PRODUCTIVITY GROWTH AND DISINFLATION IN CHILE

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ABSTRACT

This paper analyzes the role productivity growth had on disinflation in Chile during the 1990s. It argues that productivity growth was key in avoiding the output costs of stabilization in a highly indexed economy. Disinflation from the early 1990s through 1998 was costless. Among the many external and domestic factors that contributed to good macroeconomic performance, which combined simultaneously very high rates of growth and declining inflation, productivity stands high. The simulations presented in this paper illustrate this point.

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1. Introduction

Chile enjoyed unprecedented economic success during the 1990s, in particular until 1998. Inflation, measured at the end of the year, declined from 27.3 percent in 1990 to 4.7 percent in 1998, and in every year of the decade, the inflation rate was below that in the previous year. Since 1994, inflation has been in single digits, something previously seen only on the eve of the 1982 crisis (briefly) and in the early 1960s. Meanwhile output grew at a record annual rate of 7.6 percent from 1990 to 1998, which is impressive not only by Chile's own historical standards but by international standards as well (figure 1). In terms of both output growth and inflation, the decade of the 1990s was the period of highest achievement in Chile's modern economic history.

The surge in growth began before the decline in inflation, having started during the recovery from the debt crisis in the mid-1980s. Indeed, in the seventeen years from 1985 to 2002, GDP grew at an average annual rate of 6 percent. The persistent decline in inflation, by contrast, occurred only after 1990 (figure 2).

Chile has long been a country with chronic moderate to high inflation. Between 1960 and 1990, the average annual inflation rate was 72 percent, although that average falls to 26 percent when the years of three-digit inflation, 1972-76, are excluded. The slow but persistent reduction of inflation is particularly impressive in that it was not accompanied by output losses. Why was disinflation so successful in Chile? And why were there no output costs in bringing down inflation in a country so used to high inflation?

These questions have received two different answers. The first answer claims that Chile's success was the result of good macroeconomic policies, including a clear commitment to reducing inflation, sound fiscal policy, and the adoption of an inflation targeting strategy. However, there are at least three problems with this view. The first is that Chile's disinflation was not just accompanied by low output costs, but by no output costs at all. Although the absence of output costs is consistent with a fully credible disinflation à la Lucas and Sargent, in those models prices are fully flexible except for informational problems, which can be overcome if there is sufficient policy credibility. In contrast, there was a high degree of price stickiness in the Chilean economy, in particular

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through the widespread use of backward-looking indexation in labor contracts. Thus one cannot explain a disinflation with no output costs at all (see, for example, De Gregorio, 1995). Second, one also has to account for the speed of the disinflation. A fully credible disinflation is also a rapid one. But the decline of inflation in Chile was quite slow, characterized by the sluggishness in prices that is the expected result of accommodation in an economy that has lived so long with inflation. Finally, during this period there was no clear subordination of macroeconomic policy to the anti-inflation strategy. Indeed, there were several episodes in which control of inflation was subordinated to exchange rate policy. In addition, the inflation target was set annually on a declining path, recognizing the need to disinflate gradually, and the target was set at a level consistent with inflationary trends. This is why Chile's inflation target was difficult to distinguish from an inflation forecast.

The other answer that one hears is that Chile's successful disinflation was due to good luck: that the fall in inflation was the result of a highly favorable external environment, which induced a large appreciation of the peso, which in turn ultimately drove inflation down.[1] However, this view, too, is at best incomplete. It cannot explain why, when the external environment turned sharply negative, as it did in the early 2000s, inflation did not return to its previous high levels. This view fails to recognize that, given its strong macroeconomic fundamentals, Chile *should* have had low inflation, and hence the issue is how it made the transition from high to low inflation. The existence of an independent central bank, with an explicit mandate of price stability, was essential to inducing credibility in the declining path of inflation. Meanwhile the performance of fiscal policy was also very strong. Between 1990 and 1998 gross public debt fell from 76 percent to 34 percent of GDP, and net debt from 35 percent to 5 percent (figure 3). Relying only on good luck to explain the success of disinflation ignores the argument that strong growth performance was possible, among other things, because of Chile's sound macroeconomic policies.

I take an intermediate view, arguing that strong output growth was a necessary condition for Chile's gradual and costless disinflation. The adoption of an inflation target, coupled with strong fundamentals, provided room for achieving low inflation in the long

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[1] This explanation is associated with Calvo and Mendoza (1999).

run, which was consistent with noninflationary backward-looking indexation. However, the stickiness in wages and prices explains why the adjustment was very slow. It is in this context that another factor, productivity growth, played a key role in speeding disinflation, but above all in securing the systematic reduction of inflation. Thus, one can interpret the inflation targeting of the 1990s as a commitment to a declining path of inflation consistent with the prevailing slow adjustment of prices. Had productivity growth been slow, this adjustment would not have been possible, since there was also the constraint of full lagged wage indexation.

In this paper I simulate a simple price adjustment in the presence of full indexation of wages to past inflation. In such a scenario, if there is no growth, inflation reproduces itself, and it is then impossible to reduce inflation without output losses. Thus a strong growth performance is essential to avoid the stabilization costs to legitimate the disinflation as it comes together with strong economic and social progress. The next section of the paper presents the framework used for the simulations, which is based on a simple productive structure of the economy with wage indexation. Section 3 presents the results, and section 4 concludes.

2. The Framework

The exercise starts with the following demand function for labor in period t (lowercase letters indicate the logarithm of the variable, and constants are normalized to zero):

$$y_t - l_t = w_t - p_t, \tag{2.1}$$

where y is output, l is employment, w is nominal wages, and p is prices. The implicit production function is Cobb-Douglas. This framework allows for prices to be a constant markup over marginal costs, and, for normalization, the markup and the share of labor in production are ignored.

I assume 100 percent lagged indexation of wages. Nominal wages are increased by inflation in the previous year, which in log terms implies that,

$$w_t = w_{t-1} + \boldsymbol{p}_{t-1} \tag{2.2}$$

where $\boldsymbol{p}$ is inflation.

The wage equation captures the simple idea that wages are fully adjusted for past inflation. In order to be a reasonable working assumption a declining path of inflation is needed. If inflation were rising, this would not be a sensible assumption. Although here I assume a labor market at full employment and in which real wages equal the marginal productivity of labor, the issue about the level of nominal wages is important to determine the average real wage during the duration of the contract. Therefore, if inflation were expected to rise, it would be unlikely that workers would tolerate a deterioration in their real wages during the term of the contract, and hence they would demand a premium. In Chile, however, with the central bank committed to declining inflation, the wage equation (2.2) would entail real wage gains toward the end of the contract. One could add a real wage drift to equation (2.2), but it would not change the basic mechanics of the simulations.

Along similar lines, García (2003) has emphasized the distinction between expected and unexpected productivity growth by assuming a wage equation with a drift based on expected productivity gains. In contrast, in equation (2.2) I assume that unexpected shocks are hedged by allowing adjustment of wages based on past inflation, as long as it is expected that inflation will decline.

Solving equation (2.1) for p and subtracting prices lagged one period on both sides, we have

$$\boldsymbol{p}_t = w_{t-1} - p_{t-1} + \boldsymbol{p}_{t+1} - (y_t - l_t) \tag{2.3}$$

But for real wages during $t - 1$ we can use equation (2.1) lagged one period to arrive at

$$\boldsymbol{p}_t = \boldsymbol{p}_{t-1} - (\hat{y}_t - \hat{l}_t) \tag{2.4}$$

where a caret over the variable represents a rate of change. I will use this as a baseline equation for the exercises below. However, to add more realism to the Chilean experience of the 90s, one needs to add the exchange rate. I consider the exchange rate in what follows.

Consider an open economy that produces traded and nontraded goods, identified by the subscripts T and N, respectively. A proportion $\boldsymbol{a}$ of the goods are nontraded, and the remaining $1 - \boldsymbol{a}$ are traded goods.

Now consider that the inflation rate on the left-hand side of equation (2.4) corresponds to inflation in nontraded goods (p_N). In this case we need to add to the change in inflation the change in the real exchange rate.

We can write inflation as a weighted average of inflation in traded and inflation in nontraded goods, with weights a and $1 - a$, respectively. In addition, the real exchange rate (q), defined as the price of foreign goods in domestic currency (sp^*) relative to the price of domestic goods (p), can be shown to be

$$q = a(p_T - p_N),\qquad(2.5)$$

where the price of traded goods is $p_T = sp^*$, and s is the nominal exchange rate.

It is easy to show that inflation in nontraded goods can then be written as

$$p_N = p - \frac{1-a}{a}\hat{q},\qquad(2.6)$$

which, substituted into equation (2.4), leads to the following expression for inflation:

$$p_t = p_{t-1} - (\hat{y} - \hat{l}) + \frac{1-a}{a}\hat{q},\qquad(2.7)$$

Strictly speaking, productivity growth as in equation (2.7) should be productivity in nontraded goods, but for the purpose of the simulations, and given some additional assumptions, it is possible to justify the use of economy-wide productivity.

One could add some other ingredients to this formulation. For example, one could assume that wages are partly indexed, and partly based on expectations or the credibility of the inflation target. Therefore wages would increase both with past inflation and with the inflation target: $w_t = w_{t-1} + j p_{t-1} + (1 - j)p^*$. In addition, it is possible to link productivity to the evolution of the real exchange rate along the lines of Balassa and Samuelson. However, I do not pursue these extensions, because the simulations, rather than replicating the actual path of inflation, attempt only to show a lower bound for inflation given an extreme assumption of total indexation.

3. Results

The two basic simulations are presented in figures 4 and 5. The simulations are static; that is, to simulate period t, I use the actual values of inflation in $t - 1$, since at the moment

contracts were indexed, all past information was known, and in addition, the inflation target was also set on a yearly basis.

Two extreme assumptions are considered regarding the share of nontraded goods. In figure 4 I assume the economy is closed, so that all goods are nontraded. This is the most unfavorable scenario for the reduction of inflation, since the change in the real exchange rate plays no role. In the other case I assume that half of all goods are traded, in which case $(1-a)/a$ is equal to 1. This is a case of a very open economy, since, as suggested by recent research, even traded goods have an important nontraded component, mainly in the distribution sector. Therefore the traded goods share is smaller than that implied by classifying large economic sectors as traded or nontraded. In this case the contribution of the change in the real exchange rate to disinflation is at its maximum.

In the case of the closed economy ($a = 0$), figure 4 shows that, except for a couple of minor deviations, the simulated mechanical rate of inflation derived from full backward indexation was always until 1998 below actual inflation. Therefore the inflation path was consistent with what the economy could actually achieve. In contrast, the dashed line shows the simulation assuming no productivity growth. In this case the minimum possible rate of inflation would have been the past rate of inflation. Of course, in the case of no productivity growth one would need to have other reasons to explain the decline in inflation over time. Precisely, what the figure highlights is that the trajectory of inflation that occurred between 1990 and 1998 would have not been possible if actual inflation would have not been below past inflation, and for that productivity growth was necessary.

The other simulation, presented in figure 5, includes the contribution of the change in the real exchange rate to disinflation. As expected, the minimum feasible rate of inflation consistent with both productivity growth and the path of the real exchange rate is lower than in the previous case, because of the additional impact of the real appreciation. And again, the actual path of inflation was consistent with this lower bound. Of course, the change in the real exchange rate was related to productivity growth, as well as the favorable external conditions regarding the terms of trade and capital inflows. In this exercise, however, I have considered productivity growth and the real exchange rate to move independently.

What is interesting to note in figure 5 is that when only the real appreciation is considered and no productivity growth is assumed (the dashed line), disinflation would have not been possible under full backward indexation. This is clearly a conservative estimate, since, as explained before, without productivity growth the appreciation would have been lower, and hence the simulated rate of inflation would have been even higher. The bottom line is that changes in the real exchange rate are not enough by themselves to explain the disinflation; the increase is still necessary productivity.

Finally, note also in figure 5 that the deceleration of growth and the real depreciation that have taken place in Chile since 1999 would not have allowed a further decline in inflation if full backward indexation had still been pervasive. Indeed, in the presence of full backward indexation one would have expected inflation to go back up. Two additional factors that were not present at the beginning of the disinflation must be considered when analyzing macroeconomic developments since 1999. First, the decline in inflation in these years did have output costs, as one would expect under normal circumstances, and they have allowed a further reduction of inflation to historically low levels in Chile. But, in addition, there is evidence that indexation has become much less important

The deindexation process that has occurred in Chile is illustrated in figure 6. The figure shows average growth in wage and labor costs across six-month periods as well as inflation during the past six months, forwarded four months ahead. The data are smoothed using quarterly moving averages. Thus the figure graphically aligns wages and labor costs with the period of past inflation that is relevant for indexation purposes since 1990. If there were widespread indexation, one would never observe inflation above wages and labor costs. The figure thus suggests that indexation has been on the wane recently, in particular since 2003. Of course, deindexation may have started much earlier, but the recent data provide the most definitive evidence. As expected, indexation is a way of protecting wages in an environment of high inflation. As inflation has come down and the economy is still below full employment, wages have moved consistently with the inflation target, making the indexation rigidities much less relevant. This later period coincides with the implementation of a full-fledged inflation targeting regime, which has kept inflation low.

4. Concluding Remarks

This paper has made a simple point: that the successful growth performance of the Chilean economy in the 1990s was essential to Chile's unprecedented disinflation. Although the decline in inflation was slow by many standards, it was not accompanied by output costs. Instead, just as indexation was putting constraints on the speed of disinflation, productivity growth was at the same time relaxing those constraints. I have used a simple framework where there is full backward-indexation.[2]

I do not discuss here the relationship between the inflation targets of the 1990s and the actual reduction of inflation. What the exercise performed here shows is that the targets were fully consistent with the actual rigidities in the economy. In addition, a commitment to a persistent decline in inflation was necessary to achieve consistency between indexation and wage setting. Backward-looking indexation and low inflation is much more difficult to sustain in an environment were inflation is not actually declining.

On the question of whether Chile's disinflation was due to good luck or good policies, one cannot deny that the 1990s were years of a very positive external environment for emerging economies, which may have allowed for an extra growth bonus. However, Chile's persistent growth is to a large extent the result of good policies and good institutions (De Gregorio and Lee, 2003). In particular, evidence has shown that low inflation fosters economic growth. But the point made here is that growth in turn can make a great contribution to disinflation, and the Chilean experience is a good example.

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[2] In general, what matters for the costs and speed of stabilization is not indexation, but price inertia (Lefort and Schmidt-Hebbel, 2002). In this paper, productivity growth reduces price inertia induced by the presence of widespread indexation.

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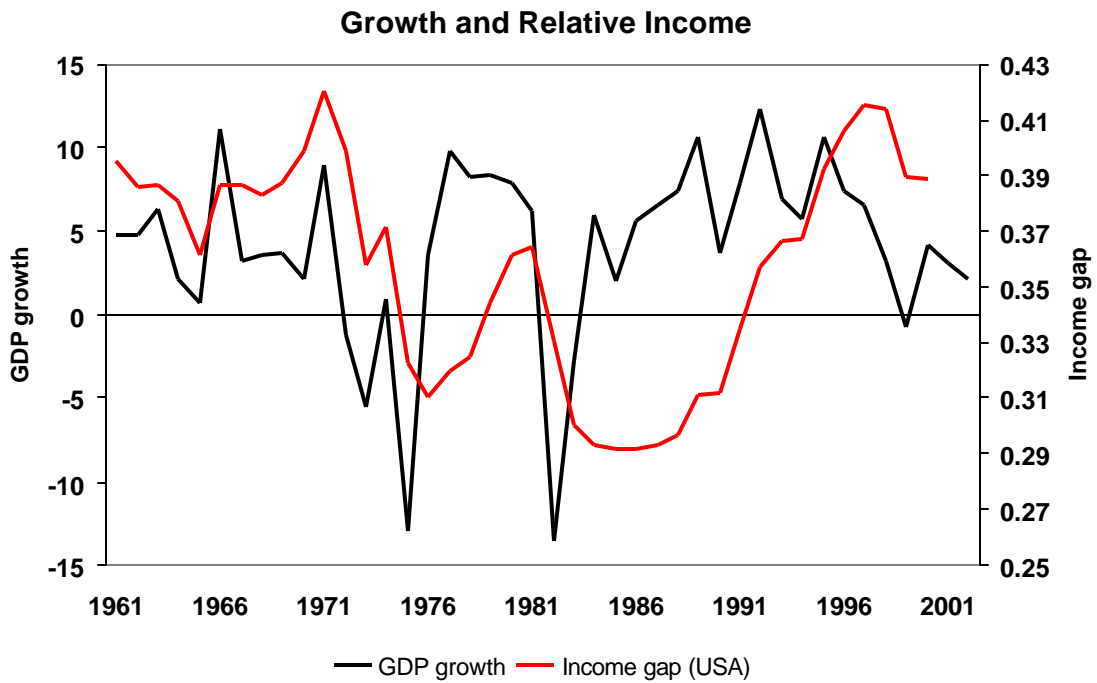
Figure 1

Growth and Relative Income

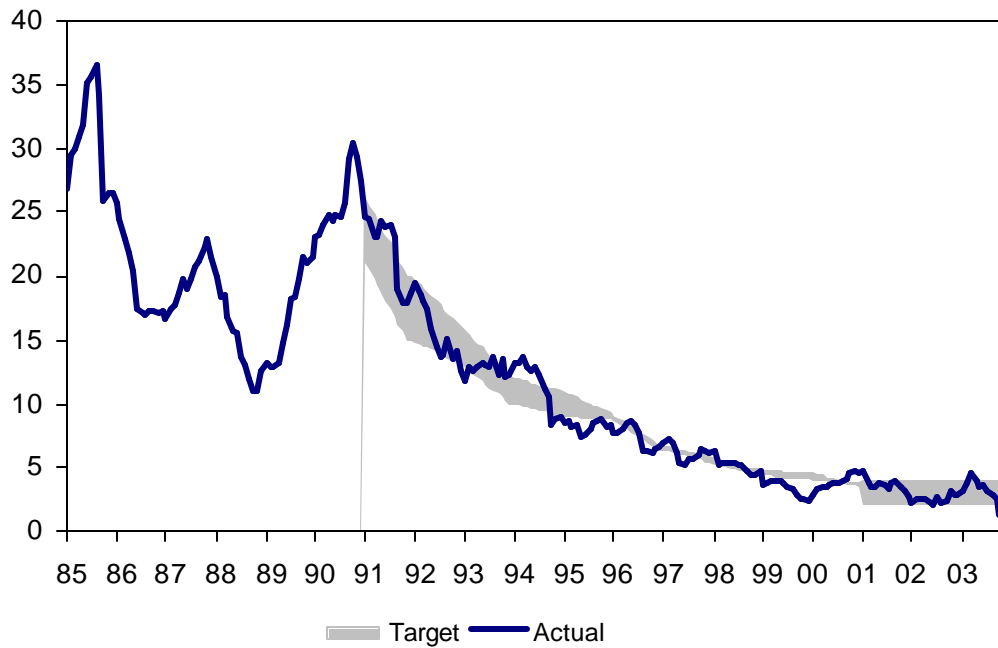## Figure 2

Inflation: Actual and Target
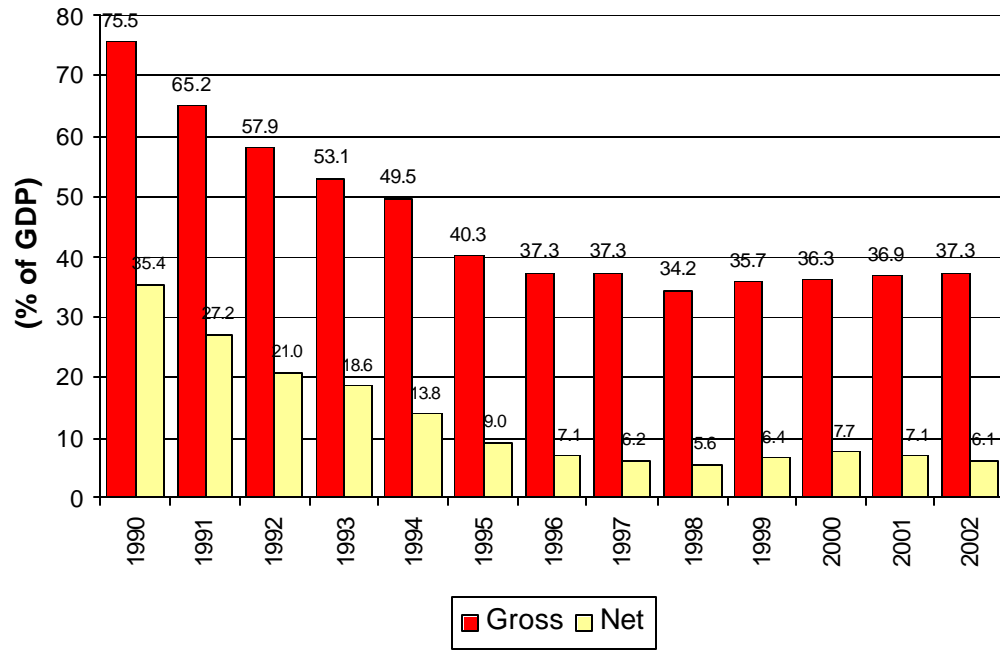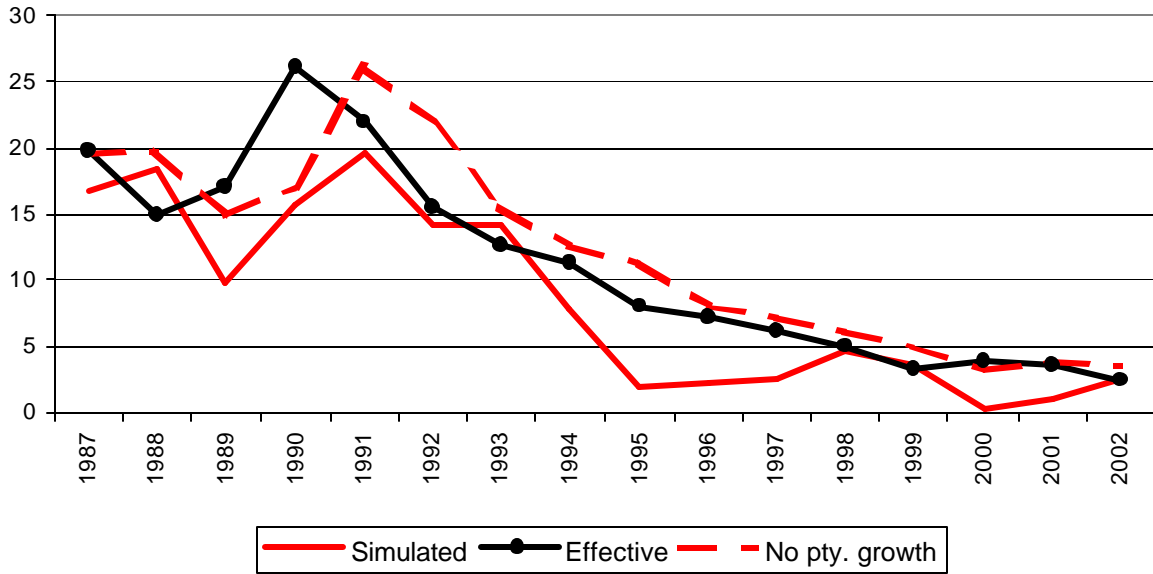
Figure 3

Public Debt in Chile
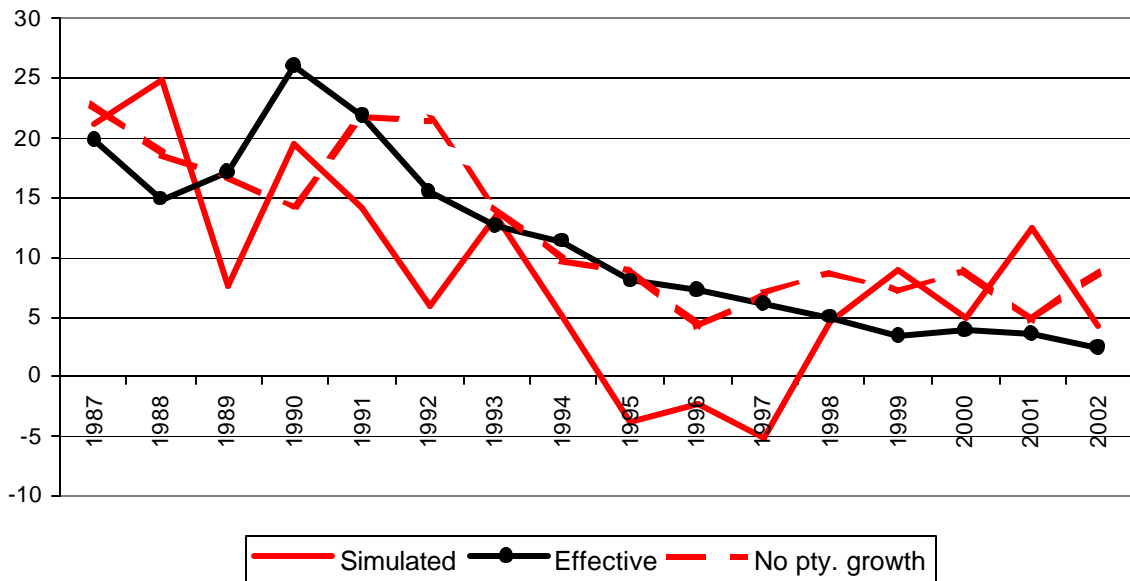### (Central Govt. Plus Central Bank)

Figure 4

(a=0)

Inflation

Figure 5

(a=0.5)

Inflation

Figure 6

Inflation and Nominal Wages (1)
(% ch. Semester, CPI forwarded 4 months)

(1) Quarterly moving average.
Source: Instituto Nacional de Estadísticas