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GROWTH AND ADJUSTMENT IN CHILE: A LOOK AT THE 1990S

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Resumen

Este estudio analiza en detalle la desaceleración de la economía chilena posterior al año 1998. Éste fue un período turbulento en la historia económica y, como tal, llama a investigar sobre las probables causas del freno a la actividad y sus posibles soluciones. Los autores aplican un modelo econométrico para probar tres hipótesis y derivan las implicancias generales del análisis. La primera hipótesis culpa a la "mala suerte" por los shocks externos, específicamente el deterioro de los términos de intercambio y de los flujos de capitales a consecuencia de la crisis asiática. Una segunda hipótesis atribuye la desaceleración a las políticas implementadas para enfrentar las malas condiciones internacionales, en particular a la incapacidad de lograr una combinación equilibrada entre las políticas fiscal y monetaria en los años 1997 y 1998. Se argumenta que los desequilibrios fiscales y la política monetaria restrictiva generaron una enorme presión sobre el sector privado al generar un importante aumento en el costo del endeudamiento. Por último, una tercera explicación es que la desaceleración fue la consecuencia del término de un ciclo de alto crecimiento asociado con las reformas estructurales que se habían venido aplicando entre 1985 y 1995. Los autores concluyen que el menor dinamismo de la economía chilena respondió a una combinación entre shocks externos severos y falta de cooperación entre las políticas fiscal y monetaria.

Abstract

This study provides a thorough review of the post-1998 slowdown in economic growth in Chile. This was a rather turbulent period in economic history, and as such, it motivates to carry on research on the likely causes of the slowdown and its possible solutions. The authors use an econometric model to test three competing hypotheses and derive general implications from the analysis. The first hypothesis puts the blame on bad luck, because of external shocks: namely, terms-of-trade losses and reduced capital inflows following the Asian crisis. A second hypothesis blames the slowdown on policies implemented as a response to the deteriorating external conditions, in particular the inability to achieve a balanced mix of monetary and fiscal policies during the 1997–1998 period. Fiscal imbalances and restrictive monetary policy, it is argued, led to very high interest rates, severely affecting the investment and consumption decisions of the private sector. Finally, a third explanation is that the slowdown resulted from the completion of a high growth cycle associated with the structural reforms introduced in the 1985–1995 period. The authors conclude that the slowdown in the Chilean economy was a mix of severe external shocks and lack of cooperation between fiscal and monetary policies.

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Introduction

In the mid-1970s, Chile was the first country in Latin America to start moving away from a model based on pervasive government intervention to one in which the market plays a central role in resource allocation and in production and consumption decisions. This move toward a market economy was accompanied by a restoration of order in the public finances in an attempt to reduce inflation to single digit levels and to put the macroeconomic situation under control. The changes accomplished since then have been dramatic. At the time the shift was instituted, the Chilean economy was highly distorted as a result of the cumulative effects of forty years of interventionist policies and disregard for the macroeconomic fundamentals. It was dominated by a very large and intrusive public sector, with severe macroeconomic unbalances that had their roots in a high public sector deficit, which reached 25 percent of gross domestic product (GDP) in 1973. Price controls and rationing were widespread, and the financial sector was repressed through the use of controls on nominal interest rates at levels that were far below inflation.

The Chilean economy went through a major political and economic crisis in the early 1970s. A deep recession in 1975 was then followed by a period of recovery and rapid growth that lasted until 1981, when a new crisis developed. After a costly adjustment effort, growth resumed

again in 1984. The average growth rate between 1985 and 1997 was 7.4 percent, with 1997 growth at 7.4 percent. This period of high growth was interrupted in the late 1990s as a result of severe external shocks (namely, reduced capital inflows, worsening terms-of-trade, and contagion of the Asian, Russian, Brazilian, and Argentine crises) and the domestic policy response to these shocks.[1] Table 1 presents Chile's main economic indicators in the 1974-2000 period.

The post-1997 growth slowdown does not have a single cause. Several hypotheses have been put forth to explain the situation. One cites the bad luck resulting from a series of external shocks: terms-of-trade losses and a slowdown in capital inflows following the Asian crisis. Another blames the slowdown on the policy responses to the deterioration in the external environment. In particular, the inability to achieve a more balanced mix of monetary and fiscal policy during the 1997–1998 period put all the weight of reducing expenditures on monetary policy, with detrimental effects on sectors that are heavily dependent on the interest rate cost (namely, small and medium-sized enterprises and the construction sector). A related hypothesis is that the staunch defense of the exchange rate band resulted in high interest rates, with similar costs on the most exposed sectors. A final explanation is that the slowdown resulted from the completion of a high growth cycle associated with the structural reforms introduced in the 1985–1995 period. According to this last hypothesis, the favorable supply shock linked to the structural reforms of the previous twenty years unleashed a period of high productivity growth that was completed by the second half of the 1990s.

This paper evaluates Chile's macroeconomic performance in the second half of the 1990s, concentrating on the role played by each of these competing hypotheses, with a special emphasis on the first two. The rest of the paper is organized in five sections. Section 1 uses a Solow's growth accounting framework to identify the factors contributing to growth from 1951 to 1997, just before the slowdown. Section 2 reviews the main developments in policies and macroeconomic development in the 1990s to set the stage for the analysis carried out in the next two sections. Section 3 uses a framework based on nonstructural vector autoregressive (VAR) models to look at the main factors accounting for the post-1997 slowdown of the economy. Section 4 uses a small macroeconomic structural model to assess the economic consequences of some of the actions undertaken in 1997–1998. Finally, section 5 presents our main conclusions.

1. For a review of the period at different stages and from different points of view, see the papers in Bosworth, Dornbusch, and Labán (1994) and Larraín and Vergara (2000b).

Table 1. Chile: Macroeconomic Indicators, 1974-2000

	Real GDP growth (%)	*Domestic expenditure growth (Real,%)*	*Trade balance (% GDP)*	*Current account balance (% GDP)*	*Public sector balance (% GDP)*	*Real price of copper (1990=1)*	*Real price of oil (1990=1)*	*Inflation rate (% Dec-Dec)*	*Unempl. rate national (%)*	*Real exchange rate (1986=100)*	*Real interest rate (% annual)*	*Terms of trade (1986=1)*
1974					-5.4	1.678	1.185	369.2				2.077
1975	-13.3	-21.1	1.0	-6.8	-2.0	0.921	0.966	343.3	14.9			1.261
1976	3.2	-0.5	6.5	1.5	4.0	1.001	1.055	197.9	12.7			1.387
1977	8.3	12.9	0.3	-4.1	0.4	0.879	1.082	84.2	11.8	57.1		1.254
1978	7.8	9.7	-2.8	-7.1	1.6	0.851	1.001	37.2	14.2	68.1		1.207
1979	7.1	10.4	-1.7	-5.7	4.8	1.098	2.001	38.9	13.6	70.2	22.9	1.444
1980	7.7	10.5	-2.8	-7.1	6.1	1.062	2.070	31.2	10.4	60.8	13.4	1.343
1981	6.7	12.4	-8.1	-14.3	0.8	0.775	1.836	9.5	11.3	52.9	14.7	1.169
1982	-13.4	-23.8	0.3	-9.8	-3.4	0.645	1.639	20.7	19.6	59.0	15.5	1.066
1983	-3.5	-8.6	5.1	-5.7	-3.0	0.686	144.2	23.1	14.6	70.8	11.1	1.161
1984	6.1	8.7	1.9	-10.9	-4.3	0.579	1.359	23.0	13.9	74.0	9.2	1.077
1985	3.5	-2.4	5.4	-8.6	-2.6	0.599	1.312	26.4	12.0	90.9	9.1	1.032
1986	5.6	4.9	6.2	-6.7	-2.1	0.598	0.706	17.4	10.4	100.0	7.6	1.000
1987	6.6	9.8	6.3	-3.6	-0.2	0.759	0.880	21.5	9.6	104.3	7.2	1.147
1988	7.3	7.7	9.1	-1.0	0.2	1.061	0.687	12.7	8.0	111.2	7.4	1.552
1989	10.6	13.3	5.4	-2.5	1.3	1.107	0.798	21.4	7.1	108.6	8.9	1.575
1990	3.7	2.9	4.2	-1.6	3.6	1.000	1.000	27.3	7.4	112.7	12.7	1.382
1991	8.0	6.2	4.3	-0.3	2.4	0.876	0.841	18.7	7.1	106.4	8.3	1.283
1992	12.3	15.0	1.7	-2.3	2.9	0.850	0.812	12.7	6.2	97.6	8.3	1.273
1993	7.0	10.8	-2.2	-5.7	2.1	0.702	0.701	12.2	6.4	96.9	9.3	1.255
1994	5.7	5.5	1.4	-3.1	2.3	0.838	0.645	8.9	7.8	94.2	9.3	1.423
1995	10.6	16.2	2.1	-2.1	3.8	1.027	0.671	8.2	6.6	88.9	8.5	1.573
1996	7.4	7.9	-1.6	-5.1	2.0	0.783	0.786	6.6	5.4	84.7	8.8	1.376
1997	7.4	9.1	-2.1	-5.0	1.0	0.778	0.735	6.0	5.3	78.2	8.4	1.418
1998	3.9	3.9	-3.4	-5.7	-1.2	0.580	0.502	4.7	7.2	78.0	10.9	1.259
1999	-1.1	-10.0	2.5	-0.1	-2.3	0.547	0.692	2.3	8.9	82.3	8.2	1.203
2000	5.4	6.6	2.1	-1.4	-0.6	0.597	1.046	4.5	8.3	86.0	7.4	1.228

Source: see appendix A.

1. Growth Accounting: Explaining GDP Trends

Chile's favorable growth record in 1985–1997 has attracted the attention of researchers and policymakers interested in learning from the successful transformation of a Latin American country. The Chilean model is relevant beyond Latin America as it provides a clear contrast with the East Asian model, by relying on a private market economy guided more by rules than by discretion. Consequently, the country requires a smaller government than the East Asian model, and it therefore economizes on human capital and government capacity. The model might thus be more suitable for the typical developing country. Given that Chile is rich in natural resources, however, it is natural to question whether the success is due to the results of the economic policy implemented or whether it is only a consequence of a period of good luck in the commodity lottery.[2]

To answer this question, we study the factors contributing to the Chilean growth record in this period. Much work has been done in this field in recent years, extending the standard Solow model of the 1950s. It is mostly of the cross-sectional variety and is based on the now fairly standard new growth theory framework (Barro and Sala-i-Martin, 1995; Fischer, 1993). Within this framework, a sudden jump in the growth rate, such as that observed in 1985–1997 in Chile, has to be attributed to a change in the growth rate of capital accumulation, a temporal increase in the growth rate of employment above the growth rate of the labor force, a jump in the growth rate of total factor productivity (TFP), or a combination of these three factors. Of course, the rate of increase in capital accumulation can be affected by changes in the prices of export commodities.

Lefort and Solimano (1994) and Meller, O'Ryan, and Solimano (1996) use this type of framework for the case of Chile. The latter paper shows that in the prereform period (1951–1973 in the study), TFP growth was small relative to GDP growth, while in 1984–1989 (which the authors define as a period of recovery and reconsolidation of reforms), TFP growth was 0.79 percent per year, and growth in the labor input was the main factor contributing to growth. In contrast, in 1989–1993 (here defined as a period of sustained growth), the growth of TFP was 2.39 percent per year and accounted for one-third of the GDP growth rate. The contribution of capital accumulation alone in this period was close to one-half of the GDP growth rate—3.5 percent compared with 7.1 percent.

2. Bulmer-Thomas (1994).

Table 2. Factors Accounting for Growth

Period	*Labor*	*Capital*	*TFP*	*Total*
1951-1960	0.99	1.33	0.64	2.96
1961-1970	0.74	1.61	1.39	3.74
1971-1980	0.40	0.79	0.09	1.28
1981-1985	0.74	0.50	-2.95	-1.71
1986-1995	0.87	1.56	3.97	6.4
1995-1997	0.69	4.80	3.01	8.5

Source: Authors' own calculations.

Lefort and Solimano (1994) follow the work of Fischer (1993) in endogenizing the growth rate of factor inputs and TFP. They relate the growth rate of these variables to macroeconomic factors, economic reforms, and external shocks. They find that macroeconomic instability, measured by the inflation rate and the standard deviation of the inflation rate, has a negative effect on the growth rate of factor inputs and the rate of change of TFP.[3] They also find that the volatility of the real exchange rate, measured by its standard deviation, has a negative effect on the rate of change of TFP, whereas trade liberalization and financial deepening have a positive effect on the rate of change of TFP. Indeed, financial deepening "is the most important factor in explaining the change in total factor productivity growth, both in the whole sample and in the period 1974–1989" (Lefort and Solimano, 1994, p. 25).

The same study finds that rate of change in the terms of trade has a positive effect on the rate of capital accumulation for the period 1974–1989. After testing the robustness of their findings, the authors conclude that macroeconomic factors and TFP growth chiefly affect capital formation.

To further examine the factors accounting for Chile's growth record, we re-estimate Lefort and Solimano's extended production function framework, extending the sample up to 1997. We then use the estimated equation to compute the factors contributing to growth in six subperiods (1951–1960, 1961–1970, 1971–1980, 1981–1985, 1986–1995, and 1995–1997). Table 2 reports the results. We find that the acceleration of growth during the high growth periods, 1986–1995 and 1995–1997, is largely due to a quantum jump in the growth rate of

3. Lefort and Solimano (1994) also find that the response of the rate of change of factor inputs and of TFP to inflation is nonlinear, with a higher response to high inflations.

total factor productivity, which alone accounts for more than half of the GDP growth rate, on average. This result is higher than that reported by Meller, O'Ryan, and Solimano (1996) just for the period 1989–1993. The second most important factor is capital accumulation, which contributes more than 40 percent of the total.

This raises the question of the extent to which the growth reported above really reflects sustained growth, rather than recovery. There is no way to answer this question short of developing a full general equilibrium model for the period. One point is clear, however. As the economy was approaching full employment toward the end of 1997, sustaining the growth process would have required maintaining a high growth rate of capital formation; continuing to improve the allocation of resources and the incentives for firms to increase efficiency; and increasing the contribution of human capital accumulation. Instead, Chile suffered another string of external shocks and some important slippages in economic policy: a string of large increases in the minimum wage starting in May 1998, an expansionary fiscal policy just when the current account deficit had to be reduced, and a hard monetary policy response to exchange rate pressure. This combination of factors derailed the economy from its previous high growth path.

2. Macroeconomic Policies and Developments in the 1990s: An Overview

By the end of the 1980s, the transition to a democratically elected government was in process, and the Chilean economy was enjoying a solid economic performance backed by strong macroeconomic fundamentals and sound microeconomic policies that promoted integration into the world economy and competition. On the macroeconomic side, the public sector debt was manageable, there was a fiscal surplus, and monetary policy was geared toward avoiding an acceleration of inflation and—with the help of the fiscal surplus—maintaining a competitive real exchange rate. In 1989, growth was 10.6 percent, the unemployment rate was 7.1 percent (down from 12 percent in 1985), inflation reached 21.4 percent, and the current account deficit was 2.5 percent of GDP.[4]

The new coalition government that took power in March 1990 made a strategic decision to embrace the market-oriented, open-economy policies of the past administration. Early on, the government implemented a stabilization program to slow down an economy that was clearly over-

4. For a description of monetary policy in this period see Fontaine (1991).

heating by the late 1980s, with accelerating inflation. The recently installed Board of the Central Bank had the responsibility of bringing inflation under control. The newly independent Central Bank was created in October 1989 and began operating in December 1989, only three months before the Presidency was transferred from Pinochet to Aylwin. It undertook as its main task the gradual reduction of inflation. The focus on gradualism was based on the concern that a rapid reduction of inflation would introduce serious distortions in relative prices in an economy characterized by widespread indexation of key prices to past inflation. Although the Central Bank's main objectives are to achieve price stability and to ensure the proper functioning of the domestic and external payment systems, the existence of a robust financial system and solid external accounts allowed the Central Bank to focus on the inflation rate objective. In terms of the current literature on central bank independence, the Central Bank of Chile is modeled on Rogoff's conservative central banker (1985)[5]. Chilean law gives the Central Bank independence to set its own targets, as well as to choose the instruments it deems appropriate for achieving those targets[6]. In contrast to other independent Central Banks created recently, the Central Bank of Chile is also responsible for the exchange rate system and for exchange rate policy.

The Central Bank initially set itself the objective of gradually reducing inflation. That objective was later modified to achieving inflation rates similar to those observed in industrial countries, while maintaining current account deficits that would not jeopardize the stability of the external payment system[7]. Whenever the two objectives entered into conflict, as was the case in 1996, the inflation target was given priority.

The inflation objective for the coming year is chosen by the Central Bank and then announced to the Congress and the country during the first fifteen days of September of each year. At first, that objective was

5. In this model, the Central Bank Board behaves as if minimizing a quadratic loss function. The arguments of the function are the departure of the inflation rate from its target and the departure of the current account deficit from its target (or the unemployment rate from its target in Rogoff's model). De facto, the Central Bank has been assigning the greatest weight to the inflation term, resulting in conduct similar to that observed for what Rogoff describes ad the conservative central banker.

6. This is by omission more than by commission, since the Central Bank's charter spells out its objective of achieving price stability but does not specify who sets the inflation target.

7. Massad (1998) defines this level as 4 percent of GDP when the current account is measured using normal terms-of-trade levels. Unfortunately, normal is not defined in the same paper. Morandé (2001b) states that the current account objective was 2 to 4 percent up to 1995 and between 4 percent and 5 percent between 1996 and 1998.

stated in terms of a range for the consumer price index (CPI) inflation rate for the period December to December of the coming year. In September 1994, the Central Bank moved toward setting a point estimate for the inflation objective. Finally, in September 1999, it announced that the objective was now to maintain an inflation rate in the range of 2 percent to 4 percent, allowing only for temporary deviations from these bounds. At the same time, the Bank replaced the exchange rate band system with a floating rate. In the initial years, the target was announced without an explicit declaration of how policy was going to be conducted. The system has since converged to a full-fledged inflation-targeting regime. The inflation target is the ultimate objective of policy, while a publicly announced inflation forecast is the intermediate objective; the interest rate is the main instrument for achieving those objectives.[8]

When the independent Central Bank started to operate in late 1989, it inherited a passive crawling peg exchange rate band system that had been in operation since the mid-1980s. In that system, the mean point of the band was adjusted by the differential between domestic and foreign inflation in a sort of constant central parity for the real exchange rate. The width of the band at the time was 5 percent in each direction of the central parity. As the Central Bank pursued its objective of achieving a target inflation rate, the secondary objective of also targeting a level for the real exchange rate became increasingly problematic, given that the combination of favorable external factors and perceived good domestic policies in Chile resulted in a quantum jump in capital inflows. Consequently, a conflict between the inflation target and the real exchange rate objective surfaced repeatedly in the 1990s. The inflation objective was given priority, but the Central Bank also struggled to avoid an excessive real appreciation. Throughout most of this period, it actively intervened in the foreign exchange rate market, implementing an aggressive and costly policy of foreign reserve accumulation, accompanied by the sterilization of the monetary effects of this accumulation. At other times, the Bank accommodated a real appreciation with a downward adjustment of the central parity and reduced the slope of the central parity by introducing a discount related to the growth rate of productivity[9]. It was during this period

8. For reviews and descriptions of monetary policy in this period- see Corbo and Fischer (1994); Corbo (1998); Budnevich and Pérez (1995); Massad (1998); Zahler (1998). A review of the international experience with inflation targeting in the same period can be found in Bernanke and others (1999).

9. The discount was estimated to be a 2 percent annual appreciation, based on a Harrod-Balassa-Samuelson effect. More recent estimations obtain values of 0.7 percent (see Délano and Valdés, 1998).

of high capital inflows that the Central Bank introduced an unremunerated reserve requirement for capital inflows.

The problem inherent in the simultaneous pursuit of inflation and exchange rate targets is well known. Within the exchange rate system, as long as the observed value of the exchange rate is well within the band, the uncovered interest rate parity condition provides a link between the interest rate and the exchange rate, such that any adjustment of the domestic interest rate results in a movement of the nominal exchange rate. For all practical purposes, therefore, exchange rate policy cannot be independent[10]. The Central Bank of Chile also ran into conflicts with the Ministry of Finance whenever an increase in domestic interest rates caused a sharp nominal and real exchange rate appreciation, since such an appreciation could lead to a deterioration in the profitability of exports and eventually damage the long-term sustainability of the export-led growth process.

Chile did not suffer the effects of either the tequila crisis itself or its extension to Argentina, thanks to continuous access to foreign financing and very favorable terms of trade. The economy was by then delivering growth above 7 percent per year, the unemployment rate was falling rapidly, and annual inflation decrease continuously throughout the period. Public support for the economic policies thus began to increase. Difficulties on the macroeconomic front only began to emerge in early 1998, when the authorities were unable to articulate a coordinated monetary and fiscal policy response to a series of severe external shocks. In addition, several speculative attacks on the currency initiated a period of very high interest rates, which ultimately resulted in a sharp slowdown.

Various factors were behind the slowdown in growth, but one of the key processes was the deterioration in the external environment, including a drop in the terms of trade and reduced financial inflows owing to contagion from the series of emerging market crises. The terms of trade fell 15.2 percent between 1997 and 1999. But this was not all. On the eve of the Asian crisis, 33.1 percent of Chilean exports went to

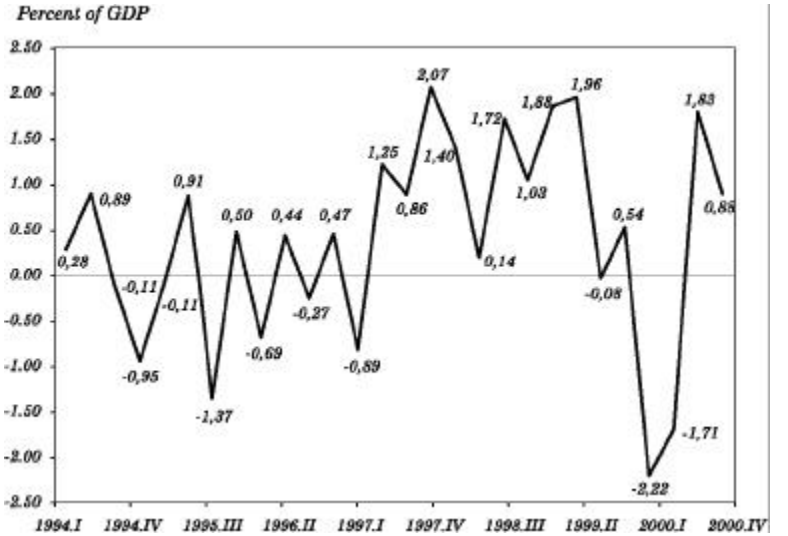
10. The exchange rate system took the form of a diagonal exchange rate band throughout most of the 1990s. The central parity of the band was adjusted passively, on a daily basis, by the difference between the domestic and international inflation. The width of the band was increased to 10 percent on both sides of central parity in January 1992. Central parity was established in terms of the value of the U.S. dollar before July 1992 and in terms of a basket of currencies thereafter. Starting in November 1995, a further 2 percent per year was subtracted from the central parity to accommodate an estimate for trend appreciation of the equilibrium real exchange rate.

Asia; these subsequently dropped by 25 percent. Furthermore, in what is a major difference with the tequila crisis of late 1994, this time the deterioration in the external environment came when the economy was already overheating. Domestic expenditure was growing at an average four-quarter rate of 14.4 percent during the last two quarters of 1997 and the first of 1998. The spending boom was fueled by a combination of a private-sector-led spending boom, overgenerous public sector wage increases, a sharp increase in the minimum wage, and another foreign-financed lending boom. In contrast with the crisis of the early 1980s, however, the financial system was quite strong thanks to a well-designed and effectively enforced supervisory and regulatory system, as well as the existence of well-capitalized banks. Even so, the overheating did take place, and, as a result, the excess of domestic spending over national disposable income—that is, the current account deficit—reached 7.4 percent of GDP in the year ending in the third quarter of 1998. The real exchange rate suffered a sharp appreciation, as is typical of an economy facing increasing demand pressures in the nontradables market.

The deterioration in the external environment coincided with a strongly expansionary economic cycle, and it set in motion several speculative attacks on the exchange rate system, this time on the exchange rate band. Although the explicit exchange rate band was a very wide 12.5 percent on each side of the central parity, and the market exchange rate was solidly on lower end of the range, the Central Bank was implicitly targeting a level of the exchange rate as an additional tool—on top of the short-term interest rate—to keep inflation within the target and to avoid an excessive exchange rate appreciation that could contribute to widening the current account deficit (Morandé, 2001a).

By the time the Asian crisis hit, the Chilean economy was overheating behind a foreign-financed boom in private domestic spending and expansionary fiscal and monetary policies. Indeed, the Central Bank initiated a series of cuts to reduce the policy interest rate from 7.5 percent to 6.5 percent, starting in February 1997. The latter level was set in October of the same year. Three arguments might be used to justify these reductions in the policy rate. First, inflation was coming down and was well within the target-band; the Central Bank could thus have been quite confident that future inflation was not a problem. Second, if the terms-of-trade shock was expected to provide enough restraint, authorities may have seen room to introduce a more expansionary policy, given that inflation was under control. Third, the high costs of sterilization may have led the Central Bank to decide to stop

Figure 1. Quarterly Fiscal Impulse



Source: Authors' calculations.

sterilizing the monetary effect of the foreign reserve accumulation. The Central Bank in fact accumulated more than US$3 billion in foreign reserves from end-January 1997 to end-October 1997. As shown in appendix B, fiscal policy was also expansionary during this period. Measures of quarterly fiscal impulse indicate that fiscal policy was expansionary during almost the whole period between 1997:2 and 1999:2 (see figure 1). The fiscal impulse for the periods before and after 1997:2 exhibit clear differences. Marcel and others (2001) use annual data to show that half of the deterioration in the fiscal accounts in 1997–1999 can be accounted for by a more expansionary fiscal policy and the other half by the cycle and the temporary deterioration in the price of copper.

When the Asian crisis emerged in the third quarter of 1997, domestic expenditure was growing at 12.0 percent and GDP at 8.7 percent (both as the four-quarter rate of change), while the current account deficit in the year up to the third quarter of 1997 had reached 4.5 percent of GDP. The deterioration in the external environment and the resulting reduction in the terms of trade raised the prospects for a further rise in the current account deficit. Under these circumstances, the appropriate response was a monetary and fiscal policy mix capable

of providing appropriate restraint while facilitating the real depreciation required for switching. Given that the exchange rate was already in the lower range of the exchange rate band, the correct mix here was a restrictive fiscal policy and a monetary policy geared toward assisting a nominal and real depreciation of the currency. The budget submitted to and approved by Congress, however, was extremely expansionary, as it was built under the assumption of a 7 percent growth rate in 1998. Moreover, some additional fiscal decisions that did not directly affect the budget might have had a perverse effect on the evolution of private sector expenditure and wage arrangements. The minimum wage was raised more than 40 percent in May 1998—many months after the Asian crisis had emerged—and public sector wages were raised 6 percent in 1998. The sharp minimum wage adjustment, together with the generous increase in public sector wages in the same year, gave a bad signal to private sector workers and made switching more difficult and costly in terms of unemployment. A more conservative budget and lower wage adjustments might have helped to adjust domestic demand without having to rely exclusively on monetary policy. As it was, monetary policy was confronted with an important trade-off between the inflation target and deteriorated real activity given the deterioration of the external environment.

The first episode of an attack on the peso coincides with the development of the Asian Crisis, when the sharp increases in domestic interest rates all across Asia and the massive capital flight that was developing resulted in a major downfall in regional stock markets, including Latin America. Brazil, Argentina, and Mexico experienced record falls on Monday, 27 October. Later that week, severe pressure started to build on the Latin American currencies and stock markets, especially in Brazil, Argentina, and Mexico. By early 1998, as the plunge in the Asian currencies intensified and Indonesia's political problems increased, the contagion to Latin America accelerated through Brazil and Argentina. The observed value of the Chilean market exchange rate at this time was well within the lower half (the most appreciated part) of the band. The Central Bank was in a difficult position, however, with an expansionary fiscal policy for the year already approved in Congress and an overheating economy. It was thus reluctant to allow the exchange rate to depreciate within the band out of a fear that a high pass-through from the depreciation to inflation would jeopardize the inflation target for the following year[11]. This fear of depreciation—that is, of letting the exchange

11. Indeed all through this period the market exchange rate was well within the lower—or most appreciated—part of the band.

rate depreciate within the exchange rate band—is clearly stated in a recent paper by the then Chief Economist of the Central Bank:

> At first, in early 1998, the main fear of the Central Bank was that the rapid depreciation of the peso in progress was a serious threat to the inflation target set for the year's end. This concern was based on the high pass-through from the peso depreciation to domestic inflation when the local demand was growing at annual rates of over 12 percent, estimated then at 0.6 (Morandé, 2001a, p. 4).

The fear of depreciation was also sometimes linked to its potential balance sheet effects.[12] Given this fear of depreciation and despite the refusal of the fiscal authorities to revise the level of government expenditures for the year 1998, the Central Bank decided to lean against the wind, first selling foreign reserves and then, beginning in early January of 1998, increasing the policy interest rate. Between end-November 1997 and end-January 1998, the level of foreign reserves fell by US$2 billion, equivalent to more than 10 percent of the initial stock. This provides evidence in favor of the view that the failure to coordinate monetary and fiscal policy had its share of responsibility in the costly adjustment of the 1997–1998 period. The rise in the policy real interest rate, introduced a little later, was quite steep, from 6.5 percent in January to 8.5 percent in February—a full 200 basis points in less than two months. When the rate was raised another 150 basis points on 3 February 1998, the Central Bank also changed its operation procedures, shifting its intermediate target away from the interest rate and toward a monetary aggregate. As stated by the Central Bank Board on 3 February:

> The administration of liquidity will be oriented toward providing enough resources for the normal functioning of the financial system, with the objective that the inter-bank rate, at a minimum, be equal to the policy or reference interest rate [authors' translation].

Not surprisingly, as the expectation of a depreciation increased with the deterioration in the external environment, the market interest rate became much higher than the policy interest rate, with the latter now serving as a minimum value for the overnight interest rate. The operational procedure used for this purpose was the introduction of monetary targets. Restrictions on capital inflows were also progressively reduced in April 1998.

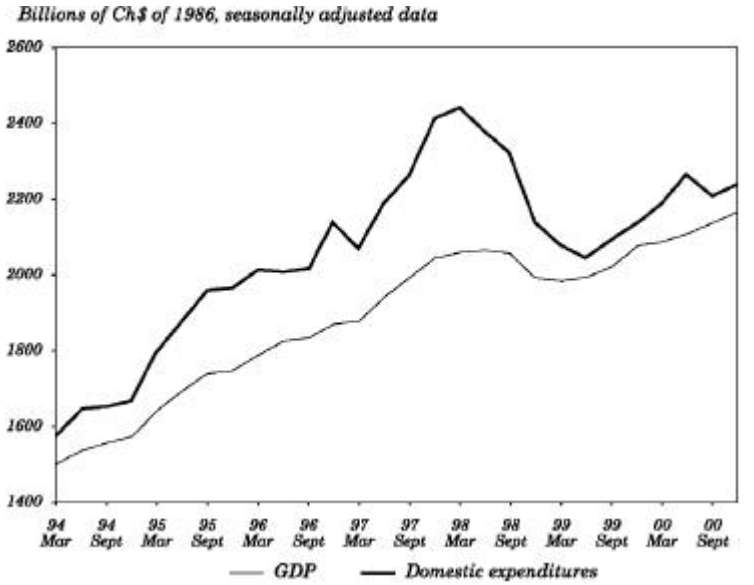
12. Public Statement of the Central Bank, 23 December 1998.

The second episode of a speculative attack took place around the last week of June 1998, when Brazil's large current account deficit (7.4 percent of GDP in the year ending in the third quarter of 1998) and contagion from the developing Russian crisis put renewed pressure on the Brazilian exchange rate system. The country's looming budget and current account deficits and upcoming presidential elections made Brazil the center of the attack.[13] When the contagion from the attack on the Brazilian currency reached Chile, the Central Bank used a battery of instruments to withstand the attack. A set of measures was announced on 25 June. First, the reserve requirement on capital inflows was reduced from 30 percent to 10 percent. Second, dollar-indexed Central Bank bonds were offered to facilitate private sector coverage of exchange rate risks and to relieve the pressure on the spot foreign exchange market. Third, in a move that took everybody by surprise, the Central Bank narrowed the exchange rate band from 12.5 percent on both sides of a central parity to an asymmetric band with a 3.5 percent lower band and a 2 percent upper band. The Central Bank statement at the time justified the move as a way of reducing the volatility in foreign exchange and financial markets. Because the market interest rate was the main instrument used to defend the narrow band, domestic interest rates increased substantially, reaching monthly levels of close to 4.5 percent in real terms. The deterioration of the situation in Russia and the continuous pressure on the Brazilian currency made the move to reduce the width of the band a very costly undertaking, in that the high interest rates required to defend the narrower band had detrimental effects on sectors sensitive to a sharp increase in interest rates.

A third attack on the peso developed after the Russian crisis of August 1998 and continued through mid-September, when the pressure on the Brazilian real was gaining renewed force. By then, however, the very high interest rates of the previous months were taking their toll on domestic spending, which was contracting sharply and thereby helping achieve a sharp reduction in the current account deficit. The four-quarter rate of change of domestic expenditures fell from 18.1 percent in the

13. The logic of this attack on the Brazilian currency can be derived from a second-generation model of currency crisis (Obstfeld, 1996; Krugman, 1996). In this model, private agents anticipate that the government faces a clear trade-off between the benefits of holding the exchange rate fixed (the exchange rate was by then the key anchor for inflation) and the costs associated with defending it through high interest rates with elections approaching in October 1998. Although the Brazilian Central Bank decided to fight the attack with high interest rates, this defense probably was not credible given the upcoming elections and the already weak public finances.

Figure 2. GDP and Domestic Expenditure Growth



Source: Authors' calculations. Seasonally adjusted using X-12 ARIMA.

first quarter of 1998 to 9.2 percent in the second quarter, 2.8 percent in the third quarter, and –11.6 percent in the fourth quarter.

Following this attack, the Central Bank decided to raise the policy interest rate and make it binding again by providing enough liquidity to an economy that was slowing down very fast.[14] Thus, the policy interest rate, which had not been relevant for the determination of the interest rate since January, was raised to 14 percent on 16 September, bringing up the market rate along with it. At the same time, the Central Bank announced that the exchange rate band was going to converge by the end of the year to a wider, symmetric band of ±5 percent around a central parity. These changes helped ease the pressure on the exchange rate, and the nominal exchange rate effectively remained close to the middle of the band for the rest of the year.

Table 3 presents the quarterly evolution of the main macroeconomic variables for the 1997–2000 period. Table 4 shows the cumulative change

14. Also on 3 September, the period considered for the computation of minimum reserve requirements was reduced from thirty to fifteen days to reduce the opportunities for banks to speculate against the peso.

Table 3. Chile: Macroeconomic Indicators: 1996.I-2000.IV

	Real GDP growth (%)	*Domestic expenditure growth (Real,%)*	*Trade balance (% GDP)*	*Current account balance (% GDP)*	*Public sector balance (% GDP)*	*Real price of copper (1990=1)*	*Real price of oil (1990=1)*	*Inflation rate (% 4th qtr)*	*Unempl. rate national (%)*	*Real exchange rate (1986=100)*	*Real interest rate (% annual)*	*Terms of trade (1986=1)*
1996-I	8.9	12.6	1.4	-2.97	4.6	0.9	0.7	7.9	6.6	86.9	9.1	1.073
1996-II	7.5	7.7	2.1	-3.20	2.0	0.8	0.7	8.4	6.6	84.2	9.5	1.057
1996-III	5.5	3.0	-4.0	-3.74	1.9	0.7	0.8	6.8	6.8	83.8	9.4	0.958
1996-IV	7.7	8.7	-5.9	-5.12	0.9	0.7	0.9	6.5	5.4	83.8	9.3	0.975
1997-I	5.0	2.0	3.8	-4.09	5.0	0.8	0.8	7.0	5.8	80.5	9.1	1.046
1997-II	6.1	9.1	0.6	-4.32	0.9	0.9	0.7	5.6	6.6	79.1	8.8	1.094
1997-III	8.7	12.0	-4.8	-4.48	2.1	0.8	0.7	5.7	6.7	76.8	8.6	1.064
1997-IV	9.8	13.1	-7.4	-4.95	-0.5	0.7	0.7	6.3	5.3	76.3	8.5	0.981
1998-I	8.8	18.1	-3.5	-6.63	3.9	0.6	0.6	5.6	5.3	77.8	10.3	0.942
1998-II	6.3	9.2	-3.0	-7.29	0.6	0.6	0.5	5.4	6.1	77.6	10.6	0.951
1998-III	3.4	2.8	-5.9	-7.40	-0.3	0.6	0.5	5.1	6.8	78.4	15.2	0.926
1998-IV	-2.5	-11.6	-1.5	-5.67	-2.5	0.5	0.4	4.4	7.2	78.2	11.6	0.897
1999-I	-2.8	-14.8	3.6	-3.95	1.3	0.5	0.4	3.8	8.2	79.0	9.4	0.868
1999-II	-3.7	-14.0	3.2	-2.43	-2.2	0.5	0.6	3.9	10.8	78.7	8.4	0.871
1999-III	-1.8	-9.9	0.1	-1.00	-1.0	0.6	0.8	3.2	11.4	83.6	7.3	0.902
1999-IV	4.0	-0.3	2.9	-0.12	-3.2	0.6	0.9	2.5	8.9	87.8	7.6	0.910
2000-I	5.5	5.4	4.9	-0.02	4.4	0.6	1.0	3.2	8.2	83.1	7.6	0.917
2000-II	6.0	11.0	0.4	-0.95	0.4	0.6	1.0	3.6	9.4	83.0	7.7	0.906
2000-III	5.6	5.7	0.6	-1.04	-1.7	0.6	1.1	4.0	10.7	88.4	7.5	0.904
2000-IV	4.5	4.7	2.2	-1.41	-2.3	0.6	1.1	4.6	8.3	89.6	7.2	0.899

Source: see appendix A.

Table 4. Cumulative Changes in Selected Macroeconomic Aggregates

Panel (a): Changes from 1998.II[a]
Percent

	1998.IV	*1999.I*	*1999.II*	*1999.III*	*1999.IV*
Gross Domestic Product	-3.9	-4.0	-3.6	-2.6	-0.3
Absorption	-10.3	-12.6	-14.2	-12.1	-10.1
Total Consumption	-9.8	-11.1	-12.2	-7.9	-4.5
Fixed Investment	-11.8	-16.3	-19.2	-22.5	-24.0
Net Exports	54.9	69.6	83.4	77.5	80.8
Exports	0.6	2.6	6.4	5.4	10.1
Imports	-15.1	-17.8	-19.0	-18.0	-15.7

Panel (b): Changes from 1998.II

	1998.IV	*1999.I*	*1999.II*	*1999.III*	*1999.IV*
			Difference (percentage points)		
Unemployment Rate	0.30	2.00	3.10	4.70	4.80
Core Inflation[b]	0.187	0.44	-0.169	-1.286	-2.382
Real Interest Rate	4.18	0.63	-1.13	-2.23	-3.25
Capital Flows (GDP)[c]	10.07	7.75	-4.52	1.63	4.05
Capital Flows (GDP)[d]	-1.45	-0.18	-2.84	-2.39	-3.95
			Change (%)		
Real Money M1A	-5.8	-9.5	-8.3	-5.1	-1.4
Real Money M2	3.0	2.6	1.5	5.7	8.1
Terms of Trade	-2.7	-5.7	-8.7	-8.5	-5.2
Employment	0.1	-1.2	-2.4	-3.7	-3.4

a. Seasonally adjusted data
b. 4-quarter change
c. Quarter
d. 4-quarter moving average
Source: Authors' own calculation on base of Central Bank of Chile (2001) and *Economic and Financial Report,* various issues.

for the main macroeconomic variables with respect to their values in the second quarter of 1998; and figure 2 presents the seasonally adjusted levels of GDP and domestic expenditure. The tables and figure illustrate that after peaking in early 1998, GDP and domestic spending (private consumption, public consumption, and total investment) started to fall rapidly.

Identifying the possible sources of this slowdown is not an easy task, since many factors were present at the same time. A primary

Table 5. Decomposition of the Economic Slowdown: Annual Values
Percent

	Government consumption	*Private consumption*	*Inventory investment*	*Fixed investment*	*Exports*	*Imports*	*GDP*
1998	0.07	-2.40	-1.15	-2.71	-1.62	4.25	-3.57
1999	0.03	-9.34	-5.59	-11.65	-2.94	17.91	-11.57
2000	0.07	-11.55	-4.34	-14.19	-4.08	20.50	-13.59

Source: Authors' calculations, based on the methodology of Hall (1993).

exploration can be achieved by computing the differences between the actual values of each component of GDP and values simulated under the alternative scenario of each component growing at the average GDP growth rate of the previous fourteen years. The results of this analysis are shown in table 5, which reports the values as a percentage of the GDP value obtained under the assumption that all variables grew at the previously observed average growth. As can be observed, the major decelerations came from private consumption and fixed investment.[15]

Carrying out the same decomposition using quarterly data allows us to take a closer look at the factors behind the slowdown. Unfortunately, Chilean quarterly national accounts provide a demand decomposition with only four terms: total consumption (private and public consumption plus change in inventories); fixed investment; imports of goods and nonfactor services; and exports of goods and nonfactor services. Despite the loss of detail in the disaggregation, working with quarterly data has a big advantage in that the possible break point can be observed more closely.[16] We use the first quarter of 1998 as our break point, as it represents the peak in the level of domestic spending and thus allows us to capture possible differences among variables in the timing of the slowdown. The benchmark scenario is one in which each component grows at a rate equal to the average quarter-to-quarter growth rate of GDP during the previous fourteen years. In line with the previous results, the major deceleration during 1998 came from total consumption and fixed investment. The slowdown of real imports was also very severe, but in our analysis this means a positive contribution to GDP growth (see table 6).

15. The import figure is positive because from an accounting perspective, a lower imports value implies a higher GDP value.

16. We use seasonally adjusted data.

Table 6. Decomposition of the Economic Slowdown: Quarterly Values
Percent

	GDP	*Total consumption*	*Fixed investment*	*Net exports*	*Exports*	*Imports*
Mar-98	-1.09	-0.90	-0.08	-0.11	-1.78	1.68
Jun-98	-2.68	-4.87	-1.16	3.35	-1.11	4.46
Sep-98	-4.71	-7.63	-3.12	6.04	-1.76	7.81
Dic-98	-9.61	-15.41	-6.02	11.81	-2.35	14.16
Mar-99	-11.69	-17.79	-7.92	14.02	-2.31	16.33
Jun-99	-13.10	-19.83	-9.29	16.02	-1.67	17.69
Sep-99	-13.43	-17.98	-10.70	15.25	-2.73	17.99
Dic-99	-12.66	-16.83	-11.59	15.76	-1.86	17.62
Mar-00	-13.95	-17.21	-10.93	14.19	-1.63	15.82
Jun-00	-14.70	-15.94	-10.75	11.98	-3.07	15.05
Sep-00	-15.25	-19.95	-10.80	15.49	-2.14	17.63
Dic-00	-15.69	-20.45	-10.71	15.47	-2.66	18.13

Source: Authors' calculations, based on the methodology of Hall (1993).

This analysis does not allow us to separate the deceleration between exogenous innovations in the variable and changes caused by endogenous responses to shocks in other variables. To recognize the causes of the slowdown it is necessary to take a closer look at those exogenous innovations. As an approximation of these effects, we follow the analysis that Blanchard (1993) uses to identify shocks to GDP components during the 1990–1991 recession in the United States.[17] We estimate a quarterly VAR model including three components of GDP: total consumption, fixed investment, and net exports.[18] The first two variables are expressed as four-quarter rate of change and the third as percentage of trend GDP, which is measured as an exponential trend of seasonally adjusted GDP. An additional variable—the four-quarter rate of change of GDP—was included in the exercise, but its lags were not included as explanatory variables; this step is made just to obtain its forecast errors[19].

To identify the structural shocks, we again follow Blanchard (1993) in assuming that every variable is affected only by its structural shock and by the current GDP structural shock. GDP is assumed to be independent, so it is not affected by the other shocks.[20] To compute the effect of the GDP

17. Walsh (1993) carries out an alternative and more elaborated analysis.
18. Total consumption is the sum of private consumption, inventory investment, and government consumption.
19. For a more detailed explanation of this methodology, see Blanchard (1993).
20. This implies that the forecast error is exactly the structural shock.

Table 7. Shocks to GDP and its Components
Percent

Normalized Shocks[a]

	GDP	*Total consumption*	*Fixed investment*	*Net exports*
1997.IV	-0.655	0.509	0.547	-1.321
1998.I	-1.167	0.120	-0.702	0.161
1998.II	0.762	-1.103	0.561	0.019
1998.III	-0.583	-0.413	-0.471	1.494
1998.IV	1.212	-0.932	0.015	1.403
1999.I	0.630	-0.707	0.097	0.531
1999.II	-0.268	1.383	-0.575	-0.285
1999.III	-1.008	0.828	-1.570	0.325
1999.IV	-0.542	-0.369	-0.477	0.404

Source: Authors' calculations.
a. Shocks are normally distributed with mean 0 and standard deviation 1.

structural error on the rest of the variables, we estimate three equations, one for each forecasting error, with the GDP shock included as an explanatory variable. These regressions are estimated using two-stage least squares (TSLS); the instruments used are the GDP growth of the main trade partners, the change in the U.S. dollar London interbank offer rate (LIBOR), and the rate of change in the terms of trade.[21] The structural errors are reported in table 7.

The picture presented in the table is not as clear as we would like. Fixed investment suffered a severe negative shock in the second half of 1999, but before that there is no evidence of changes not forecast by the lagged structure of the VAR model. GDP suffered a large negative shock the first quarter of 1998, but this was offset by a large positive one in the fourth quarter.

What is important to note is the presence of two large positive shocks to the foreign demand component in the last two quarters of 1998, perhaps reflecting the good external environment provided by a sound U.S. economy. So, apart from some large and specific shocks, the evolution of GDP is almost entirely explained by the internal dynamic of the economy implied in the model. Total consumption has just one signifi-

21. We use different sets of instruments, and the results are robust to these changes. The results also hold when the estimation is carried out using ordinary least squares (OLS) instead of TSLS.

cant shock, but after the second quarter of 1998, it suffered four consecutive negative shocks that may have pushed its significant deceleration. The puzzling result is the important positive effect of the external demand component.

3. Sources of the Economic Slowdown: Results from a Nonstructural VAR Model

A further step toward understanding the post-1997 slowdown involves the use of a nonstructural VAR model. We estimate a nonstructural VAR including six endogenous and two exogenous variables.[22] The endogenous variables are the interest rate of the PRBC-90, the gap between core inflation rate and the linearized target inflation rate, the twelve-month rate of change of nominal money (M1A), the twelve-month rate of change of the real exchange rate, a monthly measure of the current account (as a percent of GDP), and the twelve-month rate of change of a monthly activity index (IMACEC).[23] The two exogenous variables are lags of the logarithm of the terms of trade and lags of the external inflation (expressed as a twelve-month rate of change).[24] We also estimate a VAR including the twelve-month rate of change of the monthly aggregate expenditure (AGEXP) instead of overall economic activity among the endogenous variables (IMACEC).[25] The variables included here are frequently used in VAR analyses of monetary policy in Chile.

We use these nonstructural VARs to simulate alternative scenarios starting from two different break points: September 1997 and June 1998. For the first period, we estimate the VAR up to September 1997 and then simulate it forward using the observed values of the exogenous variables. These simulated values are used as a benchmark for comparisons with simulations that use alternative scenarios for the

22. For a review of the VAR methodology, see Hamilton (1994); Greene (2000); Stock and Watson (2001). For references on VAR estimation for Chile with surveys of related work, see Valdés (1997); García (2000); Cabrera and Lagos (2000). Our estimations closely follow the structure used by Valdés (1997).

23. The PRBC-90 corresponds to the rate of the Central Bank's ninety-day indexed bonds. The lags were selected according to the Akaike info criteria. All the individual equations presented a good fit of the data, with R-squared statistics higher than 0.8 in almost every case.

24. The monthly terms of trade were obtained from Bennett and Valdés (2001). They also compute a different measure of the monthly terms of trade; our results do not change significantly when we employ this alternative.

25. The authors compute monthly aggregate expenditure.

exogenous variables. The results of the dynamic simulation are very interesting. Comparing the observed values of the IMACEC with the dynamic forecasts, we observe no great differences up to April 1998. This is not the case for AGEXP. When aggregate expenditure is used, the dynamic forecasts are not very good; in fact, the strong acceleration of its growth observed during the first months of 1998 is not explained by the VAR (see figure 3).

After the third quarter of 1997, the current account steadily decreased during the simulated period. This major deficit is almost entirely captured by the dynamic simulations, especially when the aggregate expenditure is added.

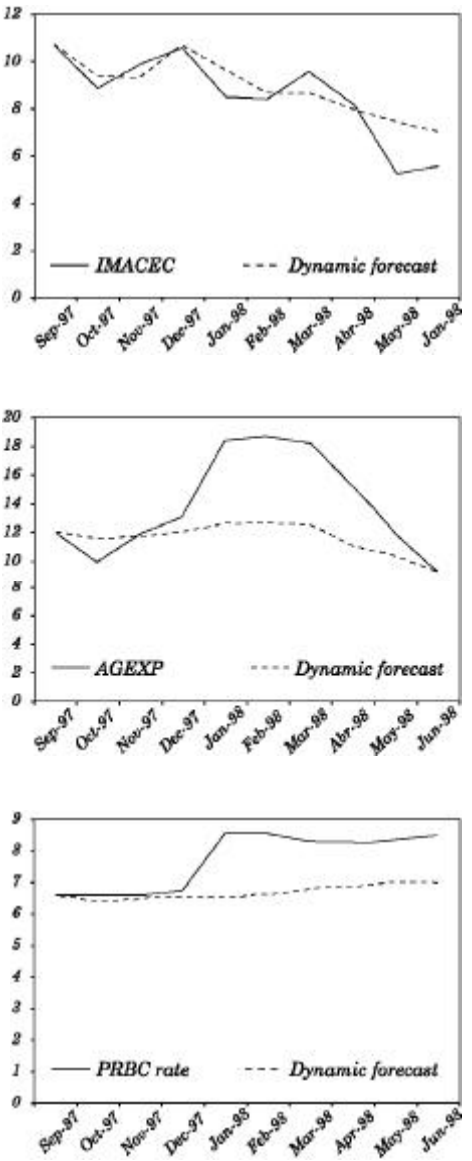
In the case of the real interest rate, the results are qualitatively similar to the AGEXP results. The dynamic forecasts are very different from the actual values, and the difference is important from January 1998 up to the last point of the simulation. The divergence coincides with an episode of strong pressure on the Chilean peso and a sharp increase in the overnight interest rate in mid-January. After the pressure on the currency was reduced as a result of the very high overnight and short-term interest rates, the Central Bank reacted by officially changing the interpretation of the policy interest rate from a guide for the overnight interest rate to a floor for the same rate. The policy rate was raised at the same time. The policy response is not explained by the dynamic forecasting errors of domestic spending (AGEXP) or of the current account; an alternative simulation using the observed values of both variables does not eliminate the difference.[26] According to this preliminary evidence, then, monetary policy exhibited a different reaction, understanding as normal what is implied by the VAR equation.[27] We cannot extract strong inference because the model is very simple, but the simulations give us an insight into possible explanations for the slowdown. The justification for this "different" monetary policy reaction is another question entirely, which we address later in the paper by introducing a series of different considerations.

Next we simulate the effect of alternative external environments on the endogenous variables listed above. The alternative scenarios take

26. Corbo (2002) shows that the current account deficit was effectively another target variable for monetary policy during the 1990s in Chile. This view is also supported in the empirical results reported in section 4 below.

27. This raises the question of whether the correspondent equation of the VAR is a good estimator of the policy reaction function. If we assume that monetary policy is forward-looking, the equation implies that the right-hand variables include the entire set of information available to the policymakers and that the estimation method gives us consistent estimators.

Figure 3. Actual and Dynamic Forecasts, VAR Model, October 1997-June 1998



Source: Authors' calculations.

into account different elements of the impact of the change in the external environment on the Chilean economy. The alternative scenarios are simulated from October 1997 up to June 1998, such that period of simulation includes the sudden stop of capital inflows after the third quarter of 1997, the first speculative attack on the peso in January 1998, and the aggregate expenditure and current account boom of the first months of 1998.

There are four alternative scenarios. The first scenario fixes the terms of trade at their September 1997 value and uses the observed values of the other exogenous variable; the solution for the current account balance is obtained from the model.[28] The second examines the external financing shock by fixing the value of the current account balance at its September 1997 value and using the actual values again for the exogenous variables. The third combines the two previously described scenarios, that is, it fixes both the terms of trade and the current account at their September 1997 values. Finally, the fourth scenario takes the observed values of the current account instead of the estimated equation of the VAR, that is, we force the adjustment in the current account that actually took place.[29]

As shown in figure 4 to 7, the results from the alternative scenarios are quite robust. In the case of IMACEC, this variable is closely tracked by each of the simulations, especially for the period up to February 1998. In the case of aggregate expenditure and the market real interest rate, the simulated values deviate substantially from the actual values, with the actual values well above those obtained from the dynamic solution of the model in all the scenarios studied. We conclude that there was an overexpansion of domestic expenditure that is not explained by our historical structure. As stated above, the increase in the real interest rate that began in January 1998 is also not explained, even if we take into account the actual values of the current account and the aggregate expenditure growth.[30]

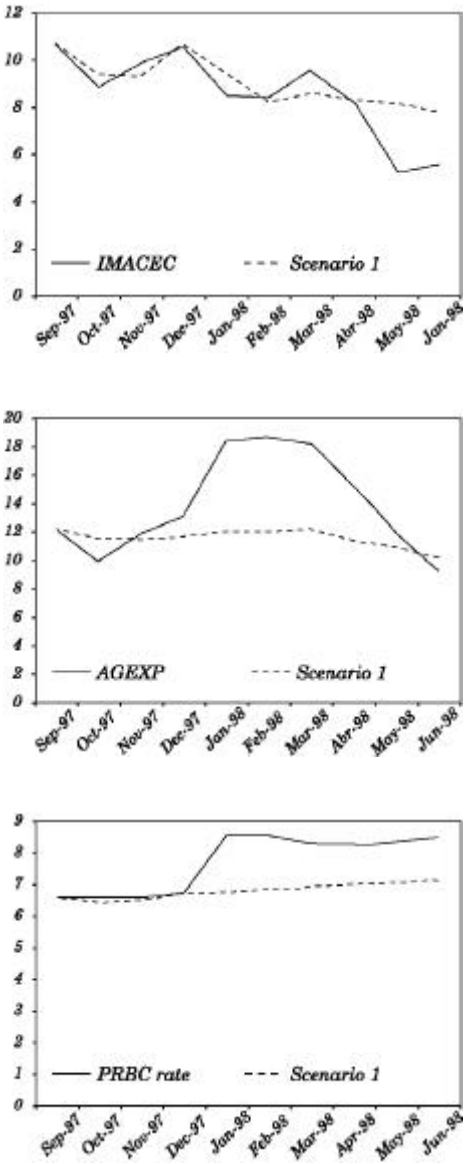
How do we interpret these findings? Generalized volatility on the emerging markets might be one possible answer. Interpreting the apparent overshooting in aggregate expenditure is more difficult, as by

28. This scenario is equivalent to eliminating all the endogenous variables' shocks.

29. These scenarios were simulated using the VAR including the IMACEC and the VAR including the aggregate expenditure, so that we could check the robustness of the results.

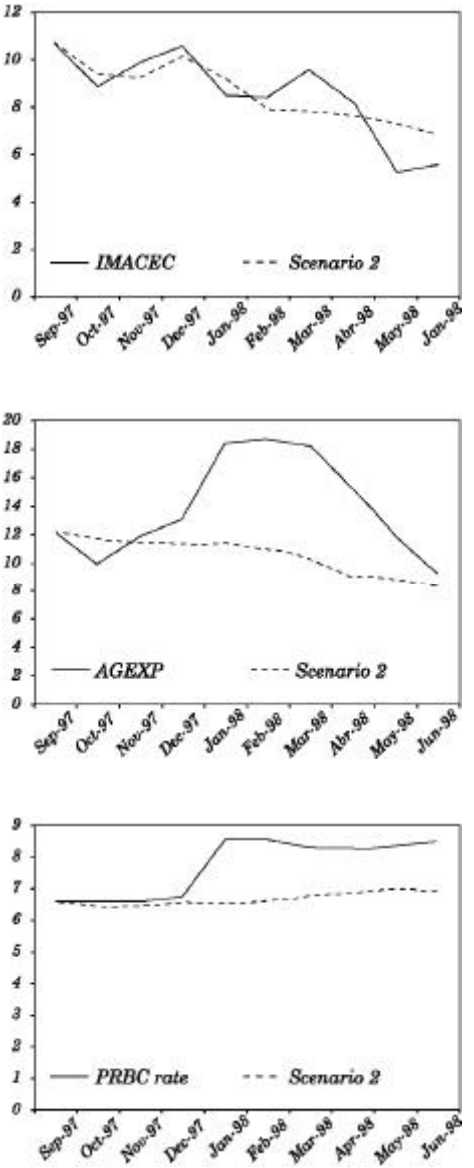
30. Massad (1998) recognizes that the current account deficit was another objective for the Central Bank.

Figure 4. Actual and Scenario 1, VAR Model, October 1997-June 1998



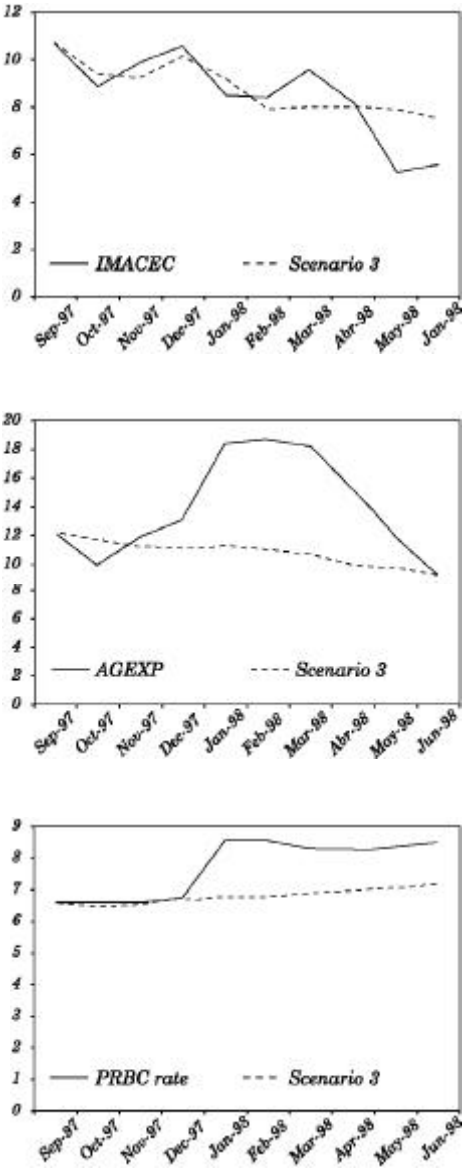
Source: Authors' calculations.

Figure 5. Actual Values and Scenario 2, VAR Model, October 1997-June 1998



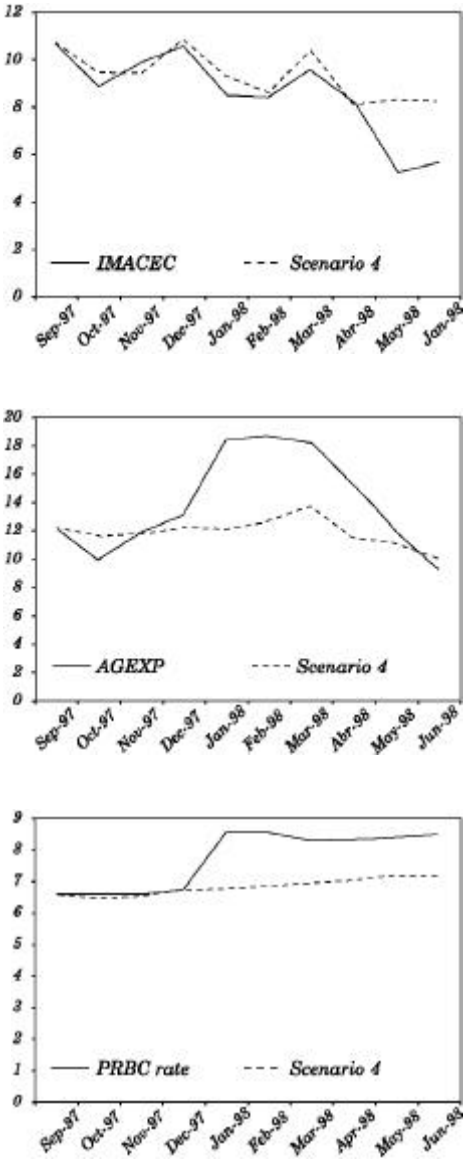
Source: Authors' calculations.

Figure 6. Actual Values and Scenario 3, VAR Model, October 1997-June 1998



Source: Authors' calculations.

Figure 7. Actual Values and Scenario 4, VAR Model, October 1997-June 1998



Source: Authors' calculations.

that time there were already clear signals of a major deceleration of world activity. An expansionary fiscal policy may be the missing piece of the puzzle.[31]

We conduct a second set of simulations to analyze the effects of the post-July 1998 shock that followed the Russian and Brazilian crises. For this purpose, we estimate the VAR model up to June 1998 and simulate it forward through March 1999. This time interval is even more interesting than the previous one because it includes the second episode of severe exchange rate pressure (August and September 1998). During this period, the overnight interest rate rose as high as 63 percent (expressed as an annual nominal rate), and the exchange rate target zone was narrowed to provide a signal that the Central Bank was not going to allow a sharp depreciation of the currency at a time when the pressure on the peso was intensifying. After solving the model forward to derive a benchmark solution, we simulate two alternative scenarios.[32] The first replaces the equation of the real interest rate in the VAR model by the observed real interest rate (scenario 5). That is, we take the observed real interest rate as exogenous in order to analyze whether the decline in real activity in the following months can be explained by monetary policy.[33] The second scenario (scenario 6) fixes the value of the real interest rate at its June 1998 level. That is, it turns off any response of monetary policy, thereby eliminating both the endogenous monetary policy response and the "exogenous" monetary policy shock. It must be noted that both scenarios include the observed values of the exogenous variables to control for any additional external shock that may have occurred during the simulation period.

The results for this second period are quite interesting. With regard to the real interest rate, the more interesting evidence derives from the comparison of the observed values and the values obtained from the dynamic solution (figure 8). The difference is very clear: neither the September hike nor the posterior reductions are similar to the dynamic derived from the historical values. The difference observed during the first months of 1999 could be explained as the endogenous

31. A more detailed analysis of the fiscal stance during the period is presented in appendix B.

32. Both alternative scenarios are very similar to the ones included in Bernanke, Gertler, and Watson (1997).

33. Here we include the endogenous response to the other shocks, as well as any possible monetary policy shocks. The benchmark case of the dynamic simulation includes only the endogenous response of the real interest rate to the rest of the variables of the economy. Since all the shocks are ignored, there is no endogenous response to exogenous shocks on the other variables.

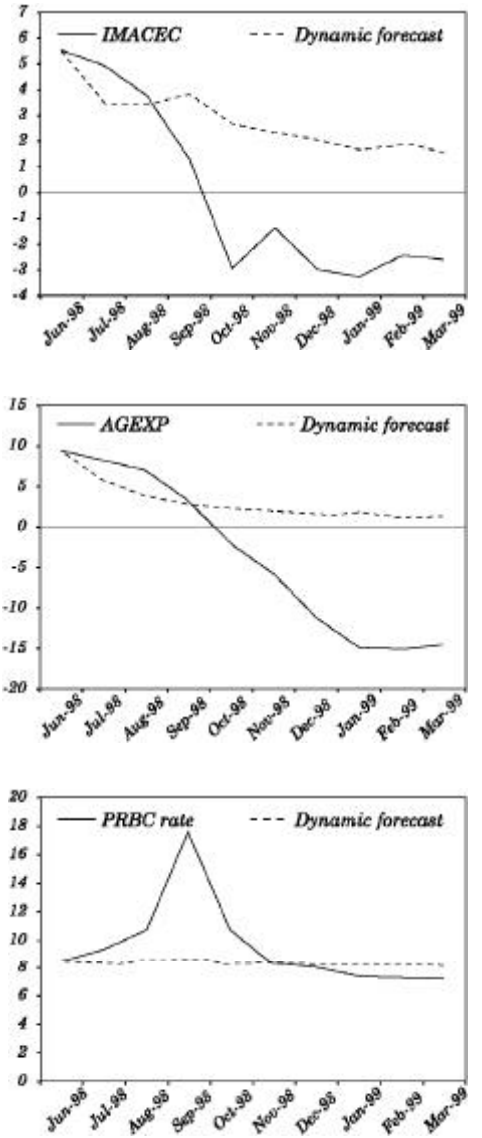
response of monetary policy to a deteriorated real activity resulting from the very high interest rate of the previous months.[34] A consideration similar to the one identified for the first simulation period applies here. Analyzing the policy response in terms of its compatibility with the previous behavior is not necessarily equal to analyzing it in terms of rationality or optimality. Also, new information that arrived during this period is not included in the simulations, and so we cannot control for them.

We now turn to the results generated when the overall economic activity index (IMACEC) is replaced by the aggregate expenditure index (AGEXP). The dynamic solution shows a smooth and steady deceleration, but it does not exhibit negative growth rates. The results are completely different, however, if we look at the simulation obtained when the observed values of the real interest rate are used. The expenditure index shows an abrupt slowdown, slightly smoother than the observed trend but with the dynamic continuing through February-March 1999.[35] One can interpret this result as evidence that the posterior slowdown was the result of monetary policy actions, both at the beginning of the simulation period and during the months immediately preceding it. When the IMACEC is used as the economic activity variable instead of domestic expenditure (AGEXP), the results are qualitatively similar. There is one problem, however: the point forecast for December 1998 is abnormally high owing to the lagged structure of the real interest rate variable in the equation for the IMACEC. If we ignore the effect of this month, the simulated values are somewhat lower than the actual ones, although they are significantly closer than the values obtained either with the dynamic simulation or under the alternative scenario with the real interest rate fixed at its June 1998 level. The picture here is almost exactly the same as that derived from the above analysis for the expenditure index. Based on this evidence, we can say that the mayor part of the deceleration of real activity during the period can be explained by external factors—mainly terms of trade—and the high real interest rate path. Results of the simulations of scenarios 5 and 6 are presented in figures 9 and 10.

34. An additional consideration for explaining this reduction can be inferred from the deceleration of observed and core inflation.

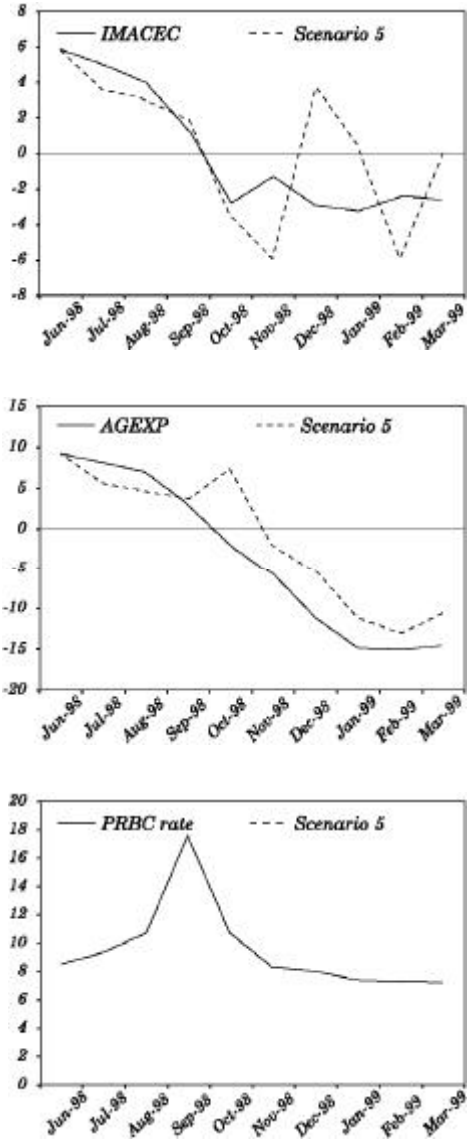
35. When the same scenario is simulated for a longer period, the recovery implied by the model is faster than the observed recovery. This difference might be the result of the previously unobserved (in the sample used for the estimations) real interest rate and some type of nonlinear effects of monetary policy on real activity not captured by the VAR model.

Figure 8. Actual and Dynamic Forecasts, VAR Model, July 1998-March 1999



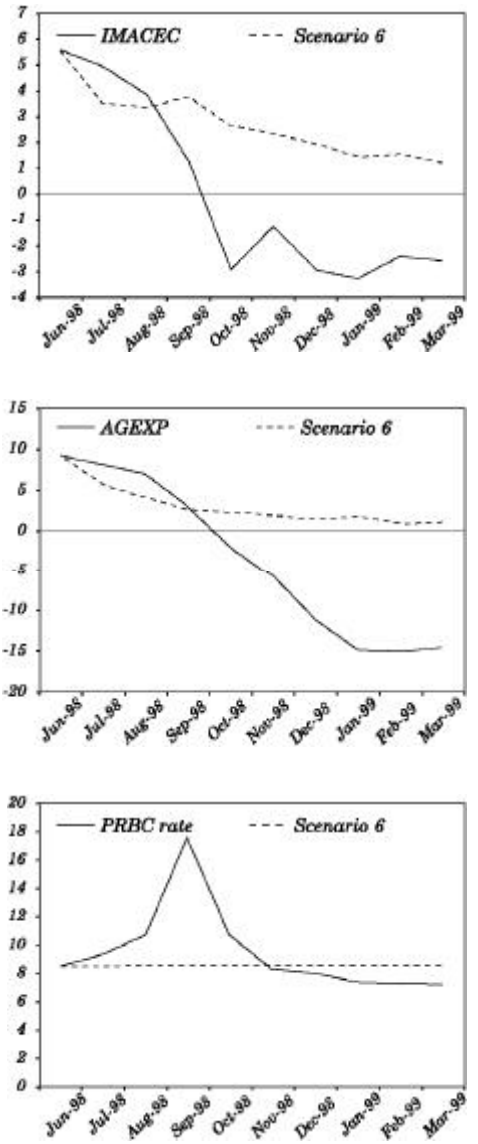
Source: Authors' calculations.

Figure 9. Actual Values and Scenario 5, VAR Model, July 1998-March 1999



Source: Authors' calculations.

Figure 10. Actual Values and Scenario 6, VAR Model, July 1998-March 1999



Source: Authors' calculations.

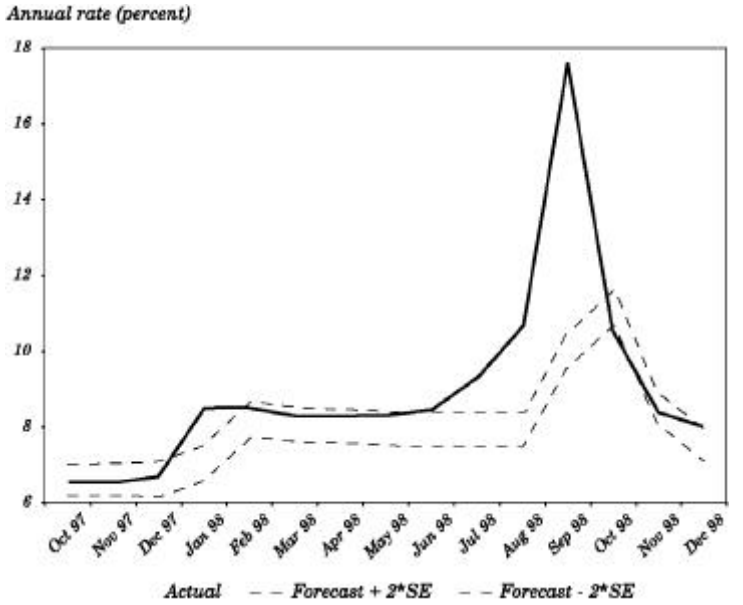
One additional point needs to be addressed. In January 1998 and again in August-September of the same year, the market real interest rate (the PRBC-90, which is the same rate used in our estimations) deviated significantly from the policy interest rate (*tasa de instancia*). During both periods, the policy rate was raised after the market rate reached its peak. This is related to a change in policy. Before January 1998, the *tasa de instancia* was closely related to the overnight rate and the real market interest rate (the PRBC-90 rate), as monetary policy was geared toward providing enough liquidity to move the overnight rate toward the policy rate. When the currency was attacked in January 1998, however, the Central Bank abstained from providing enough liquidity to keep market rates close to the policy rate. Market rates were thus left to adjust on their own in order to defend the currency. The disconnection between the market rates and the policy rate without any previous warning represents an important change in the interpretation of monetary policy, which could have had important effects on balance sheets and private behavior. After the meeting of the Central Bank's Board on 3 February 1998, the policy rate was increased and its interpretation was officially changed to a floor rate for the overnight interbank rate. To analyze the importance of this change, we carry out an experiment in which we retain the relation between the market rate (PRBC-90) and the policy rate that existed before September 1997—that is, we assume that the conduct of monetary policy had not changed. We first estimate a linear relationship between the policy rate and the market rate.[36] The estimated equation is then used to obtain forecasts of the market rate for the period from October 1997 to December 1998 (see figure 11). In January and July-September 1998, the observed values of the market rate (the PRBC-90 rate) lie outside of the band of plus or minus two standard errors. The implications for the two periods are quite different, however. In January, the change was abrupt. The sharp increase in market rates most likely took economic agents by surprise and thus resulted in important losses for those that were indebted in local currency at market rates. On the other hand, the Central Bank's actions to defend the currency against the attack protected economic agents that were short in dollars from a capital loss[37]. In July 1998, the market real interest rate (the PRBC-90)

36. The estimation was carried out using monthly data from June 1995 up to September 1997. The equation used in the simulation is as follows ($R^2 = 0.87$):

$$\text{Market Rate}_t = 1.41 + 0.80*\text{Policy Rate}_t + 0.41*(\text{Market Rate} - \text{Policy Rate})_{t-1}.$$

37. Indeed, a statement by the Central Bank on 22 December clearly recognizes that in 1998 the Board of the Central Bank was concerned with the balance sheet effects of a sudden and abrupt depreciation of the peso.

Figure 11. PRBC-90 Rate and Forecasts based on Policy Rate



Source: Authors' calculations.

started to rise slowly, following increases in the overnight rate. The difference reached a maximum by mid-September and disappeared when the policy rate was raised at the Board's meeting on 16 September.

The January and September episodes were thus quite different. By September, the market knew that the market rate could be significantly higher than the policy rate. Nobody could have been aware of that in January, however, because the official interpretation was completely different. This unannounced change of methodology was not a minor one. As pointed out by Lefort (2000), the joint existence of a floor policy rate and a legal ceiling on the lending interest rates (in accordance with Chilean banking law) may leave a fraction of borrowers unable to obtain financing from the formal market. These were the high-risk and high-cost-of-intermediation borrowers, including small and medium-sized enterprises that had reduced access to foreign financing and not enough high-quality collateral. Just looking at the market real interest is misleading because some firms face an unobserved interest rate that is much higher than the market rate, or are simply unable to borrow.

Caballero's (2002) interpretation is related to ours. Apart from the reduced supply of financial resources stemming from the monetary-policy-induced credit crunch, the much-reduced access to external markets forced large enterprises—which were credit worthy in the internal financial market—to look for internal resources, further worsening the squeeze on small and medium-sized firms. This means that at least part of the explanation of the slowdown could have been an adverse supply shock owing to financial constraints. This shock was exogenous to borrowers, but its origin can be attributed, at least partially, to monetary policy actions. This effect was probably exacerbated by portfolio adjustment toward dollar assets in anticipation of an eventual exchange rate adjustment that was postponed through the high real interest rates.

4. Macroeconomic Policies in 1997–1999: Evaluation with a Small Structural Model

The analysis of the previous two sections generates a number of questions about the appropriateness of the policy response to the increased pressure over the peso. The Central Bank faced the problem of fulfilling its main responsibility—namely, achieving and maintaining low inflation—in a situation in which the currency was under attack and the economy was overheating. Without the help of a contractionary fiscal policy, all the weight of the expenditure reduction fell on monetary policy. At the same time, the exchange rate adjustment that has to accompany the expenditure reduction to avoid a sharp increase in unemployment was postponed because of a fear of depreciation. This fear was linked to the estimated inflationary effects of the depreciation in an economy that was overheating when the first attack came.

In this section we use a small semi-structural model of the Chilean economy to throw more light on these episodes. This type of model is widely used in studies on Chilean inflation.[38] Corbo and Schmidt-Hebbel (2001) use a similar model to assess the role played by the inflation-targeting policy during the inflation reduction of the 1990s. The model corresponds to a short-run version of a traditional small open economy model. Models of the same type are commonly used in policy evaluations by researchers and central banks.[39]

38. See, for example, Corbo (1985, 1998); Corbo and Fischer (1994); Edwards (1993).

39. See, for example, Hargreaves (1999) for New Zealand; Beechey and others (2000) for Australia; Cunningham and Haldane (2000), Bank of England (1999), and Dhar, Pain, and Thomas (2000) for the United Kingdom.

The model used here closely follows the one used in Corbo and Schmidt-Hebbel (2001), but we have made some modifications to address the issue of interest, to capture the effect of the 1998 policy change. Because we want to assess policy changes that occurred in late 1997 and early 1998, the dataset includes only information that was publicly available by the end of the third quarter of 1997.

There is some international evidence on the use of revised data to evaluate or study policy decisions made in a specific time moment. For example, Runkle (1998) presents evidence that revisions of U.S. data are important and that the differences between the first estimates and the final values are sometimes large. Orphanides (2001), who focuses on estimated Taylor rules, also emphasizes the striking divergences that can emerge when policy actions are evaluated with ex post data instead of real-time data

The estimated model is presented in equations 1 through 9 and also summarized in table 8.

$$\pi_t^S = \alpha_0 + \alpha_1\omega_t + \alpha_2\hat{e}_{t-1} + \alpha_3 \mathrm{GAP4}_t + \alpha_4\pi_{t-1}^E + \alpha_5\pi_{t-1}^S \quad (1)$$

$$\omega_t = (1-\rho_\omega)\left[\beta_0 + \beta_1\pi_{t-1} + (1-\beta_1)\pi_{t-1}^E\right] + \rho_\omega\omega_{t-1} \quad (2)$$

$$\mathrm{GAP}_t = \gamma_0 + \gamma_1\mathrm{LTOT}_t + \gamma_2\mathrm{PRBC}_{t-2} + \gamma_3\mathrm{CK}_t \cdot \mathrm{D96} + \gamma_4\mathrm{GAPX}_{t-1} + \gamma_5\mathrm{GAP}_{t-1} \quad (3)$$

$$\mathrm{CA}_t = \delta_0 + \delta_1\mathrm{GAP}_t + \delta_2\mathrm{LTOT}_t + \delta_3\mathrm{LRER}_t + \delta_4\mathrm{CA}_{t-1} \quad (4)$$

$$\pi_t^E = \chi_0 + \chi_1\mathrm{TAR}_{t+4} + \chi_2\pi_t \quad (5)$$

$$\hat{e}_t = \phi_0 + \phi_1\pi_{t-1} + \phi_2\pi_{t-1}^* + \phi_3\mathrm{CA}_t + \phi_4\Delta\mathrm{RIN}_t + \phi_5\hat{e}_{t-1} \quad (6)$$

$$\mathrm{PRBC}_t = (1-\rho_{\mathrm{PRBC}})\left[\mu_0 + \mu_1\left(\pi_{t+3}^S - \mathrm{TAR}_{t+3}\right) + \mu_2\mathrm{CA}_{t+2}\right] + \rho_{\mathrm{PRBC}}\mathrm{PRBC}_{t-1} \quad (7)$$

$$\pi_t = \pi_t^S + \mathrm{SHOCK}_t \quad (8)$$

$$\mathrm{LRER}_t = \mathrm{LRER}_{t-1} + \pi_t^* + \hat{e}_t - \pi_t \quad (9)$$

where π_t^S is the annualized core inflation, π_t is the annualized CPI inflation, and SHOCK_t the divergence between them. The expected rate of annual inflation in Chile, π_{t+1}^E, is measured as the difference between nominal and real interest rates charged on 90- to 365-day deposits in

the banking system. The inflation target announced by the Central Bank is denoted TAR_t [40] while π_t^* represents the annualized international inflation. The annualized change in average wages is denoted by ω_t while the devaluation of the nominal exchange rate (Ch$ to the US$) is denoted $\hat{e}_t$.

The output gap (GAP_t) is computed as the log difference between the seasonally adjusted quarterly GDP and its long-run trend, measured by the Hodrick-Prescott filter.[41] $GAP4_t$ is the four-quarter moving average of GAP_t. The gap in Chile's main trading partners is labeled $GAPX_t$. We use $LTOT_t$ to denote the logarithm of the terms of trade, $LRER_t$ for the logarithm of the real exchange rate, and $PRBC_t$ for the real interest rate of the Central Bank bonds with ninety-day maturity. Finally, capital inflows CK_t and the current account balance CA_t are computed at the end of each period and expressed as percentage of GDP, while ΔRIN_t is the change in the foreign reserves of the Central Bank, in dollars.

Each equation was estimated separately from the others to avoid spillover effects from specification errors in a particular equation to the estimation of other equations in the model. The estimation of equation 7 is more complicated because two of the right-hand variables depend on observed values of the left-hand variable, creating an endogeneity problem (as explained in Clarida, Galí, and Gertler, 1998; Corbo, 2002). Following previous work on the issue, we use generalized method of moments (GMM) to obtain consistent estimators of the coefficients.[42]

Analyzing alternative scenarios

As cited above, Morandé (2001a) describes how the Central Bank's concerns about its ability to reach the inflation target pushed it to try to avoid a major depreciation of the peso when the attack on the currency first developed in late 1997. In fact, the nominal exchange rate depreciated more than 11 percent during the last days of 1997 and the first days of January 1998. Had this depreciation been permanent, the resulting effects on the inflation rate—the target of monetary policy—

40. Computed by the authors, linearizing the official target expressed as a December-to-December rate of change.

41. Trend GDP was computed up to the third quarter of 1997.

42. For a review of generalized method of moments, see Hamilton (1994); Greene (2000); Matyas (1998). For a review of previous works on the estimation of monetary policy reaction functions, see Clarida, Galí, and Gertler (1998) in the case of developed countries and Corbo (2002) in the case of Latin American countries.

Table 8. Econometric Results

First period

$$\pi_t^S = \underset{(0.56)}{-0.88} + \underset{(0.06)}{0.14}\omega_t + \underset{(0.05)}{0.10}\hat{e}_{t-1} + \underset{(0.22)}{0.48}\mathrm{GAP4}_t + \underset{(0.06)}{0.15}\pi_{t+3}^E + \underset{(0.10)}{0.67}\pi_{t-1}^S$$
Sample 86.4-97.3, $R^2 = 0.977$

$$\omega_t = (1-0.44)\left[\underset{(0.47)}{3.84} + \underset{(0.11)}{0.88}\,\pi_{t-1} + (1-0.88)\,\pi_{t-1}^E\right] + \underset{(0.11)}{0.44}\omega_t$$
Sample 86.2-97.3, $R^2 = 0.941$

$$\mathrm{GAP}_t = \underset{(1.32)}{5.81} + \underset{(0.02)}{0.04}\mathrm{LTOT}_t - \underset{(0.19)}{1.06}\mathrm{PRBC}_{t-2} + \underset{(0.02)}{0.13}\mathrm{CK}_t \cdot \mathrm{D96} + \underset{(0.34)}{0.42}\mathrm{GAPX}_{t-1} + \underset{(0.12)}{0.35}\mathrm{GAP}_{t-1}$$
Sample 90.1-97.3, $R^2 = 0.616$

$$\mathrm{CA}_t = \underset{(0.06)}{-0.18} - \underset{(0.001)}{0.002}\mathrm{GAP}_t + \underset{(0.02)}{0.04}\mathrm{LTOT}_t + \underset{(0.01)}{0.03}\mathrm{LRER}_t + \underset{(0.06)}{0.71}\mathrm{CA}_{t-1}$$
Sample 86.4-97.3, $R^2 = 0.868$

$$\pi_t^E = \underset{(0.86)}{1.00} + \underset{(0.07)}{0.93}\mathrm{TAR}_{t+4} + \underset{(-)}{0.00}\pi_t$$
Sample 89.4-97.3, $R^2 = 0.939$

$$\hat{e}_t = \underset{(2.34)}{-5.35} + \underset{(0.17)}{0.63}\pi_{t-1} - \underset{(0.11)}{0.16}\pi_{t-1}^* - \underset{(0.34)}{0.79}\mathrm{CA}_t - \underset{(0.001)}{0.003}\Delta\mathrm{RIN}_t + \underset{(0.12)}{0.44}\,\hat{e}_{t-1}$$
Sample 87.2-97.3, $R^2 = 0.826$

$$\mathrm{PRBC}_t = (1-0.67)\left[\underset{(0.27)}{6.14} + \underset{(0.12)}{0.53}\left(\pi_{t+3}^S - \mathrm{TAR}_{t+3}\right) - \underset{(0.12)}{0.27}\mathrm{CA}_{t+2}\right] + \underset{(0.07)}{0.67}\mathrm{PRBC}_{t-1}$$
Sample 90.1-97.4, $R^2 = 0.627$

Second period

$$\pi_t^S = \underset{(0.33)}{-0.83} + \underset{(0.06)}{0.14}\omega_t + \underset{(0.04)}{0.09}\hat{e}_{t-1} + \underset{(0.19)}{0.50}\mathrm{GAP4}_t + \underset{(0.05)}{0.14}\pi_{t+3}^E + \underset{(0.09)}{0.67}\pi_{t-1}^S$$
Sample 86.4-98.2, $R^2 = 0.981$

$$\omega_t = (1-0.46)\left[\underset{(0.40)}{3.67} + \underset{(0.10)}{0.90}\,\pi_{t-1} + (1-0.90)\,\pi_{t-1}^E\right] + \underset{(0.08)}{0.46}\omega_t$$
Sample 86.2-98.2, $R^2 = 0.949$

$$\mathrm{GAP}_t = \underset{(1.29)}{5.91} + \underset{(0.02)}{0.04}\mathrm{LTOT}_t - \underset{(0.18)}{1.07}\mathrm{PRBC}_{t-2} + \underset{(0.02)}{0.11}\mathrm{CK}_t \cdot \mathrm{D96} + \underset{(0.31)}{0.41}\mathrm{GAPX}_{t-1} + \underset{(0.12)}{0.33}\mathrm{GAP}_{t-1}$$
Sample 90.1-98.2, $R^2 = 0.604$

$$\mathrm{CA}_t = \underset{(0.06)}{-0.22} - \underset{(0.001)}{0.001}\mathrm{GAP}_t + \underset{(0.02)}{0.04}\mathrm{LTOT}_t + \underset{(0.01)}{0.04}\mathrm{LRER}_t + \underset{(0.06)}{0.73}\mathrm{CA}_{t-1}$$
Sample 86.4-98.2, $R^2 = 0.879$

$$\pi_t^E = \underset{(1.18)}{1.93} + \underset{(0.11)}{0.92}\mathrm{TAR}_{t+4} + \underset{(-)}{0.00}\pi_t$$
Sample 89.4-98.2, $R^2 = 0.915$

$$\hat{e}_t = \underset{(2.25)}{-5.47} + \underset{(0.16)}{0.62}\pi_{t-1} - \underset{(0.11)}{0.15}\pi_{t-1}^* - \underset{(0.32)}{0.76}\mathrm{CA}_t - \underset{(0.001)}{0.003}\Delta\mathrm{RIN}_t + \underset{(0.12)}{0.45}\,\hat{e}_{t-1}$$
Sample 87.2-98.2, $R^2 = 0.827$

$$\mathrm{PRBC}_t = (1-0.71)\left[\underset{(0.31)}{6.58} + \underset{(0.15)}{0.59}\left(\pi_{t+3}^S - \mathrm{TAR}_{t+3}\right) - \underset{(0.14)}{0.46}\mathrm{CA}_{t+2}\right] + \underset{(0.07)}{0.71}\mathrm{PRBC}_{t-1}$$
Sample 90.1-98.2, $R^2 = 0.647$

Note: Standard errors are shown in parenthesis.
First period estimates are used in the simulations of the first semester of 1998. Second period estimates are used in the simulations of the end of 1998 and 1999.

would have depended on the pass-through coefficient. To analyze this episode, we start by using the estimated model to determine the effect of depreciation on inflation by late 1997. First, we solve the model dynamically for the year 1998 as a whole to see whether it fits the out-of-sample data. The results are very different from the historical event. This could be because of flaws on the model or because the structure of the model changed after this period. We assess this point by replacing equations with the observed values of some key variables; the results are very interesting. The major differences stem from two variables: the nominal exchange rate and the monetary policy real interest rate. These two equations give poor forecasts even if we take into account the observed values of the other variables. The model-simulated values for the nominal depreciation are higher than the actual values, while the simulated values for the real interest rate are lower than the actual values. In the same simulation exercise, the rest of variables perform quite well after taking into account the differences in the interest rate and in the nominal devaluation.

If the problem is just with the two mentioned variables, then replacing them by their actual values should eliminate the problem; this also serves as a test for the remaining equations of the model. As expected, the use of the actual values of the interest rate and the nominal depreciation without further modifications of the model gives us forecast values of the inflation rate very close to the actual ones. We therefore conclude that when we impose the new trajectory of the nominal depreciation and the real interest rate that emerged after the third quarter of 1997, the model explains the short-run structure of the economy quite well. The simulated values from this amended model are used as a benchmark to evaluate alternative policies.

The next step was to define the alternative scenarios to be considered for the counterfactual simulations. The first, and simpler, scenario is the dynamic solution of the model using the estimated equations for the nominal depreciation and for the real interest rate. As already mentioned, nominal depreciation is above actual depreciation, core and headline CPI inflations are well above their actual values, and the real interest rate is much below the actual interest rate. These findings are consistent with those derived from the analysis using the reduced-form VAR models described in section 3. Thus, the structural changes associated with the reduction in the unremunerated reserve requirement on capital inflows, in the exchange rate policy, and in the design of monetary policy (the interpretation of the monetary policy interest rate) had important effects, changing not only the parameters

of the equations, but also the values of the variables most closely affected by policy actions. The most important point to single out is that under the old structure, the shock was bound to result in an acceleration of inflation that would have left the inflation rate for 1998 much above the annual target, resulting in a loss of credibility for monetary policy. This finding supports the point that monetary policy actions in the first semester of 1998 were a response to an anticipation of an acceleration of inflation above the target. Throughout this period, there was a continuous tension between an expansionary fiscal policy and the need to adjust the real exchange rate to facilitate the real depreciation that must accompany the expenditure reduction while keeping inflation within the target. In this game of coordination between the independent Central Bank and the Ministry of Finance, society was forced to pay a higher cost in terms of the output gap and unemployment than would otherwise have been the case.

The second alternative scenario employs the uncovered interest parity to compute the nominal depreciation expected by the market, which was implicit in the spread between peso and dollar rates for the same maturity and type of instrument. Although the empirical evidence in favor of uncovered interest rate parity is weak, a recent paper of Flood and Rose (2001) shows that it works quite well for periods of high inflation and crisis. We use the uncovered interest rate parity to obtain alternative paths for the nominal exchange rate devaluation. We use two different assumptions to compute the behavior of the exchange rate in 1998[43]. First, we compute the nominal exchange rate from the uncovered interest rate parity condition for February 1998, and then use the previously estimated equation to obtain the values for the rest of the year. Second, we assume that after February the exchange rate follows a random walk with a drift, the latter measured as the difference between internal and external inflation[44]. No matter which assumption is made for the rest of the year, the results are qualitatively the same: an inflation rate well above both the target and the effectively observed one. The differences are important; they represent as much as one-third of the target set for the year. Table 9 presents the

43. To check the robustness of the conclusions, we also compute a third scenario for the exchange rate by applying the actually observed monthly depreciations to the level computed for February under the assumption of uncovered interest parity. We thus obtain a monthly series of the nominal exchange rate used to derive the four-quarter depreciations included in the model.

44. Which is equivalent to assuming purchasing power parity for the rest of the year.

results, both as deviations from the benchmark and as percentage of the target.[45] The table also contains two additional columns, in which we recalculate the second scenario using the reaction function presented in Corbo (2002), who uses the same data definition over a longer period.[46] The results confirm our analysis and also indicate some kind of instability of the monetary policy reaction function. Corbo's estimated reaction function effectively implies a stronger reaction of monetary authorities to expected deviations of inflation from the target.

Another key element in the setting of monetary policy was the size of the pass-through coefficient from depreciation to inflation. According to our estimation, the pass-through coefficient turned out to be smaller than the 0.6 value mentioned in Morandé (2001a). Our estimated value is 0.09 for the impact effect coefficient and 0.28 for the total or long-run effect—about half of Morandé's value. While the pass-through could conceivably have been higher in an economy that was overheating, the economy should have had a greater capacity to absorb a depreciation with less effect on inflation, given that the equilibrium exchange rate had increased as a result of changes in fundamentals.[47]

The reduction in the pass-through is not a phenomenon exclusive to the Chilean economy. Cunningham and Haldane (2000) show that Europe underwent three remarkable experiences between 1992 and 1996, in which CPI inflation did not show major changes after pronounced shifts in the nominal exchange rate (both appreciations and depreciations). Taylor (2000) argues that the extent of the adjustment of prices to changes in costs depends on expectations about how persistent the changes will be—and an environment with reduced inflation persistence generally gives rise to perceptions that the changes will last for a shorter period.[48] Choudhri and Hakura (2001) test the implications derived by Taylor (2000) for a comprehensive set of countries for the period 1979–2000. They confirm the existence of a positive relation between the pass-through and the average inflation level, which is related

45. Another robustness test was made by using the actual depreciation rates to compute the nominal exchange rate for the whole year. This series obviously contains a lot more information than anyone could have supposed by January 1998.

46. His estimations include information through year-end 1999.

47. Unfortunately, in our empirical work we were unable to find a relation between the pass-through coefficient and the cycle.

48. Taylor also mentions a work by J. McCarthy of the Federal Reserve Bank of New York, who documents the declining pass-through for nine OECD countries in a comparison of the periods 1976–1982 and 1983–1998. Goldfajn and Werlang (2000) present a comprehensive study analyzing possible determinants of the magnitude of the pass-through.

Table 9. Structural Model Simulations: Inflation (%, 4-quarter rate of change)

			No defense scenario				*No defense scenario using Corbo (2001)**			
	Dynamic simulation		*Using equation 6*		*Assuming PPP*		*Using equation 6*		*Assuming PPP*	
	(a)	*(b)*	*(a)*	*(b)*	*(a)*	*(b)*	*(a)*	*(b)*	*(a)*	*(b)*
98.I	0.0	12.8	0.0	12.8	0.0	12.8	0.0	12.8	0.0	12.8
98.II	0.1	18.4	0.4	24.0	0.4	24.0	0.4	24.0	0.4	24.0
98.III	0.3	20.8	0.6	27.5	0.7	28.5	0.6	26.6	0.6	27.5
98.IV	0.8	24.7	1.1	30.9	0.9	28.0	0.9	27.0	0.8	24.2

Source: Author's calculations in base of the estimated model presented in the paper.
(a) Result expressed as deviation in percentage points from the benchmark.
(b) Difference between the result and the linearized target expressed as percentage of the target.
* The monetary policy reaction function estimated in the model (equation 7) is replaced by the equation presented in Corbo (2001).

to Taylor's idea about permanent and transitory effects. Policy implications of this result are straightforward: the sole existence of a credible commitment to maintaining a low and stable inflation rate contributes to a modification of expectations that proves crucial when a country faces abrupt exchange rate fluctuations.

We now proceed to examine possible reasons behind the sharp contraction of monetary policy that occurred during the third quarter of 1998 in the midst of high pressure on the Chilean peso. We focus our analysis on the trajectory of the inflation rate under alternative monetary policies in the period from the second quarter of 1998 to year-end 1999, as controlling inflation is the main objective of monetary policy. An alternative explanation for the sharp rise in the interest rate could have been, as claimed by Morandé (2001b), to reduce the size of the current account deficit. To determine the weight of these different considerations, we re-estimate the model with the information available through the end of the second quarter of 1998; we also recalculate trend GDP with this new information.[49] The estimated equations do not show major changes in the values of the estimated coefficients, so the exercise also serves as a robustness test for the entire model.

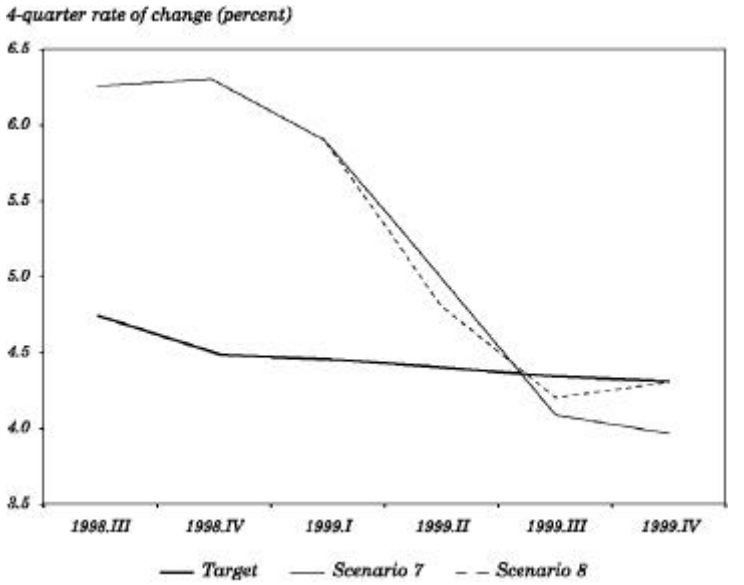
To uncover the possible influence of a concern for an acceleration of the inflation rate in the decision to defend the peso and therefore to resist a depreciation, we simulate a scenario similar to the one used for the previous period. That is, we use the uncovered interest rate parity condition to compute the expected devaluation rate in August and September of 1998, and we then use the estimated value to compute the nominal exchange rate values in the hypothetical scenario of no defense of the currency. The values in October, November, and December 1998 were computed using the monthly depreciation rate effectively observed. We assume two alternative scenarios to compute the trajectory in 1999, first using the estimated equation for the nominal devaluation (scenario 7) and second assuming PPP (scenario 8). The forecast values under scenario 7 are below the linearized target, but under scenario 8 the value is close to the target (see figure 12).[50] From this exercise, we conclude that the risk of missing the inflation target was not evident, and in any case it was much lower than in January 1998.

We now investigate the real costs associated with the alternative strategies. We compare the forecast output gaps under a base scenario

49. The trend GDP was obtained using the Hodrick-Prescott filter.

50. In both scenarios the real interest rate of the PRBC-90 is modeled with the estimated reaction function.

Figure 12. Core Inflation: Scenario 7, Scenario 8 and Linearized Target



Source: Authors' own calculation.

(scenario 7 above), allowing for the nominal devaluation and using the estimated reaction function to obtain monetary policy. The alternative scenario (scenario 9) corresponds to the simulation of the model using the observed values of the real interest rate for the entire period.[51] The differences in the simulated values of the output gap are very large (figure 13). Throughout 1999, the output gap with the effective real interest rate is well below the benchmark; this result is also valid in the case of the real interest rate (figure 14). If we compute the cumulative difference between both trajectories, the result is approximately –10.5 percentage points.[52] Had the nominal devaluation been allowed, real output would have been much higher, on average, than what actually occurred under the extremely contractionary monetary policy. Furthermore, the simulated reduction in the current account deficit is

51. Alternatively, the model was also solved using the actual values for the nominal exchange rate; the results did not significantly change.

52. Output gap is measured as the deviation from potential output as a percentage of potential or trend output.

not as abrupt in either scenario as was effectively observed. Finally, because the adjustment was carried out mainly through interest rates, firms without access to dollar-denominated liabilities suffered the major burden of the adjustment while the firms with net dollar liabilities were protected from the adjustment. This was an implicit cost of relying mostly on monetary policy to face the threat of an acceleration of inflation and reduce the size of the current account deficit.

5. Conclusions

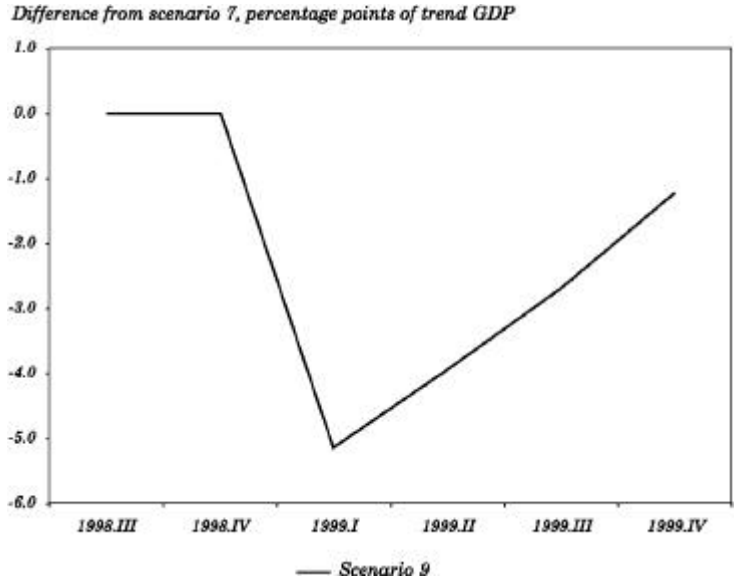
The sharp slowdown of the Chilean economy starting in the second quarter of 1998 has been a source of heated debate. This slowdown is related to a series of negative shocks and the policy response to these shocks. In particular, Chile suffered a series of external shocks—terms of trade, increase in country risk, and contagion from the Asian and Russian crises—while at the same time facing the highest interest rates of the decade. Chile was using an inflation-targeting monetary policy framework, but throughout, the Board of the Central Bank was also keeping a close watch on the size of the current account deficit. The main concern was that a high current account deficit would make the country vulnerable to a sharp reversal in capital inflows. The crisis of the early 1980s probably motivated this concern.

The deterioration in the external environment coincided with a very expansionary cycle of the economy, and it set in motion several speculative attacks on the exchange rate system, by this time an exchange rate band. Policy adjustment to the shock and to the successive attacks was not easy, since the cooperation between fiscal and monetary policy was fairly weak. Indeed, the paper shows that the period of adjustment coincides with an expansionary fiscal policy, such that the two policies worked at cross-purposes.

Much of the slowdown is traced to a sharp reduction in private investment and consumption. The results of the analysis carried out using both a nonstructural VAR model and a small structural model of the Chilean economy indicate that much of the dynamic of the Chilean economy in the post-1997 period can be explained by the external shocks and the policy response to these shocks. The main episodes studied are the ones related to attacks on the Chilean peso (January 1998, June 1998 and September 1998).

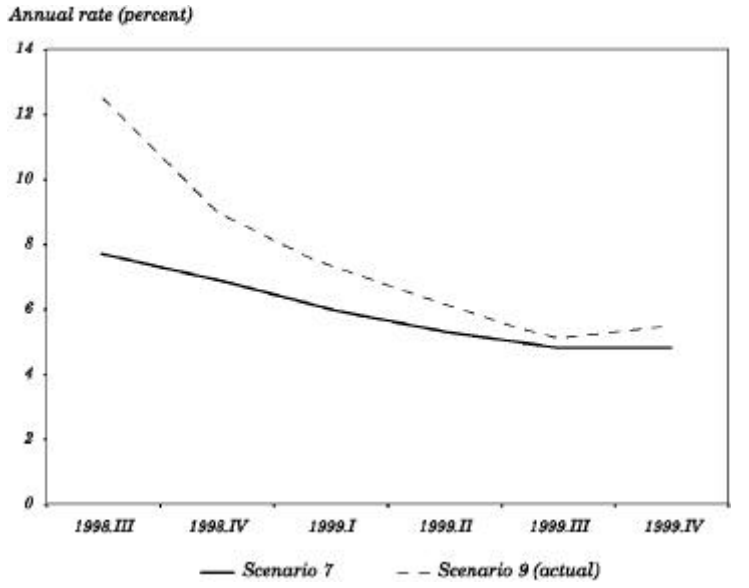
The results of the simulations with the VAR model estimated through June 1998 and simulated through March 1999 show that aggregate expenditures was bound to decelerate as a result of the shocks, although

Figure 13. Output Gap: Scenario 9



Source: Authors' own calculation.

Figure 14. Real Interest Rate (PRBC-90): Scenario 9



its growth rate did not become negative. In contrast, when the simulation is performed using the observed values of the real interest rate instead of the VAR equation estimates, the resulting abrupt slowdown in aggregate expenditures is slightly smoother than the observed trend, but it basically follows the same dynamic through February-March 1999. This provides strong evidence that the posterior slowdown was the result of monetary policy actions, both at the beginning of the simulation period and during the months just before the simulation period.

Finally, we use this small macroeconomic model to analyze the policy response to the speculative attack. With respect to the speculative attack of January 1998, we find that under the old structure, the shock was bound to result in an acceleration of inflation that would have left the inflation rate for 1998 much above the annual target and thus resulted in a loss of credibility for monetary policy. This finding supports the point that monetary policy actions of the first semester of 1998 were a response to an anticipation of an acceleration of inflation above the target. This result is robust to alternative assumptions about the size of the exchange rate adjustment. When we use the same model to analyze the August-September episode, we find that allowing the exchange rate to depreciate did not impose a high risk of inflation acceleration, and therefore other reasons must be found for this policy. The cost of this policy in terms of the gap between actual and potential output was significant.

APPENDIX A
Data Sources

The following series were obtained from the database of the Central Bank of Chile: gross domestic product, domestic expenditure, trade balance, current account balance, real prices of copper, inflation, unemployment, real exchange rate, and the real interest rate (90-365 lending operations). Nominal oil prices were obtained from the Central Bank database and deflated by the US WPI. Unemployment figures are from INE (National Institutes of Statistics). The annual public sector balance was taken from Larraín and Vergara (2000) and corresponds to the non-financial public sector balance.The quarterly series on public sector balance were obtained from the Ministry of Finance (DIPRES) and corresponds to the Central Government Balance. The data on terms of trade were obtained from Bennett and Valdés (2001).

Appendix B
Further Comments on the Role of Fiscal Policy

In this appendix, we briefly discuss two additional points that were mentioned in the paper: the coordination between fiscal and monetary policy and the estimation of the fiscal impulse for the period.

Fiscal and Monetary Policy Coordination in 1997–1998.

Almost every modern economy features the interaction of two macroeconomic policies—fiscal and monetary—with each using its own instruments to achieve certain goals. When the central bank and monetary policy are independent, the coordination of fiscal and monetary policy becomes a central issue in the evolution of the economy. Under certain circumstances, a lack of coordination between the two policies could generate results that run contrary to the general purpose of the central policy orientation and may increase the costs of economic downturns, in terms of the output gap (or unemployment) or output volatility.

A growing literature models this point as a game and then characterizes the situation as a problem of strategy and coordination. Different studies emphasize different elements that may lead to suboptimal outcomes. Frankel (1998) highlights the problems that may arise when there are differences in the model used to analyze the economy, such that policy actions may differ even without different preferences. Bennett and Loayza (2000) analyze a case in which there are different preferences, but only one model, with the fiscal authority concerned primarily about unemployment and the monetary authority concerned primarily about inflation.

In the case of Chile, the 1998 budget approved by the Congress in 1997 was expansionary. In fact, the assumption made about GDP growth was above what was prudent in light of the highly uncertain evolution of the world economy, as emerging economies were already feeling pressure from the Asian crisis. Additional fiscal decisions, perhaps not directly affecting the budget, might also have had a perverse effect on the evolution of private sector expenditures and wage arrangements. The high adjustment made to the minimum wage, which was highly resisted by employers, and the very high adjust to public sector wages gave a bad signal to private sector workers. This was not a good idea in the face of a very high current account deficit and a sudden stop in net capital inflows. The required adjustment on aggregate expenditures would be extremely difficult given an expansionary budget and a major

wage pressure on the labor market. A more conservative budget, combined with lower wage adjustments, might have helped adjust domestic demand without putting all the pressure on monetary policy. Furthermore, given the deep concern about a possible overvaluation of the peso, a moderate expansion of aggregate expenditures could have helped avoid a large nominal and real depreciation, thereby reducing inflationary pressures. These fiscal policy decisions forced monetary policy to confront an important trade-off between the inflation target and the possibility of deteriorated real activity given the large deterioration of the external environment.

Estimating the Fiscal Impulse[1]

We base our estimation of the fiscal impulse on the Central Government accounts, including the Treasury, the ministries, and transferences to and from local governments, public enterprises, and public universities.[2] This definition is useful for our purposes because (a) local governments are not able to raised debt, and if they present a deficit, it must be financed by the Central Government; (b) universities are relatively small (in financial terms) compared with the public sector; (c) public enterprises, for the most part, post a surplus that is considered in the Central Government accounting; and; (d) the Central Bank is an independent institution.

Another topic that deserves special attention when estimating fiscal indicators is the selection of the fiscal aggregates to be considered above the line, because choosing different aggregates may lead to different conclusions. In this study, we select those aggregates that seem to have the most direct impact on domestic absorption, taking as a starting point the selection carried out by the Government Budget Office (DIPRES) in the estimation of the Structural Budget Balance.[3] One adjustment was necessary: we leave out copper incomes, because its inclusion may lead to a completely opposite conclusion about right fiscal stance. For example, if copper prices in a given period are higher than an arbitrarily chosen neutral price, this would imply that the government should implement a contractive policy, when actually the

1. This section draws on work in progress by Oscar Facusse.

2. These data are available at the Dirección de Presupuestos de Chile website (www.dipres.cl).

3. For the estimation of the structural budget balance for 2002, DIPRES changed its procedures to estimate recognition bonds. The old methodology better suits our requirements here, however.

effect on demand of this positive terms-of- trade shock would be just the opposite (that is, an expansion of aggregate demand). Thus, the income and expenditure aggregates were constructed as shown in table B1. Adjusted income equals total income less loan recovery, sales of financial assets, returns on investment, and income from copper exports (net of deposits and withdrawals from the Copper Price compensation Fund FCC). Adjusted expenditures equals total expenditures plus the net use of funds from the Oil Price Compensation Fund minus financial investment and estimated pension fund RB stock.[4]

Finally, we use the Hodrick-Prescott filter for the estimation of the potential product, although we recognize the limitations that this method imposes (in particular, the ending points problem). Considering its simplicity, however, we conclude it is a good proxy for the potential product.

With all this in mind, we proceed to the construction of the annual fiscal impulse. The results are shown in table B2. The calculations were carried out using two similar methods. First, we calculate the total impulse variable following the IMF method and using trend revenues and expenditures as defined in selected Chilean issues (IMF, 2001). Second, we calculate the total impulse using the following equation:

$$FI_t = \frac{\left[E_t - E_{t-1} - g_0\left(YP_t - YP_{t-1}\right)\right] - \left[I_t - I_{t-1} - t_0\left(Y_t - Y_{t-1}\right)\right]}{Y_t} \qquad \text{(B.1)}$$

where E_t is adjusted expenditures in period t; I_t is adjusted incomes in period t; YP_t is potential product in period t; Y_t is GDP in period t; g_0 is the average ratio of adjusted expenditure to potential product for the years 1992–1997; and t_0 is the average ratio of adjusted income to GDP for the same period.

The two indicators present extremely close results, as expected, which indicates that the government pursued an expansive fiscal policy in the period 1995–1999, with a more expansive stance in the period after 1997.

Next we estimate the quarterly fiscal impulse for the relevant period (1997:1 to 2000:4). Here we use the equation presented above. The

4. FCC is a copper price-compensation fund. FEPP is an oil price-stabilization fund. The RB stock represents mandatory government transfers to private pension funds cumulative under the previous public pension fund scheme (which was changed in 1981); in this calculation, this is the stock of assets that are not supposed to have direct macroeconomic impact. For more detail, see Marcel and others (2001).

Table B.1: Fiscal Aggregates construction

Total Income	*Total Expenditure*
- Loan recovering	
- Financial assets selling	- Financial Investment
- Investment return	+ FEPP[b] use of funds
- Copper net of FCC[a]	- Estimated RB Stock[c]
Adjusted Incomes	**Adjusted Expenditures**

a. FCC is a cooper price compensation fund.
b. FEPP is an oil price stabilization fund.
c. Due to the pension reform of 1981, the government transfers to the private pension funds the existing stock of resources collected by the previous public scheme (RB). In this calculation, this stock of assets is asummed to have no direct macroeconomic impact.

Table B.2: Fiscal Impulse (As a % of GDP)

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Actual									
Revenue	21.76	22.57	21.63	21.20	22.69	22.34	22.36	21.53	22.07
Expenditure	20.48	20.98	20.55	19.52	20.89	20.90	22.01	23.65	23.43
Trend									
Revenue	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30
Expenditure	22.91	22.98	23.24	22.37	22.10	21.80	22.00	23.20	23.10
Actual less Trend									
Revenue	2.46	3.27	2.33	1.90	3.39	3.04	3.06	2.23	2.77
Expenditure	-2.43	-1.99	-2.68	-2.85	-1.21	-0.90	0.01	0.45	0.33
Total Impulse	-0.06	-0.37	0.25	0.26	0.16	0.65	0.90	1.27	-0.66
Revenue Impulse	-0.56	-0.81	0.94	0.43	-1.49	0.34	-0.01	0.83	-0.54
Expenditure Impulse	0.50	0.44	-0.69	-0.17	1.65	0.30	0.91	0.44	-0.12
Total Impulse 2	-0.14	-0.39	0.19	0.14	0.13	0.68	0.89	1.27	-0.37

Source: Authors' calculations.

objective is to figure out what happened with the fiscal accounts during the economic slowdown. The methodology is exactly the same as presented before, but on a quarterly basis.[5] Here, g_0 and t_0 correspond to the quarterly average for 1996, and the differences $(X_t - X_{t-1})$ consider changes over four quarters.

5. Quarterly GDP was seasonally adjusted before detrending with a Hodrick-Prescott filter. Here the fiscal aggregates were constructed without adjusting by the FEPP owing to a lack of quarterly data, although the results do not present significant changes.

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