic goods and losses in foreign currency reserves followed. A balance of payments crisis à la Krugman (1979) ensued, prompting a sizable exchange rate devaluation in 1967.

The devaluation of 1967 was the first in several years. A once-and-for-all devaluation episode works like a transitory shock on inflation. Given monetary conditions, inflation should have risen and fallen as indeed was the case. From 1975 onwards the exchange rate policy changed. Devaluations became more persistent and timed, as illustrated in Figure 10. Exchange rate increases no doubt fueled into inflation in the tradable component of prices. An unfortunate consequence may have been the idea that devaluation and not monetary conditions *caused* inflation; later on, as we discuss below, governments would try to curb inflation by fixing exchange rates and dealing with balance of payments difficulties via exchange controls.¹¹

¹¹Kuczynski (1977) provides an insightful insider look at the Belaúnde administration. According to Kuczynski,

Figure 10. *Devaluations*



Note: Percentage increase in official exchange rate.

Congress finally relented approving tax increases in 1968. The evolution of fiscal deficit during the Belaúnde administration, including the closing of the fiscal gap starting in 1968, is the first cycle in Figure 3, and it is one of several such cycles. The economic crisis and frustration regarding unfulfilled promises by Belaúnde (like land reform and a solution to the vexing conflict with IPC) contributed a military coup in 1968.

The new military regime, the so called Revolutionary Government of the Armed Force (1968-1975), started far reaching institutional and structural reforms well beyond land redistribution. The role of the public sector in the economy expanded via the nationalization of private firms in oil, fishing, mining, food processing, and manufacturing. The reforms also included incentives to national investors to substitute imports and promote industrialization, and extensive import controls. The ostensible purpose of the reforms was to broaden social and economic development and achieve social justice; indeed the military dictatorship styled itself a “social democracy with some officials in the Belaúnde administration perceived inflation as an inevitable collateral effect of development and not necessarily an evil. This corresponds to the Latin American “structuralist” view on inflation at the time. In that vein, Baer (1967) predicts that “runaway inflation” will not happen in the region.

full participation.”¹² Though possibly well-meaning, the distortions introduced by extensive intervention¹³ may help explain the dramatic fall in productivity in the economy in subsequent years.

During the first few years of the military dictatorship, current revenues remained stable around 24 per cent of GDP, while total expenditure rose from 25 percent of GDP to near 34 percent in 1974. Figures 11 and 12 illustrate the dramatic increase in expenditures and revenues of state-owned firms.¹⁴ Behind the increase in expenditure was a major public investment effort, including big mining projects. (See Figure 13.) Concurrently, financing of the public projects crowded out credit to the private sector.¹⁵

Besides large public investment projects, a source of spending was an arm race between the military rulers of Peru and Chile, illustrated in Figure 14. Fiscal expansion was supported with inflationary finance and foreign debt accumulation. Unfortunately, prices for Peruvian exports took a plunge, balance of payments difficulties hit the country in 1974-1975.

A palace coup ensued, starting the so-called Second Phase of the Revolutionary Government of the Armed Force (1975-1980). The new military junta adopted a stabilization policy with support of the IMF, freeing the exchange rate and adopting drastic across the board spending cuts, including cuts in funding for ongoing investment projects. The cost of fiscal adjustment contributed to the increasing unpopularity of the government. After calling for elections to a constitutional assembly that was to enshrine the irreversible achievements of the military regime, followed by presidential elections, the military returned to the barracks in 1980.

The evolution of fiscal deficit during military rule, lumping together both phases of the Revolutionary Government, corresponds to the second cycle in Figure 3. In spite of the fiscal effort, inflationary finance remained high during the Second Phase, corresponding to the plateau in the late 1970s in seigniorage in Figure 6. Accordingly, inflation remained high, reaching near 67% in 1979 and 59% on 1980. These were historical records for the country (see Table B-1).

¹²The contributions to McClintock and Lowenthal (1976) provide an in-depth look at the military regime.

¹³Documented by Schydrowsky and Wicht (1979) and others.

¹⁴In the accounts of Peru’s Central Bank, the nonfinancial public sector is equal to the general government plus state-owned enterprises; general government is equal to central plus local governments.

¹⁵See e.g. Rivera (1979) and Pastor (2012).

Figure 11. *Expenditure of central government and state-owned enterprises*

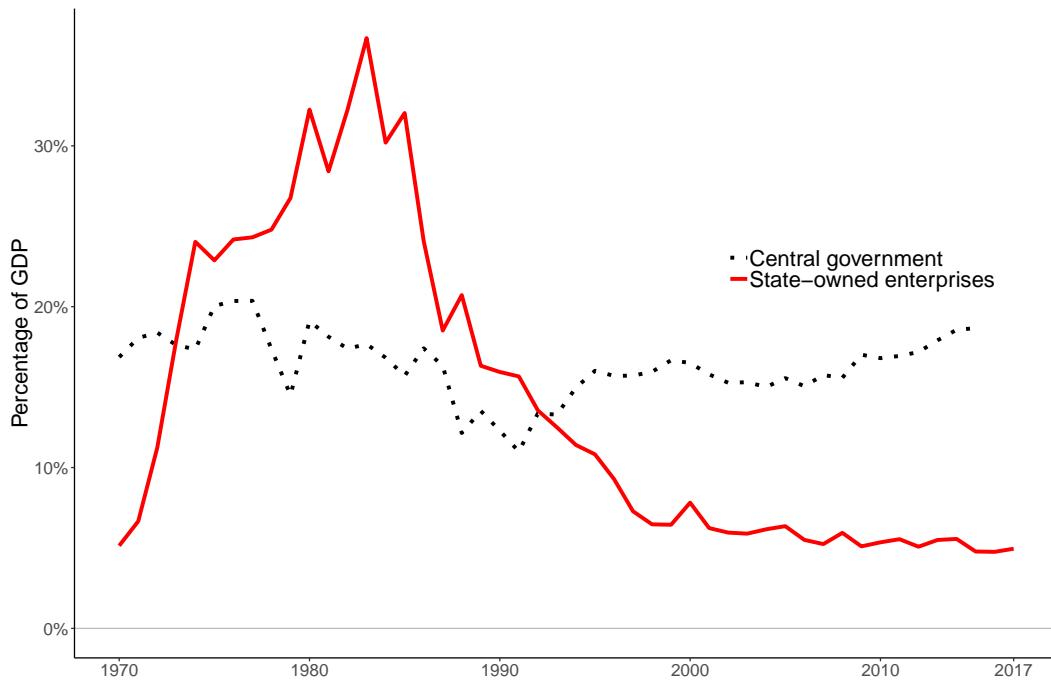


Figure 12. *Revenue of central government and state-owned enterprises*

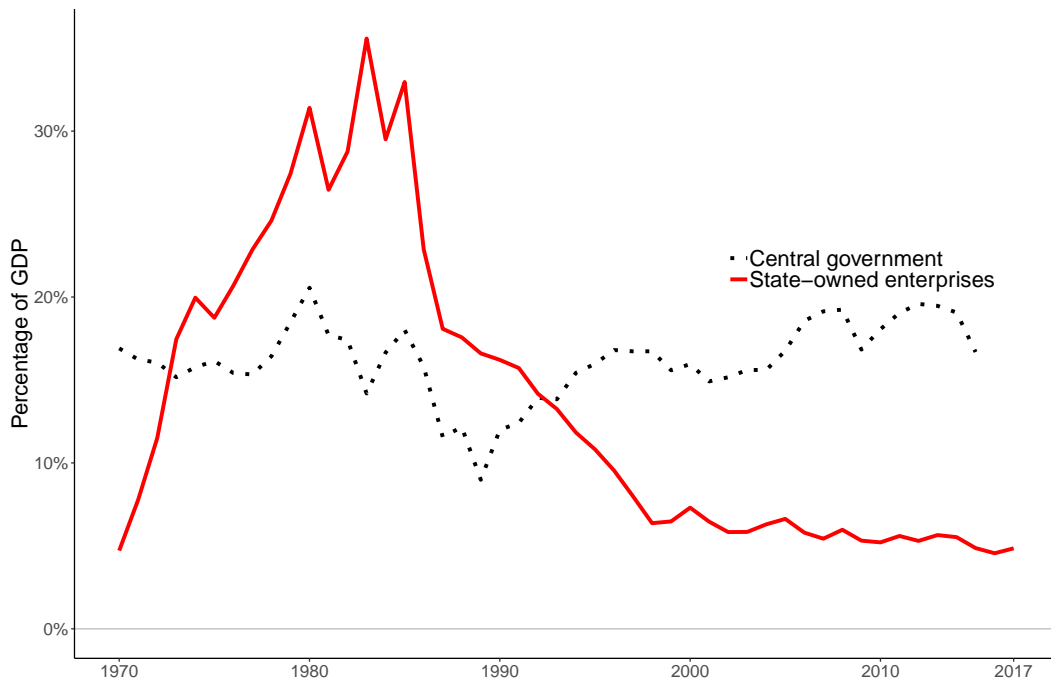


Figure 13. *Capital expenditure of state-owned enterprises*

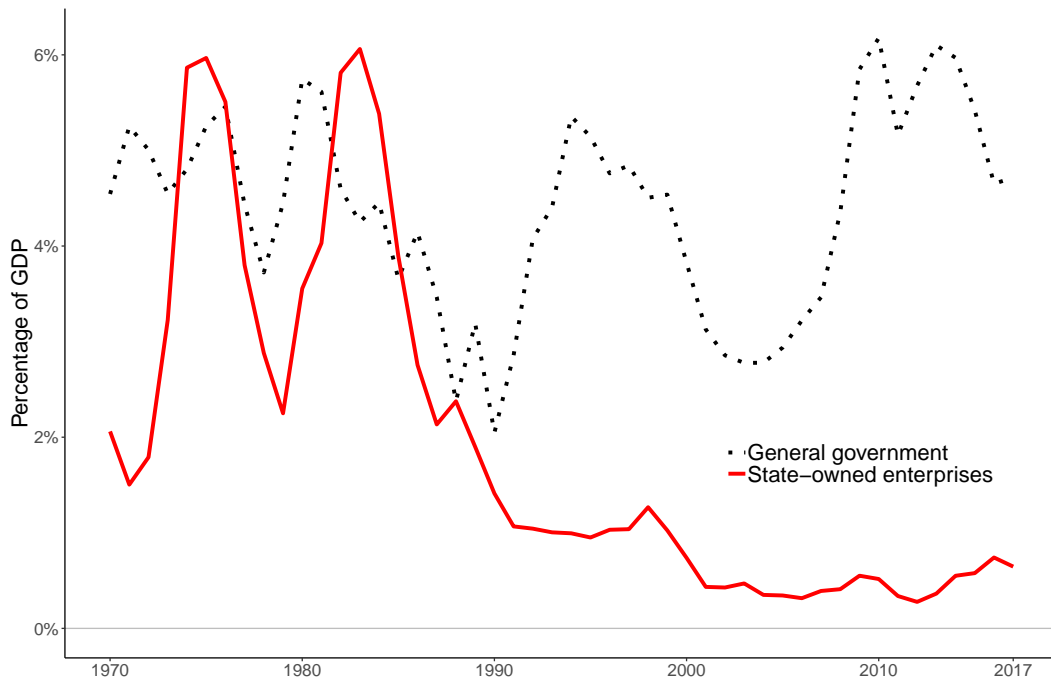
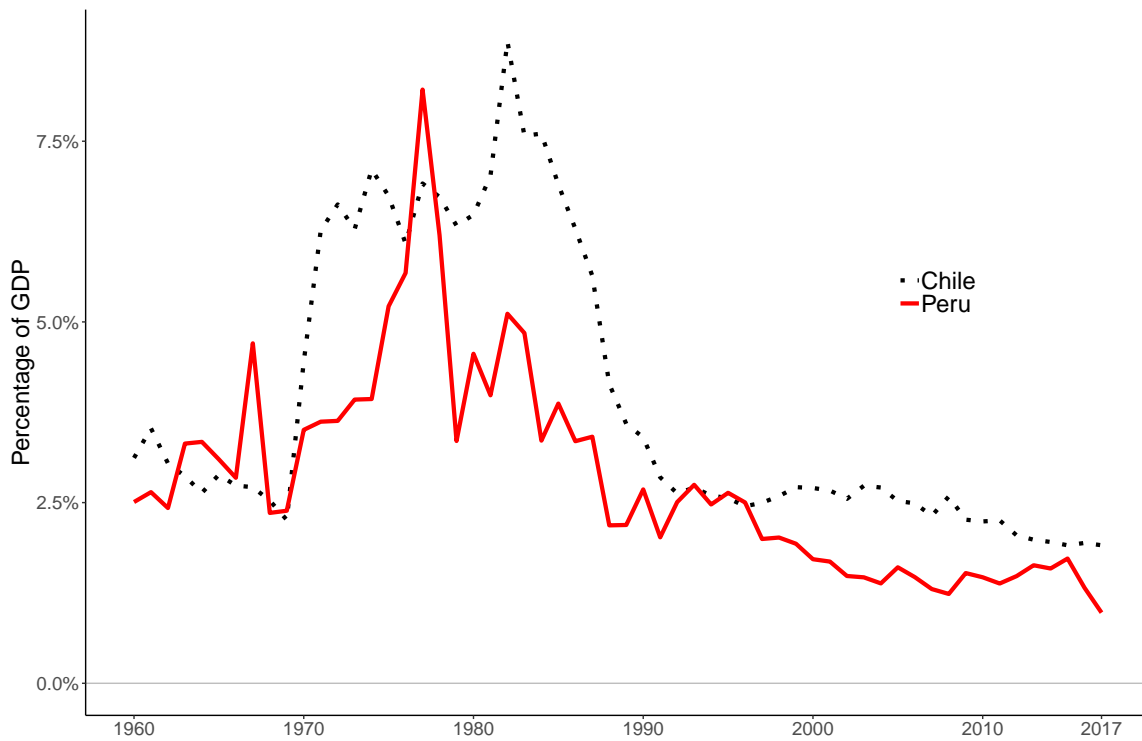


Figure 14. *Military spending*



5 Supply shocks, policy follies, and hyperinflation

The elections of 1980 returned to government Fernando Belaúnde, the same politician that the military had deposed in 1968. The second Belaúnde administration (1980-1985) started on a promising note, including recovering favorable international prices. As in the past, Belaúnde's second administration favored salary increases in the public sector and an increase spending in some of the old favorite projects, this time financed with new foreign debt (see the uptick in Figure A-5). From 1982 on, the government was hit by a combination of adverse shocks, including drying out of foreign finance, worsening interest rates on the extant debt and an extraordinary negative weather shock, el Niño of 1982-1983. Policy responses included cuts in public investment, an undeclared policy of arrears in debt payments, and resource to inflationary finance.

The rise and fall of fiscal deficit during Belaúnde's second administration is visible as the third fiscal cycle in Figure 3. Inflation surpassed 100% in 1983 for the first time and reached 163% in 1985 (see Table 1). Though inflation became a concern of policymakers, a widespread view was that inflation was not necessarily a monetary phenomenon and could originate in cost pressure.¹⁶

The elections of 1985 installed in the government Alan García. The Garcia administration (1985-1990) embarked on an ambitious policy experiment dubbed as the heterodox experiment or as Dornbusch and Edwards (1990) put it, an experiment in macroeconomic populism.¹⁷ Carbonetto et al. (1987) provide a blueprint for economic policy during the Garcia administration. In their diagnosis, inflation on manufactured goods was a result of cost pressure. For those goods, the supply curve had a *negative* slope, with ample unused production capacity. A fiscal and monetary expansion then at the same time would increase production and reduce prices.

The Emergency Plan of 1985-1986, detailed in Table 1, implemented the heterodox policies. The aim was to shut down inflationary expectations via a generalized price control and freezing

¹⁶In 1982, for instance, the central bank president, an accomplished economist on his own, would write that stopping inflation necessitated a voluntary agreement between workers, business and government, and would quote approvingly that monetarism is a theology, and central banks are not theology schools (Webb, 1985).

¹⁷Heterodox policies have been studied by Lago (1991), Caceres and Paredes (1991), Hnyilicza (2001) and Velarde and Rodríguez (1992a), among others.

Table 1. *Heterodox Peru: August-September 1985*

Fiscal policy	Monetary policy	Exchange rate policy
- Reduction of selective taxes	- Lending rate of commercial banks:	- Initial 12% devaluation and
- Reduction of sales tax from 11% to 6%	gradual reduction from 280% to	subsequent freeze of official rate
- Enhanced tax exemptions to selected	40% annual rate	- Later, introduction of multiple
sectors on sales tax, import tariffs,	- Saving rate (one year deposits):	exchange rates for exports
and other taxes	gradual reduction from 107% to 31%	and finally for imports as well
- Freeze of public-sector prices and	- Lending rate by Agrarian Bank:	
tariffs. In February 1986, reduction	a. Regular rate reduced from 116% to 25%	
of water and electricity tariffs	b. Zero interest rate for	
by 20% and of prices of petroleum	Andean highland farmers	
products by 10%		
- Authorize Treasury bonds issues		
Prices	Labor	
- Freeze of all prices	- Periodic nominal hikes so as to reach a 7% annual increase in real terms	
- Later periodic adjustments and	In practice, minimum real wages rose 34% in the 17-month period	
liberalization of most agricultural	- Tax exemption to employees on the share of income tax paid by them	
prices	- Two one-time interest-free loans to civil servants	
- Creation of a price authority (CIPA)	- Reduction of probation period from three years to three months. stability laws.	
coordinated by the Ministry of	- Establishment of PROEM allowing firms to hire temporary workers for up to two	
Finance	years without adhering to labor stability laws	

Source: Lago (1991) and Velarde and Rodríguez (1992a)

the exchange rate, while simultaneously easing credit to increase demand in the economy and achieve redistribution. In parallel, the policy of limiting debt payments contributed to relax the external constraint in the economy. The initial effect was a temporary recovery of GDP per capita and a lull in the inflation rate, both visible in Figures 1 and 2.¹⁸ The initial lull in inflation is consistent with the idea of a cosmetic stabilization in the sense of Sargent et al. (2009), that is a reset in inflation and beliefs without a reduction in underlying seigniorage.

In fact, the heterodox program increased the need for inflationary finance through several channels. Freezing the prices of state-owned enterprises led to larger deficits of these firms. All exchange flows were controlled by the central bank; after the bank started losing reserves, it increased the exchange rate for exports above the one for imports. This was equivalent to a subsidy to imports, which was monetized. Interest rates to the Agrarian Bank were subsidized; the flow of credit to this bank was important.¹⁹

Monetizing the fiscal deficit and the losses of the central bank and state-owned enterprises was going to have a strong impact on inflation, which rebounded from 1987 on, while international reserves got depleted. As a reaction, the government attempted to nationalize the banking industry, which was blamed for the failure of the program. Doubling down on failed policies seems to have been a version of the “gambling for resurrection” idea portrayed by Majumdar and Mukand (2004). In an extraordinary turn of events, popular resistance made impossible the takeover of the banking industry. The protests against the bank takeover seem to have been a turning point in popular opinion regarding the role of the state in the economy.²⁰

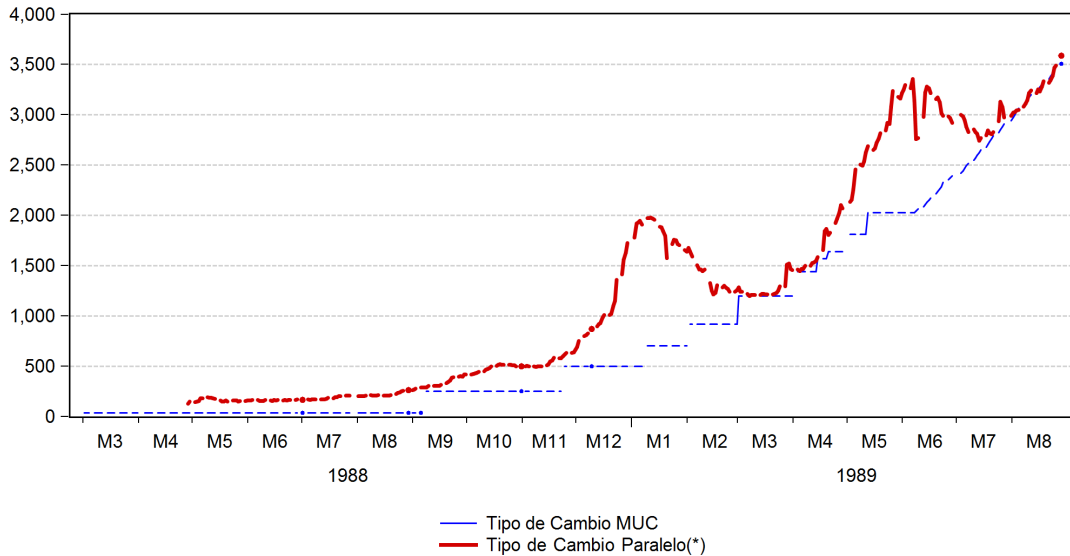
Figure 15 illustrates the behavior of the official exchange rate and the black market exchange rate. The official exchange rate, known as “Mercado Único de Cambios,” was kept frozen until September 1988. Then an attempt to correct the exchange rate lag and lags in other controlled prices led to a 757% devaluation as part of a stabilization attempt popularly named “el Salinazo,” after the then minister of finance Abel Salinas. Successive devaluations reflect

¹⁸Dornbusch and Edwards (1990) note a similar phase of initial success in other macroeconomic populist episodes in the region.

¹⁹Choy and Dancuart (1990) calculate that the quasi fiscal deficit, comprising import subsidies via exchange rate differential by the central bank, and credit subsidies by the Agrarian Bank, was 3.4% in 1986, 4.9% in 1987, 6.6% in 1988 and 2.7% in 1989.

²⁰The Peruvian writer Vargas Llosa (1993) provides a first person account as one of the protagonists of the protest.

Figure 15. *Official (Mercado Único de Cambios) vs black market exchange rates*



an attempt to correct the exchange rate gap. Multiple legal exchange rates other than the one still named “Mercado Único de Cambios” were introduced, with the central bank determining the appropriate rate for each transaction.

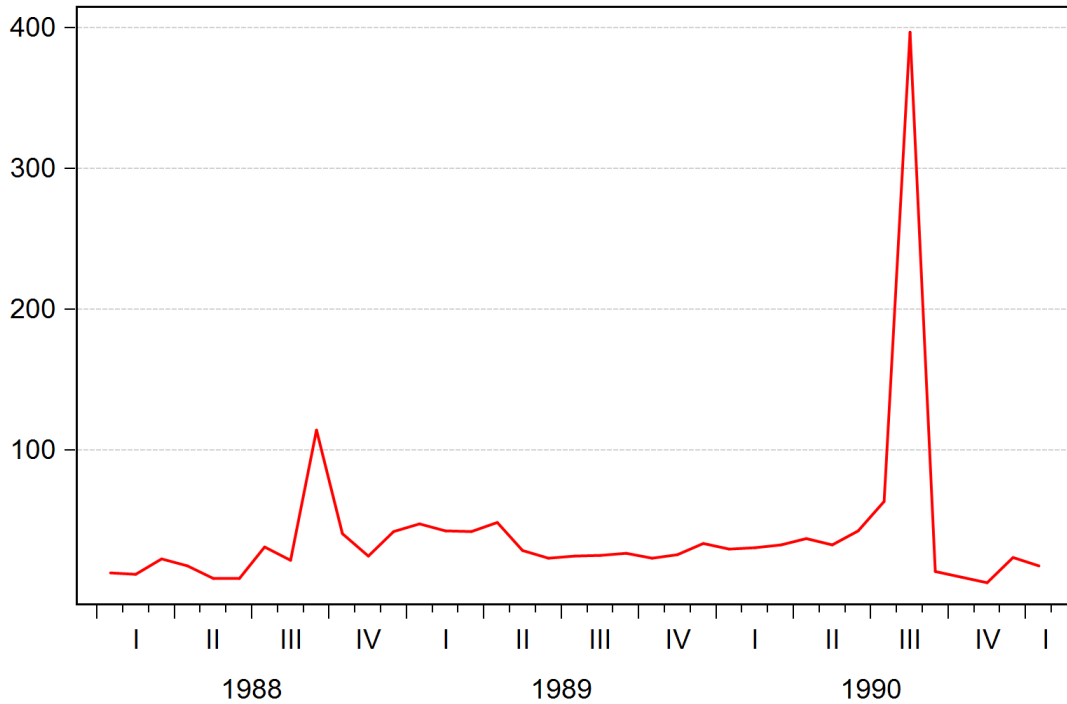
The monthly inflation rate in September 1988 was 114% (Figure 16). Peru had hit hyperinflation. Monthly inflation rates afterwards hovered in between 23.05% and 48.64%. In July of 1990, the last month of the Garcia administration, monthly inflation hit 63.23%.²¹ The incoming administration of Alberto Fujimori implemented another large correction of exchange rates and controlled prices in August 1990, popularly named “el Fuji shock.” The monthly inflation rate was 396.98%. We look at details of the stabilization of 1990 in the next section. It is instructive to notice, however, that unlike “el Salinazo,” “el Fuji shock” was followed by several weeks of deflation.²² The reaction to the two big adjustment in controlled prices reflects different expectations; from our viewpoint, economic agents (correctly) anticipated a change in regime in 1990.

The conventional definition of hyperinflation is an inflation rate of at least 50% in a month.

²¹See the corresponding yearly and monthly inflation rates in Tables B-1 and B-2.

²²See e.g. Velarde and Rodríguez (1992a). Deflation was over before the end of September so it is not captured by monthly rates in Table B-2.

Figure 16. *Monthly inflation and the hyperinflation episodes*



Note: Peaks in September 1988 and August 1990 correspond, respectively to “el Salinazo” and “el Fuji shock.”

The hyperinflation ends when the monthly inflation falls below 50% and stays below for at least a year (Cagan, 1956). Using such metric, Peru experienced two hyperinflation episodes, September 1988 and July-August 1990.²³ In an environment of controlled prices, with rampant scarcity, black markets, and hoarding in anticipation of official price adjustments, the conventional definition may be inadequate. Seigniorage starts falling in the last years of the Garcia administration (Figure 6), which we see as evidence of being on the wrong side of the Laffer curve.

It is worth noting that the expenditure and revenue of state-owned enterprises fell through the stagflation years (see Figures 11 and 12). State-owned enterprises were shocked on the revenue side by lagging prices and on the expenditure side, like the remaining of the public sector, by lagging salaries respect to inflation. Tax revenues fell from about 12.20% of GDP in 1986 to 6.5% in 1989, as a consequence of the Olivera-Tanzi effect, while expenditure fell due

²³Hanke and Krus (2013) ranks them as 12th and 37th among 53 hyperinflation episodes in the world.

to lagging salaries. In a disorderly, painful way, fiscal adjustment started during the Garcia administration, corresponding to the fourth, last fiscal cycle in Figure 3. The de facto retreat of the state from the economy during the hyperinflation is vividly described by Webb (1991). Inflationary expectations, however, would not budge until a perceived commitment to a regime change away from fiscal dominance of monetary policy.

6 Stabilization and its aftermath

By early 1990, Peruvian economy and society were in disarray. Besides recession and hyperinflation, the country was hit by violent guerrillas, whose activities included murders, bombings and blackouts. There was also considerable political uncertainty, with waning support for traditional political parties, after the perceived failures of Belaúnde and García.

An unknown outsider, Alberto Fujimori, won the presidential runoff elections in June 1990. The Fujimori administration came to power without a coherent team of advisers, a program for governing, or any indication of who would hold the key positions in the government. In terms of the economic policy debate, two distinct sides emerged in the run-up to Fujimori's inauguration and the implementation of the economic program: one side favored an exchange rate-based stabilization program, while the other leant toward a money-based program.

The monetary approach was not popular because it was associated with a deeper recession; the Bolivian 1985 stabilization, in particular, was a fresh case. Stabilization in the early 1980s in the US and the UK had relied on reducing the growth of monetary base to fight relatively high levels of inflation for those countries, but were considered to have been costly. A hard exchange rate anchor, however, was hard to conceive given the demolition of government credibility during the preceding administration. There was also the perception that the correct exchange rate was hard to determine administratively given the grave distortions during the previous years, so it was better to leave flexibility to the market.

In August 1990, the long-awaited stabilization program was announced via national television broadcast. The dramatic closing line of the announcement, capturing the feeling of uncertainty about the results, was *Que Dios nos ayude* (May God help us). Key stabilization policies are

Table 2. *Main stabilization policy measures: August 1990*

Exchange rate policy
<ul style="list-style-type: none">- One time exchange rate devaluation to a sufficiently high level- Since then, managed floating exchange rate regime- System of multiple exchange rates was unified- Most import restrictions were removed- The minimum tariff was set to 10% and the maximum to 50%
Monetary policy
<ul style="list-style-type: none">- A monetary anchor based on the control of the growth of base money, implemented through a yearly monetary program- A reduction of banking reserve requirements to alleviate financial repression; the marginal rate was reduced from 80 to 64%- Foreign currency deposit in the domestic banking continued to be allowed- Interest rates for assets and liabilities in the banking system were allowed to be market determined
Fiscal policy
<ul style="list-style-type: none">- A set of fiscal austerity measures, including a ban on new procurement processes- Increases in regulated utility prices, controlled by state-owned enterprises: gasoline (3040%), electricity (5270%), water (1318%), and others- Creation of the Budget Committee (Central Bank, Finance Ministry and Revenue Authority) to ease the monetary control process- Removal of exemptions to VAT, excise taxes, and tariffs
Wages
<ul style="list-style-type: none">- Exceptional 100% bonus- Minimum wage was increased by 400%- Ban on new wage increases in the public sector until December

Source: [Velarde and Rodríguez \(1992b\)](#)

detailed in [Table 2](#). In contrast to other stabilization programs implemented in the region, the Peruvian program used a monetary anchor with an administered exchange rate. On the real side, the stabilization program took place along a drastic structural reform agenda aimed at deregulating markets and reducing the direct economic activity of the state. As a result, price controls were removed, along with subsidies and caps to interest rates. The capital market was liberalized and the exchange market was unified.²⁴

²⁴Accounts of the stabilization and monetary policy afterwards include [Terrones and Nagamine \(1993\)](#); [Kiguel and Liviatan \(1995\)](#); [Ishisaka \(1997\)](#); [Guevara \(1999\)](#); [Pasco-Font \(2000\)](#); [Velarde and Rodríguez \(1992b\)](#); [Rodríguez et al. \(2000\)](#); [Mishkin and Savastano \(2001\)](#) and [Hnylicza \(2001\)](#).

The stabilization program relied on two pillars. The first pillar was a strong commitment to cut inflationary fiscal finance. The government committed not to ask for any financing from the central bank, except for an emergency loan to cover the initial salary increases, which was repaid to the central bank in thirty days, as promised (Velarde and Rodríguez, 1992a). Later, the Central Bank Organic Law of 1993 explicitly ruled out government financing by the central bank. The second pillar was a market-friendly approach to policy which translated into freeing the exchange market, after eliminating segmented (multiple) exchange rates, a reduction of tax and tariff dispersion, and the privatization of state-owned enterprises.

A year after the “Fujishock,” monthly inflation rate could be near 10% (see Table B-2). In fact, the economy took five years to return to yearly inflation levels near 10% (see Table B-1). This in spite of the fact that the administration kept the promises of fiscal moderation and independence of the central bank. Why such slow decline in inflation? We provide five plausible, complementary reasons below.

First, there was at the time considerable uncertainty *ex ante* about the commitment of the government to abandoning fiscal dominance of the monetary policy. Fujimori in fact had campaigned on the promise of not engaging in the sort of policies his administration adopted promptly. Later on, in 1992, Fujimori would disband Congress and assume legislative and judicial powers. Relatively free elections did not occur until the end of Fujimori’s government in 2000. It is tempting to conjecture that the authoritarian turn of the Fujimori administration provided credibility to the stabilization effort. Yet, democratically elected administrations from 2001 have kept away from inflationary finance. The political sustainability of policy regime change in the 1990s may be linked ultimately to the seismic change in public opinion during hyper stagflation becoming clear for politicians of every stripe.

Second, the intertemporal budget constraint that the government faced was unclear. Returning to normal relations with the international financial markets required dealing with the debt burden. Uncertainty about the terms of service of the public debt cast a shadow on the commitment of the government not to return to inflationary finance. News about debt renegotiation lowered inflation expectations the second semester of 1991.²⁵ A key for stabilization,

²⁵Rodríguez et al. (2000).

then, was the successful renegotiation of the public debt with foreign creditors.

Third, and turning our attention to monetary policy, implementing a money-based stabilization was difficult given uncertainty about the velocity of circulation of money. To get an idea of this problem, take Fisher's equation of exchange. In log terms, we have $m_t + v_t = p_t + y_t$, where m_t is the stock of money, v_t is the velocity of circulation, p_t is the price level, and y_t is the real GDP. If real GDP growth is unrelated to monetary policy, we have

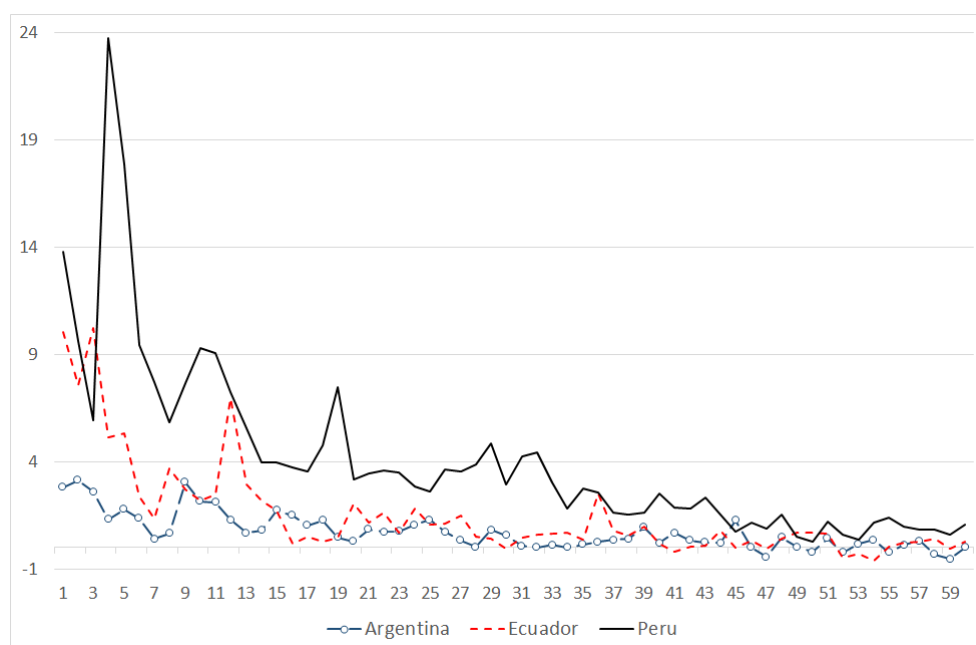
$$\pi_t = \Delta m_t + \Delta v_t - \Delta y_t. \quad (3)$$

The implementation of the monetary program relied on assuming a certain GDP growth rate for the planning year, a given velocity of money (implying $\Delta v_t = 0$), and an intended value for the inflation rate at the end of the planning year. The central bank could determine the growth of money compatible with the intended inflation target according to equation 3. The planned trajectory of the money growth rate became the intermediate target to achieve the desired inflation outcome. During mid 1990s the velocity of money became ever more unstable. In fact, the central bank did not commit publicly to any given money growth rate. Since 1994, it started making annual inflation predictions. The lack of clear targets may have hindered the building of credibility.

Fourth, and related, the high degree of dollarization of the economy as a result of the years of high inflation did not reversed during the stabilization. As pointed out by [Kiguel and Liviatan \(1995\)](#), the fact that money demand did not recover after hyperinflation left the economy vulnerable to a steep resumption of inflation were the government to resort to inflationary taxation again. In the long run, however, dollarization may have discouraged politicians from inflationary taxation, precisely because relapsing would be so costly.

Fifth, the central bank did not initially have the instruments needed to conduct an independent monetary policy. In the absence a government bonds market, implementing the desired growth rate of money was achieved in practice via open market operations. The monetary base was reduced through the placement of central bank certificates of deposits (CDs), and expanded by repurchase agreements against these certificates or their redemption. The purchase of US

Figure 17. *Monthly inflation during stabilization: Argentina, Ecuador and Peru*



Note: The horizontal axis measures the number of months after the month the stabilization program takes place. In Argentina the convertibility plan started in April 1991, in Ecuador full dollarization started in January 2000, and in Peru stabilization started in August 1990.

dollars, with the intention to recover the level of foreign currency reserves and to manage the floating exchange rate regime, was used as a means of monetary control in so far as the monetary expansion associated to the purchase was in line with monetary program. Any discrepancies were supposed to be sterilized through CD operations. Monetary policy involved a delicate maneuvering between open market operations, the management of the administered exchange rate regime, and the consistency of the monetary program. To observers like [Mishkin and Savastano \(2001\)](#), the monetary policy process was opaque, which made it difficult to signal intentions to the public.

The Peruvian stabilization program did not work as fast as those based on hard exchange rate pegs, like the Argentinean convertibility or the Ecuadorian full dollarization program. Figure 17 depicts monthly inflation rates following the month of stabilization in the three countries. Inflation fell faster in Argentina and Ecuador than in Peru; convergence of inflation rates seemingly took four years. Though much harder to manage than a hard exchange rate

peg, the monetary program would prove to be more resilient in the face of financial crisis due to external origin. Peru avoided currency crises of the sort that afflicted Argentina, which opted contemporaneously for a hard peg without full dollarization.

The global emerging market crisis of 1997 and 1998 prompted an outflow of US dollars from emerging markets in general and Peru was affected in turn. The monetary policy strategy and the instruments under disposal were not prepared for this shock. The result was a credit crunch with important consequences on the real side. As a result of the recession, inflation fell to about zero percent by 2001. In fact the monthly inflation rate was negative during some months in 2001. The time was ripe for a switch to monetary policy strategy.

By 2001, monetary policy had been aimed to reduce inflation for a decade. Now it was necessary to avoid the risk of deflation by means of an expansionary monetary policy. The policy problem was to engage in an expansionary policy without jeopardizing the painfully built anti-inflationary credibility. It was believed that inflation targeting provided the discipline the monetary authority needed at that moment. The Peruvian experience is unique in that inflation targeting was adopted to move inflation from below. Other experiences, specially in emerging market economies, feature inflation targeting adoption to complete the convergence of relatively high inflation towards lower inflation levels.

The fast decline of seigniorage in the early 1990s is visible in Figure 3. A first phase of fiscal reforms included the measures underlined in Table 2 which were later accompanied by the modernization of the tax revenue authority and by successful external debt renegotiations. A second phase of reforms included the Law of Fiscal Prudence and Transparency of 1999. This law was intended to foster fiscal counter cyclicalities by allowing the government to accumulate buffers (for example, the Fiscal Stability Fund to be used in emergency cases) to smooth economic cycles.

As can be seen in Figure 1, the pace of GDP growth has been remarkably stable, featuring an average of 5% since the turn of the millennium. Although good external conditions are doubtless related to the GDP growth performance, it is hard to believe that the macroeconomic stability reforms implemented during the 1990s did not play an important role.

7 Concluding remarks

Peruvian recent economic history is marked by an ambitious attempt to refashion the economy of the country through command-and-control policies adopted by a left-wing military dictatorship from 1968 to 1975. After the military returned to the barracks, they left as a legacy an expansive state, precariously financed through debt accumulation and inflation tax. The hyperinflation of the second half of the 1980s occurred in the midst of another radical policy experiment. The policies adopted by the populist administration then in office, such as pervasive price and exchange controls, were counter productive by and large. These policies also made it hard or impossible for the following administration to rely on a exchange rate peg to anchor expectations as part of the stabilization policies.

Looking back, it is hard to miss the fundamental mistrust in market allocations by economic and political actors in the run-up to hyperinflation.²⁶ Mistrust was compounded by wishful thinking by government authorities, in particular during the episodes of 1968-1975 and 1985-1990. Remarkably, a radical policy gamble attempted in the latter experiment was stopped by popular protest. In a way, society learnt faster than the political elites, and popular repulse of arbitrary government intervention in the economy preceded the stabilization of 1990.

The stabilization of 1990 was preceded by other attempts that looked *ex ante* similar. The question arises as to why this particular attempt was successful, leading to a persistent change in policy regime. Moreover, why did the same, or very similar, politicians behave more responsibly in fiscal and monetary matters after stabilization? The recent history suggests a process of social learning. From this viewpoint, the credibility of policy regime change in the 1990s may be linked ultimately to the change in public opinion giving proper incentives to politicians. Both the dollarization of the economy and the respect for central bank independence which are currently characteristic features of Peru's economics and politics, can be traced back to some extent to the effect of the traumatic events of the 1980s. Borrowing the phrase of [Malmendier and Nagel \(2011\)](#), those who lived through those events are "hyperinflation babies."

²⁶See e.g. [Sheahan \(1999\)](#).

Appendix A: Public debt counterfactuals

A.1 Profile of public debt if transfers were absent

We can use equation 2 to calculate the level of debt were transfers always equal to zero. Denote d'_t the level of the fiscal deficit as ratio of GDP (that is without the transfers), and define the overall government deficit, including the service of the debt, as

$$def_t = d'_t + \theta_{t-1}^n \left(\frac{R_{t-1}}{\pi_t g_t} - 1 \right) + \theta_{t-1}^* \xi_t \left(\frac{r_{t-1}^*}{\pi_{t-1}^w g_{t-1}} - 1 \right),$$

which is an observed variable. Then, equation 2 can be written as

$$\Delta \theta_t^n + \Delta \theta_t^* \xi_t = def_t - \Delta m_t - m_{t-1} \left(1 - \frac{1}{\pi_t g_t} \right).$$

Using the previous equation and the identity

$$\Delta (\theta_t^n + \theta_t^* \xi_t) = \Delta \theta_t^n + \xi_t \Delta \theta_t^* + \theta_{t-1}^* \Delta \xi_t,$$

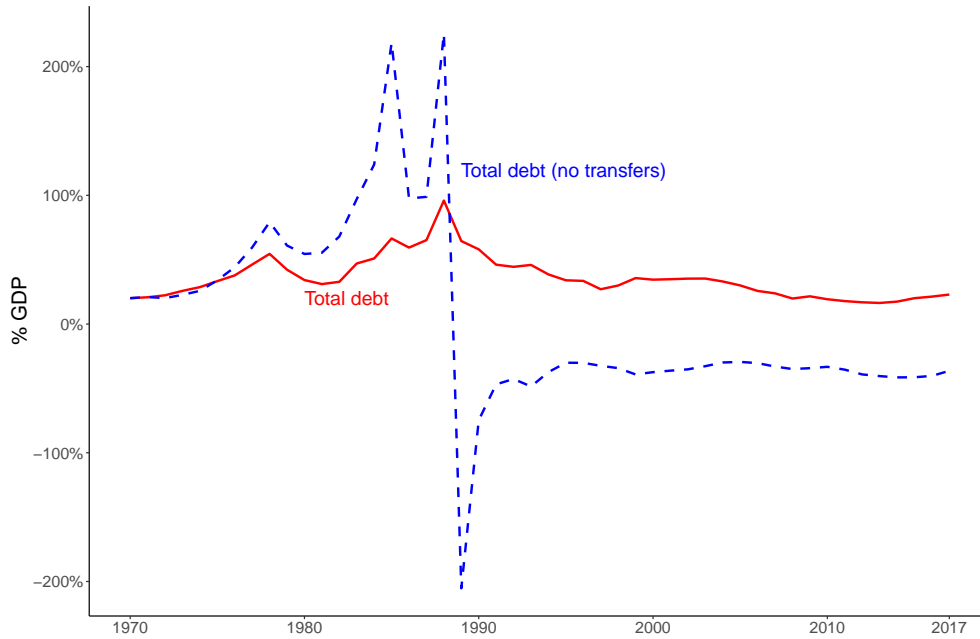
we get

$$\Delta (\theta_t^n + \theta_t^* \xi_t) = def_t - \Delta m_t - m_{t-1} \left(1 - \frac{1}{\pi_t g_t} \right) + \theta_{t-1}^* \Delta \xi_t. \quad (4)$$

Given our data starting point in 1970, we can simulate the trajectory of counterfactual debt based on the observed values of the right-hand side of equation 4. Note that the last term in equation 4 is proportional to the ratio of foreign debt to GDP. We pin down this level using the ratio observed in each period. The simulated debt is illustrated in Figure A-1.

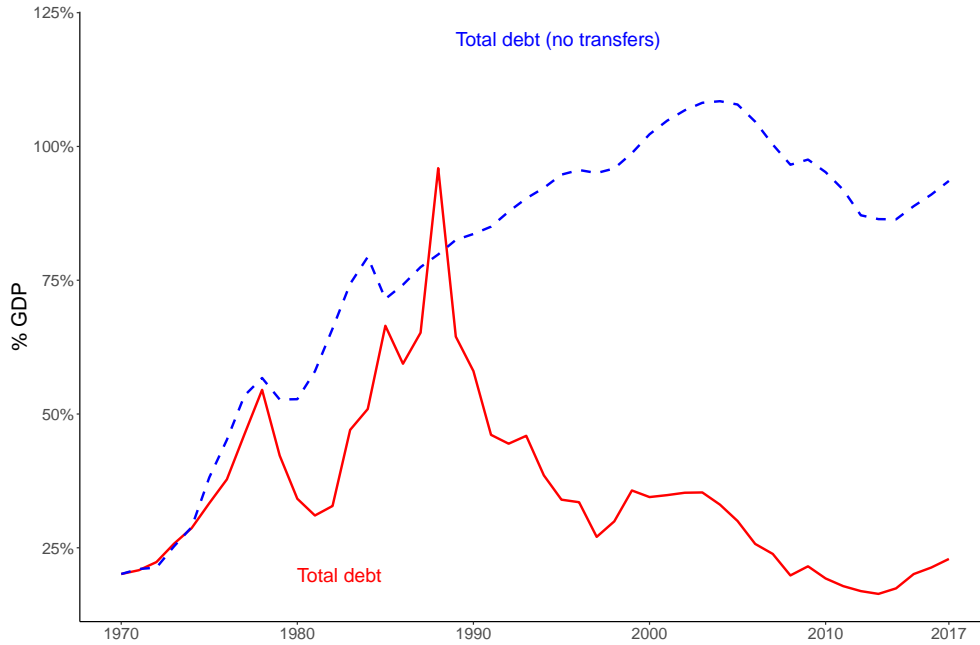
The adjustment term $\theta_{t-1}^* \Delta \xi_t$ distorts the results during the inflation instability period. When domestic inflation is too large, there is a huge real exchange rate appreciation that makes this term so negative that total debt may turn up to be negative. Conversely, in periods of large exchange rate devaluation, the term can inflate total debt. As an alternative, we shut off this adjustment term in Figure A-2. As illustrated, debt tends to be persistent at higher levels and therefore does not take into account the fact that high domestic inflation should have reduced

Figure A-1. *Counterfactual case of no transfers and full valuation effect*



Note: Maintaining the term $\theta_{t-1}^* \Delta \xi_t$ in equation 4. Sharp drop before 1990 due to hyperinflation.

Figure A-2. *Counterfactual case of no transfers–no valuation effect*



Note: Dropping the term $\theta_{t-1}^* \Delta \xi_t$ in equation 4.

real debt through a valuation effect.

A possible way to account for a valuation effect but avoiding large swing in the real exchange rate is to work with a smoothed real exchange rate, illustrated in Figure A-3. So, we can run the previous simulation of counterfactual debt with no transfers but now taking into account the full effect of the valuation effect. The result is illustrated in Figure A-4. As seen in the figure, smoothing the time series of real exchange rates leads to counterfactual debt accumulating at high levels in the 2000s. However, we actually know that a great bulk of what we call transfers in this late period is given by privatization proceeds and by changes in financial assets of the government since the end of the 1990s. So, it is the net debt and not the gross debt that better connects with fiscal deficits.

In 1999, the Law of Fiscal Prudence and Transparency was enacted to improve the management of fiscal policy by introducing a countercyclical fiscal rule and creating the Fiscal Stabilization Fund. The use of the fund is activated under specific circumstances. When this happens, financial assets diminish and are considered a source of deficit finance. The dashed line in Figure A-4 shows that the level of counterfactual government debt including the privatization proceeds and the changes in government financial assets in the calculation of financing needs. We observe that the level of this counterfactual debt is closer to the actual debt ratio (See Table A-1).

Table A-1. *Government debt to GDP ratios (Percent)*

	1990	1995	2000	2005	2010	2017
Actual government debt to GDP ratio	58	34	34	30	20	23
Counterfactual debt to GDP ratio						
- Without any type of transfers	81	35	55	60	35	34
- Considering privatization and financial assets changes	81	27	39	38	16	18

Note that the dynamics of counterfactual debt before the 1990s that is explained by observed fiscal deficits implies a huge amount of transfers, specially during the 1980s. A great deal of these transfers could represent a form of money finance. As mentioned, the central bank granted credit to state-owned banks which then lent to state-owned enterprises and the rest of the non-financial public sector. In principle, this should have been accounted as an increase in domestic debt, but according to official data domestic debt fell from 23% of GDP in 1977 to 11% in 1990.

Figure A-3. *The real exchange rate and the trend real exchange rate*

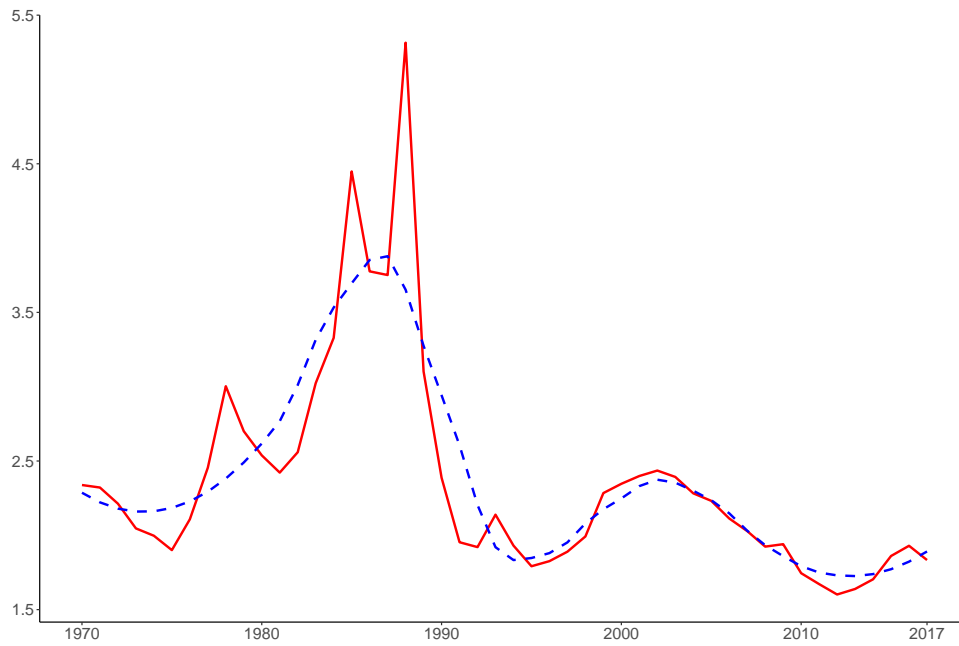


Figure A-4. *Counterfactual case of trend real exchange rate*

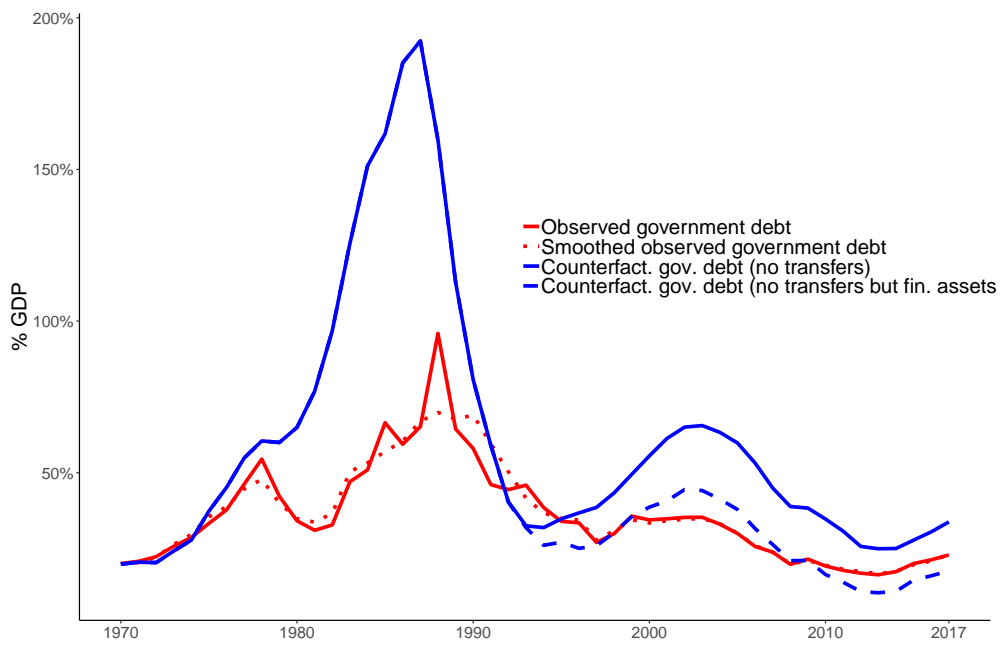
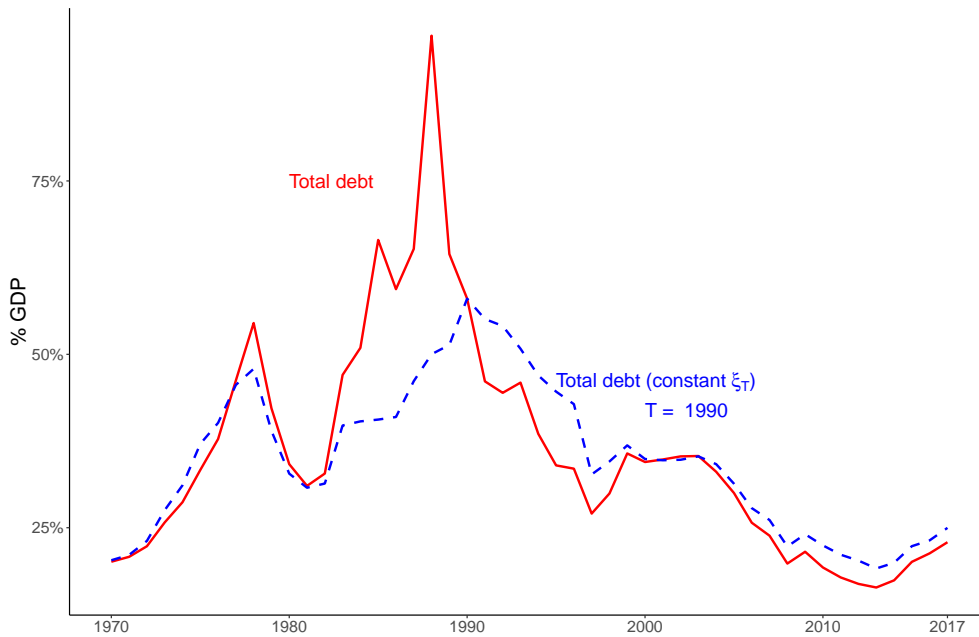


Figure A-5. *Counterfactual case of constant real exchange rate*



The effect of unaccounted transfers on the debt profile is aggravated by the real undervaluation observed during the 1980s. We tackle the effect of undervaluation next.

A.2 Profile of public debt with a constant real exchange rate

Most of the fluctuations in the overall government debt to GDP ratio are caused by real exchange rate movements. To inspect the profile of the debt ratio leaving aside real exchange rate swings, we simulate debt dynamics keeping the real exchange rate constant, using 1990 as a base year. Results are shown in Figure A-5. The simulated debt pattern follows the observed debt ratio closely except for the period between 1982 and 1990, where the observed debt ratio rises substantially due to the massive devaluation observed in the period.

The three peaks observed in the solid line correspond to three real exchange devaluation years. The first occurs in 1978 with a real devaluation of 20%, preceded by two years of lower devaluations. The second peak occurs in 1985 corresponding a 29% real devaluation. The last peak occurs in 1988 with a 35% devaluation. From the highest peak in 1988, total debt starts falling in merely due to exchange rate revaluation. If we keep the real exchange rate fixed, the

debt ratio reached its peak in 1990 at 58% percent of GDP. We can observe two periods of fiscal effort to reduce the debt ratio: a temporary one in 1978-1982, and a persistent one from 1990 onward which resulted in a sustainable debt pattern.

Appendix B: Data sources

Central Bank of Peru

Sources: annual reports, <http://www.bcrp.gob.pe/publicaciones/memoria-anual.html> and BCRData, <https://estadisticas.bcrp.gob.pe/estadisticas/series/>

1. Monetary variables

- Base money: millions of soles, end of year
- Nominal GDP: millions of soles per year
- Real GDP: millions of soles at 2007 prices
- Nominal exchange rate: soles value of the US dollar
- Nominal GDP measured in US dollars: millions of USD
- Consumer price index of Lima
- Net central bank credit to the public sector, Banco de la Nación and Banca de Fomento: ratio to base money, end-of-period
- Net foreign currency reserves: ratio to base money, end-of-period
- Net credit of banking system to the non financial public sector: millions of soles

2. Fiscal variables

- Economic results of the non financial public sector: percent of GDP
- Primary result of the non financial public sector: percent of GDP
- Interest payments of the non financial public sector: percent of GDP
- Economic results of the non financial public sector: millions of soles
- Internal financing: millions of soles
- External financing: millions of soles
- Privatization proceeds: millions of soles
- Outstanding domestic debt: millions of soles

- Outstanding external debt: millions of USD
- Total outstanding debt: millions of soles
- Total financial assets of the non financial public sector: millions of soles
- Domestic public debt: percent of GDP
- External public debt: percent of GDP
- Total public debt: percent of GDP
- Net non financial public sector debt: millions of soles
- Net non financial public sector debt: percent of GDP
- Net non financial public sector debt denominated in soles: millions
- Net non financial public sector debt denominated in USD: millions
- Share of net non financial public sector debt denominated in soles
- Share of domestic debt
- Net debt of non financial public sector denominated in soles: millions
- Net debt of non financial public sector denominated in USD: millions
- Total revenue due to tax income: percent of GDP
- Revenue due to income and asset taxes: percent of GDP
- Revenue due to taxes to imports and exports: percent of GDP
- Revenue due to VAT and excise taxes: percent of GDP
- Non financial expenditure of central government; includes consumption + capital expenditure: percent of GDP
- Central government consumptions expenditure; includes wages, goods, and services and transfers: percent of GDP
- Central government capital expenditure; includes gross investment: percent of GDP
- General government capital expenditure: percent of GDP
- Total revenue of central government: percent of GDP

- Total expenditure of central government: percent of GDP
- Primary result of central government: percent of GDP
- Total revenue of local governments: percent of GDP
- Total fiscal non financial expenditure local governments: percent of GDP
- result of local governments: percent of GDP
- Total revenue of rest of central government percent of GDP
- Total expenditure of rest of central government: percent of GDP
- Primary result of rest of central government: percent of GDP
- Total revenue of the general government: percent of GDP
- Total expenditure of the general government: percent of GDP
- Primary result of the general government: percent of GDP
- Current revenue of non financial state-owned firms: percent of GDP
- Non financial current expenditure of non financial state-owned firms: percent of GDP
- Capital expenditure of non financial state-owned firms percent of GDP
- Capital income of non financial state-owned firms: percent of GDP
- Interest payments of non financial state-owned firms: percent of GDP
- Primary result of of non financial state-owned firms: percent of GDP
- Fiscal deficit of non financial state-owned firms: percent of GDP

3. Other

- Current account balance: millones de USD
- Current account balance: percent of GDP
- Terms of trade: index 2007=100
- Exports prices: index 2007=100
- Imports prices: index 2007=100
- Peruvian population

Table B-1. *Headline yearly inflation 1901-2017*

year	rate	year	rate	year	rate
1901	7.7	1940	8.2	1979	67.7
1902	-19.0	1941	8.4	1980	58.5
1903	13.2	1942	12.4	1981	75.4
1904	3.9	1943	9.0	1982	64.5
1905	31.3	1944	14.6	1983	111.2
1906	1.0	1945	11.6	1984	110.2
1907	1.9	1946	9.4	1985	163.4
1908	4.6	1947	29.4	1986	77.9
1909	-14.2	1948	30.8	1987	85.9
1910	-2.1	1949	14.7	1988	667.0
1911	3.2	1950	12.1	1989	3398.6
1912	-9.2	1951	10.1	1990	7481.7
1913	12.4	1952	6.9	1991	409.5
1914	4.0	1953	9.1	1992	73.5
1915	7.7	1954	5.3	1993	48.6
1916	9.8	1955	4.7	1994	23.7
1917	15.4	1956	5.5	1995	11.1
1918	15.5	1957	7.4	1996	11.5
1919	14.6	1958	7.9	1997	8.5
1920	11.7	1959	12.7	1998	7.3
1921	-5.2	1960	8.7	1999	3.5
1922	-4.5	1961	6.1	2000	3.8
1923	-5.3	1962	6.7	2001	2.0
1924	3.9	1963	6.0	2002	0.2
1925	7.0	1964	9.8	2003	2.3
1926	0.5	1965	16.3	2004	3.7
1927	-3.5	1966	8.9	2005	1.6
1928	-6.7	1967	9.9	2006	2.0
1929	-2.2	1968	19.2	2007	1.8
1930	-4.5	1969	6.3	2008	5.8
1931	-6.5	1970	4.9	2009	2.9
1932	-4.4	1971	6.8	2010	1.5
1933	-2.6	1972	7.1	2011	3.4
1934	2.0	1973	9.5	2012	3.7
1935	1.3	1974	16.9	2013	2.8
1936	5.3	1975	23.5	2014	3.2
1937	6.3	1976	33.6	2015	3.5
1938	1.2	1977	38.0	2016	3.6
1939	-1.2	1978	58.1	2017	2.8

Note: 1901-1949: Consumer price index collected by the Ministry of Finance and Commerce. 1950-2017: Lima consumer price index collected by the national statistics agency (INEI). Source: http://www.bcrp.gob.pe/docs/Estadisticas/Cuadros-Anuales/ACuadro_09.xls

Table B-2. *Monthly inflation 1987-1994*

month	rate	month	rate	month	rate	month	rate
Jan-87	6.57	Jan-89	47.32	Jan-91	17.83	Jan-93	4.85
Feb-87	5.59	Feb-89	42.49	Feb-91	9.42	Feb-93	2.93
Mar-87	5.34	Mar-89	41.99	Mar-91	7.70	Mar-93	4.24
Apr-87	6.59	Apr-89	48.64	Apr-91	5.84	Apr-93	4.43
May-87	5.91	May-89	28.61	May-91	7.64	May-93	3.03
Jun-87	4.69	Jun-89	23.05	Jun-91	9.26	Jun-93	1.82
Jul-87	7.31	Jul-89	24.58	Jul-91	9.06	Jul-93	2.74
Aug-87	7.36	Aug-89	25.06	Aug-91	7.24	Aug-93	2.53
Sep-87	6.47	Sep-89	26.86	Sep-91	5.56	Sep-93	1.62
Oct-87	6.37	Oct-89	23.25	Oct-91	3.95	Oct-93	1.51
Nov-87	7.13	Nov-89	25.84	Nov-91	3.96	Nov-93	1.60
Dec-87	9.55	Dec-89	33.75	Dec-91	3.74	Dec-93	2.51
Jan-88	12.77	Jan-90	29.85	Jan-92	3.54	Jan-94	1.84
Feb-88	11.83	Feb-90	30.53	Feb-92	4.74	Feb-94	1.82
Mar-88	22.60	Mar-90	32.65	Mar-92	7.44	Mar-94	2.32
Apr-88	17.92	Apr-90	37.30	Apr-92	3.17	Apr-94	1.54
May-88	8.51	May-90	32.79	May-92	3.44	May-94	0.72
Jun-88	8.81	Jun-90	42.58	Jun-92	3.59	Jun-94	1.14
Jul-88	30.90	Jul-90	63.23	Jul-92	3.48	Jul-94	0.89
Aug-88	21.71	Aug-90	396.98	Aug-92	2.83	Aug-94	1.53
Sep-88	114.12	Sep-90	13.77	Sep-92	2.62	Sep-94	0.52
Oct-88	40.60	Oct-90	9.62	Oct-92	3.64	Oct-94	0.29
Nov-88	24.41	Nov-90	5.93	Nov-92	3.54	Nov-94	1.22
Dec-88	41.87	Dec-90	23.73	Dec-92	3.85	Dec-94	0.59

Note: Lima consumer price index collected by the national statistics agency (INEI). Source: <https://estadisticas.bcrp.gob.pe/estadisticas/series/mensuales/resultados/PN01271PM/html>

Total economy database

<https://www.conference-board.org/data/economydatabase/index.cfm?id=27762>

- Total GDP: millions of 2017 USD (converted to 2017 price level with updated 2011 PPPs); GDP EKS (Eltoto, Kovacs and Szulec)
- Population: millions
- Persons employed: millions

FRED website

<https://fred.stlouisfed.org/series/CPALTT01USA661S>

- US consumer price index: total all items for the United States (CPALTT01USA661S); base year = 2010

SIPRI Military Expenditure Database 2017

<https://www.sipri.org/databases/milex>

- Military expenditure of Peru: percent of GDP, 1949-2017. The figures for Peru before 1997 are based on data from the Peruvian Ministry of Defense and are suspected to come from different stages of the budget process. The figures for Peru from 2005 do not include the transfer of 20% of gas production revenues from state-owned company CAMISEA for the armed forces and national police.
- Military expenditure of Chile: percent of GDP, 1949-2017. The figures for Chile are from the adopted budget. The figures for Chile include direct transfers from the state-owned copper company Corporación Nacional del Cobre (CODELCO) for military purchases. Since 2004, the Chilean Ministry of Defense has built up a surplus from unspent portions of these transferred funds, which in 2011 were placed in a Strategic Contingency Fund for future equipment spending. The SIPRI figures continue to count the transfers from CODELCO rather than actual spending.

Calculated data

- Dollar price of traded goods (P_t^w) was set equal to the US consumer price index
- Price of non-traded goods (P_t^h) was calculated using the consumer price index in Lima (P_t) and the equation

$$P_t = (P_t^h)^\alpha (P_t^w)^{1-\alpha},$$

yielding

$$\ln P_t^h = \frac{\ln P_t - (1 - \alpha) \ln P_t^w}{\alpha},$$

where α is the proportion of home prices within aggregate prices

- The real exchange rate (RER) is calculated as

$$\xi_t = \left(\frac{P_t^w E_t}{P_t^h} \right)^\alpha$$

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