PRODUCTIVITY GROWTH AND DISINFLATION IN CHILE

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1. Introduction

Chile had unprecedented success during the nineties, in particular until 1998. Inflation, measured at the end of the year, declined from 27.3% to 4.7% in 1998. Every year, inflation was below the one of the previous year. Since 1994 inflation was below the one-digit mark, something only seen briefly in the eve of 1982 crisis and previously in the early sixties. On he other hand, output grew at a record annual rate of 7.6%, impressive by historical standards and in an international dimension (figure 1). In terms of output growth and inflation this was the period of the highest achievement in Chile's modern economic history.

Growth began before the decline in inflation. It started during the recovery from the debt crisis in the mid 80s. Indeed, in the seventeen years running from 1985 to 2002 GDP grew at an annual rate of 6%. Inflation, in turn, started declining somewhat later. The persistent decline occurred after 1990 (figure 2).

Chile has been a country with chronic high and moderate inflation. Between 1960 and 1990, the average inflation rate was 72%, while it declined to 26% when the years of two-digit inflation 1972-76, are excluded. The slow, but persistent, reduction of inflation is

impressive since it occurred with no output losses. Hence one may wonder why disinflation was so successful. Why there were no output costs in bringing down inflation in a country used to high inflation?

To address the issue of a costless disinflation one could appeal to two views. The first one claims that economic success was the result of good macroeconomic policies, with a clear commitment to reduce inflation, sound fiscal policy, and the adoption of an inflation target strategy. However, there are at least three caveats to this view. The first one is that disinflation had no output costs at all. This is consistent with the fully credible disinflation à la Lucas and Sargent. However in those examples prices are fully flexible except for informational problems, which can be overcome with credibility. However, given the large degree of price stickiness in the Chilean economy, in particular widespread backward-looking indexation in labor contracts, one cannot explain a disinflation without output costs at all (see for example, De Gregorio, 1995). Second, one should explain also the speed. A fully credible disinflation is also a rapid one. Therefore, the slow adjustment of inflation in Chile demonstrated the sluggishness in prices, which were the result of accommodation in an economy living so long with inflation. Finally, during this period there was no clear subordination of macroeconomic policy to the anti-inflation strategy. There were several episodes in which inflation was subordinated to the exchange rates. In addition, the inflation target was set annually at a declining path, recognizing the gradualism of disinflation, and determining the target at a level consistent with inflationary trends. This is why the inflation target was difficult to distinguish from an inflation forecast.

The other view is based on good-luck. By this I mean the view that the fall in inflation was the result of a great external environment, which induced a large appreciation of the currency, which ultimately drove inflation down. This explanation could be associated with Calvo and Mendoza (1999). However, this view is also incomplete. It cannot explain why in a very bad external environment, such as the one of the early 2000s, inflation did not go back to previous high levels. In this respect, this account does not recognize that given strong macroeconomic fundamentals Chile should have had low inflation, and hence the issue is how to go from high to low inflation. The existence of an independent Central Bank, with an explicit mandate of price stability was essential to induce credibility in the declining path of inflation. On the fiscal side, the performance of

fiscal policy was also very strong. Between 1990 and 1998 gross public debt went from 76% to 34% of GDP, and net debt from 35% to 5% (figure 3). However, what can be convincingly argued, and is discussed further here, is that the strong growth performance made this transition costless. Second, relying only in good luck to explain the success of disinflation ignores that strong growth performance was possible, among other things, because of the sound macroeconomic policies.

I take an intermediate view, by arguing that strong growth was a necessary condition to allow for a gradual and costless disinflation. The adoption of an inflation target, coupled with strong fundamentals, provided room for having low-long-run inflation, which was coherent with non-inflationary backward looking indexation. However, stickiness in wages and prices explain why the adjustment was very slow. In this context is where productivity growth played a key role in speeding up disinflation, but above all in securing the systematic reduction of inflation. Thus, one can interpret the inflation targeting prevailing in the 1990s, as a commitment to a declining path of inflation consistent with the prevailing slow adjustment of prices. With slow productivity growth 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. If there were no growth, inflation would reproduce itself and it would not be possible reduce it without output losses. But, the strong growth performance was essential to avoid costs, to legitimate low inflation, inheritance very much appreciated today. In the next section I present the framework used for the simulations which is based in a simple productive structure of the economy with wage indexation. In section 3 I present the results, and section 4 concludes.

2. The Framework

The exercise starts from the following demand for labor (small letters indicate the logarithm of the variable and constants are normalized to zero) for all period t:

$$y_t - l_t = w_t - p_t, \qquad (1.1)$$

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where y is output, l is employment, w nominal wages and p prices. The implicit production function is a 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% lagged wage indexation. Nominal wages are increased by past yearly inflation, which in log terms imply that,

$$w_t = w_{t-1} + \boldsymbol{p}_{t-1} \tag{1.2}$$

where $\boldsymbol{p}$ is inflation.

The wage equation captures the simple idea that wages are fully adjusted for past inflation, but for this to be a reasonable assumption it needs further justification. If inflation is rising, this would not be a reasonable assumption, although here I am assuming a labor market with full employment and where real wages are equal to the marginal productivity of labor, so the issue about the level of the nominal wages should be of second order. In the background, however, one has to recognize that wages are set based upon uncertain future events. For example, if inflation were expected to rise, it would be unlikely that workers would be willing to see deteriorated real wages during the term of the contract, and hence they would ask for a premium.

In Chile, however, with a commitment to declining inflation, the wage equation (1.2) would entail real wage gains toward the end of the contract. It would be possible to add a real wage drift to (1.2), however it does 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 (1.2) I am assuming that unforeseen events are protected by allowing adjustment of wages based on past inflation as long as it was expected that inflation would decline.

Solving (1.1) for p and subtracting prices lagged one period at both sides, we have that:

$$\boldsymbol{p}_t = w_{t-1} - p_{t-1} + \boldsymbol{p}_{t-1} - (y_t - l_t) \tag{1.3}$$

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But for real wages during t-1 we can use equation (1.1) lagged one period to arrive at:

$$\boldsymbol{p}_t = \boldsymbol{p}_{t-1} - (\hat{y}_t - \hat{l}_t) \tag{1.4}$$

where a '^' represents rate of change. I will use this as a baseline equation for the exercises below. However, to add more realism one would need to add the exchange rate, as well as the possibility of trend increase in real wage. I incorporate these factors in what follows.

Let us consider an open economy with traded and non-traded goods, identified by the subscript T and N, respectively. A proportion $\boldsymbol{a}$ of the goods are non traded, and the remaining 1-$\boldsymbol{a}$ are traded goods.

Now, consider that the inflation rate at the left hand side corresponds to the inflation in non traded ($\boldsymbol{p}_N$) (1.4). In this case we need to add to the evolution of inflation the changes in the real exchange rate.

We can write inflation as a weighted average between traded inflation, with a weight 1-$\boldsymbol{a}$, and non-traded inflation with a weight $\boldsymbol{a}$. In addition, the real exchange rate (q), defined as the relative price between foreign goods in domestic currency (sp^*) and domestic prices (p), can be shown to be:

$$q = \boldsymbol{a}(p_T - p_N) \tag{1.5}$$

where the price of traded goods is $p_T = sp^*$.

It is easy to show that inflation in non traded can be written as:

$$\boldsymbol{p}_N = \boldsymbol{p} - \frac{1-\boldsymbol{a}}{\boldsymbol{a}}\hat{q} \tag{1.6}$$

which substituted into (1.4) leads to the following expression for inflation:

$$\boldsymbol{p}_t = \boldsymbol{p}_{t-1} - (\hat{y} - \hat{l}) + \frac{1-\boldsymbol{a}}{\boldsymbol{a}}\hat{q} \tag{1.7}$$

Strictly speaking, the productivity growth in (1.7) should be the productivity in non traded goods, but for the purpose of the simulations, and given some additional assumptions, it is possible to justify the use of total productivity.

We could add some additional ingredients to this formulation. For example, we could assume that wages are partly indexed, and the rest based on expectations and/or credibility of the target. Therefore, wages would increase base on both, past inflation and the inflation target: $w_t = w_{t-1} + \boldsymbol{j}\boldsymbol{p}_{t-1} + (1-\boldsymbol{j})p^*$. In addition, it is possible to link productivity to the

evolution of the real exchange rate along the lines of Balassa-Samuelson. However, I do not pursue these extensions, since the simulations rather than replicating the actual path of inflation attempts just 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 the idea is that at the moment contracts were indexed, all past information was known.

Two extreme assumptions are considered regarding the share of non-traded goods. In figure 4 I assume the economy is closed since all goods are non-traded. Therefore, this is the most unfavorable scenario for the reduction of inflation since the appreciation of the real exchange rate plays no role in the disinflation process. In the other case I assume that half of the 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 component of non-traded, mainly in the distribution sector. Therefore, traded goods share is smaller than the one implied by classifying large economic sectors as traded or non-traded. In this case, the contribution of the real exchange rate appreciation to disinflation is at its maximum level.

In the case of the closed economy (a=0), figure 4 shows that, except for a couple of minor differences, the simulated mechanical rate of inflation derived from full-backward indexation was always below effective inflation. Therefore, the inflation path was consistent with what the economy was able to perform. In contrast, the dashed line shows the simulation assuming that there would not have been productivity growth. In this case the minimum possible rate of inflation would have been past inflation. Of course, one would need further extensions to the current framework to explain the decline in inflation over time. But, what the figure highlights if that the trajectory of inflation occurred in the 90s would have not been possible, as long as effective inflation was below past inflation.

The other simulation presented in Figure 5 includes the real exchange rate appreciation contribution to disinflation. As expected the minimum feasible rate of inflation consistent

with both, productivity growth and real exchange rate appreciation is lower than in the previous case. Again, the actual evolution of inflation was consistent with this lower bound. Of course, the real exchange rate appreciation was related to productivity growth, as well as the good external conditions regarding terms of trade and capital inflows. In this exercise, however, I have considered separately the productivity and real exchange rate channel.

What is interesting to note from Figure 5 is that when only the real appreciation is considered and no productivity growth is assumed, the dashed line, disinflation would have not possible under full backward indexation. This is clearly a conservative estimate, since, as explained before, without productivity the appreciation would have been lower, and hence the simulated rate of inflation would have been even higher. The bottom line is that the evolution of the exchange rate is not enough to explain disinflation if we do not add on top of it the increase in productivity.

Finally, it is also interesting to note that Figure 5, that the deceleration of growth and the real exchange rate depreciation that have taken place in Chile since 1999, would not have allowed further inflation declines if full-backward indexation would still be pervasive. Two additional factors, that were not present at the beginning of the disinflation, must be considered. First, the decline in inflation had output costs, as we would expect would occur under normal circumstances, and they have allowed a reduction of inflation to historical low levels in Chile. But, in addition, there is evidence that indexation have become much less important. Indeed in the presence of a high degree of full-backward indexation, the output costs should be large, since the disinflationary effects on wages should occur in the non-indexed sector.

The deindexation process that has occurred in Chile is illustrated in Figure 6. The figure depicts the average growth across semesters for wage and labor costs against inflation during the past six-months, forwarded four months ahead. The figures are smoothed using quarterly moving averages. Therefore, this figure places at the same date wages and labor costs with the relevant past-inflation for indexation purposes since 1990. If there is widespread indexation, we would never observe inflation above wages and labor costs. The figure suggests that recently the phenomenon of indexation have been retiring. Of course, deindexation may have started much before, but the recent figures are the ones

that provide the most definite evidence. As expected, indexation is a way to protect wages in 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-fledge inflation targeting regime, that have maintained inflation low.

4. Concluding Remarks

This paper has made a simple point: the successful growth performance of the Chilean economy was essential to allow for an unprecedented disinflation in Chile. Although the decline was slow for many standards, did not have output costs. Indexation put constrains on the speed of disinflation (De Gregorio, 1995), productivity growth speed them up.

I do not discuss the relationship between the inflation targets of the 1990s and the actual reduction of inflation. What the exercise done performed here shows is that the target was fully consistent with the actual rigidities the economy had. In addition, a commitment to a persistent decline in inflation was necessary for the consistency between indexation and wage setting. Backward-looking indexation is much more difficult in an environment were inflation is not declining. Setting wages based on past inflation implies an increase in real wages during the term of the labor contracts.

Regarding the good-luck versus good-policies disinflation, one cannot deny that the 90s were years of a very positive external environment for emerging economies, which may have allowed for an extra growth bonus. However, persistent growth is to a large the result of good policies, good institutions (De Gregorio and Lee, 2003). In particular, the evidence has shown that low inflation fosters economic growth. The point made here is that growth can make a great contribution to disinflation, and the Chilean experience is a good example.

References

Calvo, G. and E. Mendoza (1999), "Empirical Puzzles of Chilean Stabilization Policy," *Chile, Recent Policy Lessons and Emerging Challenges*, G. Perry and D.M. Leipziger (eds.), Washington, D.C., The World Bank.

De Gregorio, J. (1995), "Policy Accommodation and Gradual Stabilizations," *Journal of Money, Credit and Banking*, Vol. 27, No. 3 (August), pp. 727-741.

De Gregorio, J. and J.W. Lee (2003), "Growth and Adjustment in East Asia and Latin America," mimeo, Central Bank of Chile.

García, P. (2003), "Achieving and Maintaining Monetary Credibility in Chile 1990-2002," mimeo, Central Bank of Chile.
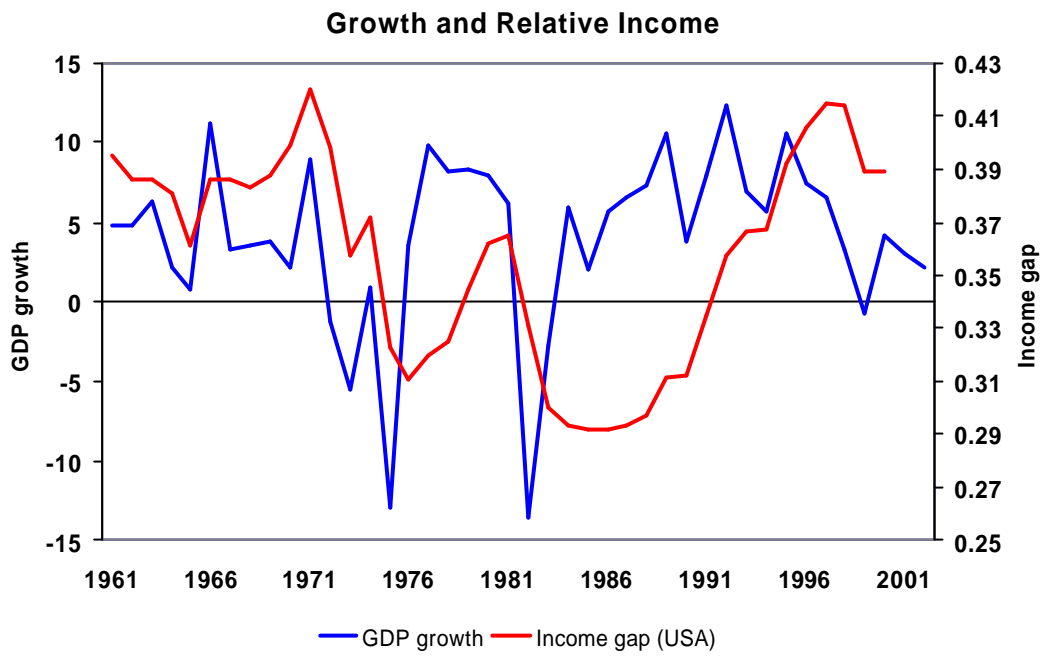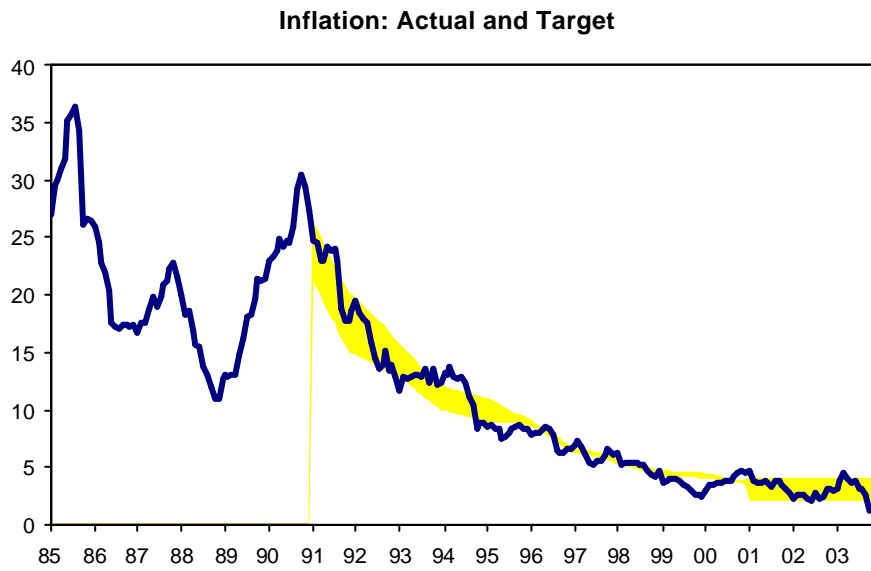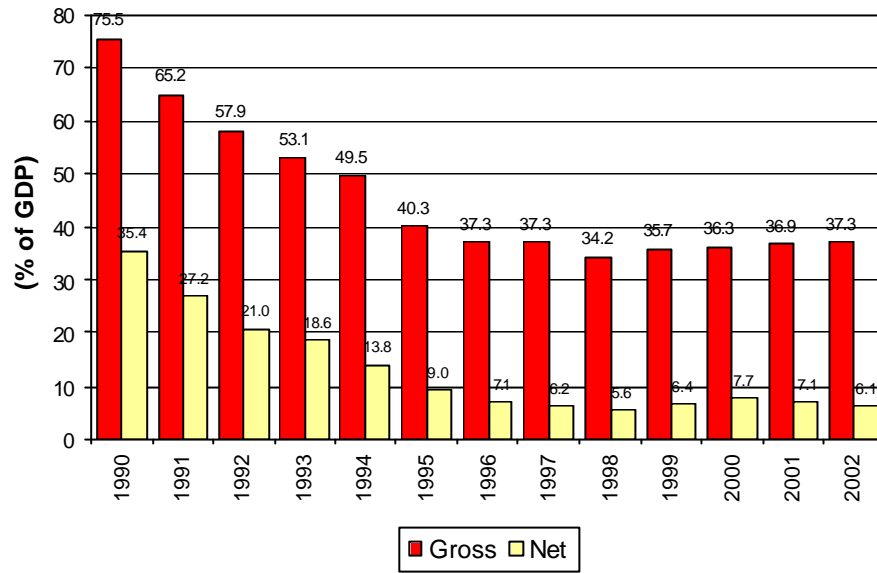
Figure 1

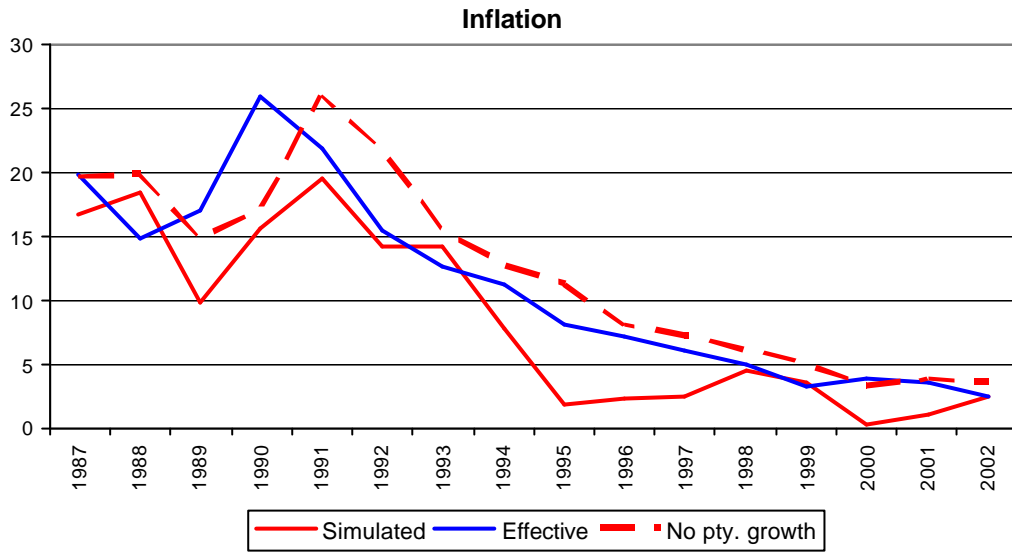### Growth and Relative Income

GDP growth — Income gap (USA)

Figure 2

Inflation: Actual and Target

Figure 3

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

Bar chart showing Gross and Net public debt as (% of GDP) from 1990 to 2002.

Year	Gross	Net
1990	75.5	35.4
1991	65.2	27.2
1992	57.9	21.0
1993	53.1	18.6
1994	49.5	13.8
1995	40.3	9.0
1996	37.3	7.1
1997	37.3	6.2
1998	34.2	5.6
1999	35.7	6.4
2000	36.3	7.7
2001	36.9	7.1
2002	37.3	6.1

■ Gross □ Net

Figure 4
(a=0)

Inflation

Figure 5
(a=0.5)
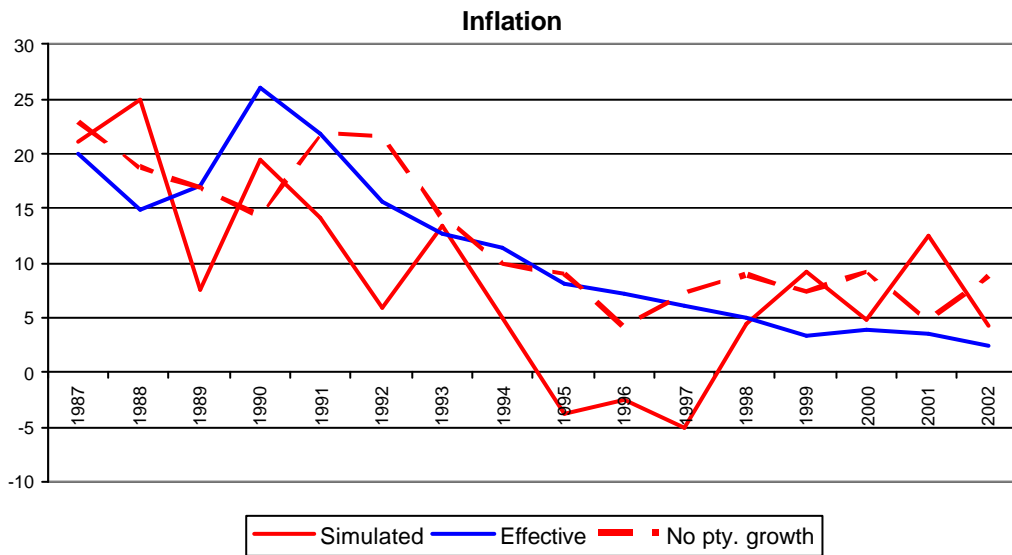
Inflation

Figure 6

Inflation and Nominal Wages (1)

(% ch. Semester, CPI forwarded 4 months)

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