Monetary Policy in Chile: A Black Box?

Ángel Cabrera
FORECAST S.A.

Luis Felipe Lagos
Pontificia Universidad Católica de Chile

During the 1990s the Chilean economy gradually cut its inflation rate from figures in the thirties to 4.7 percent in 1998. Central bank authorities have declared that the main objective of monetary policy is to reduce inflation to levels comparable to those in industrial countries. The designated instrument of that monetary policy has been an indexed interest rate,[1] through which the central bank has sought to influence the path of real market rates over different time horizons. These market rates, in turn, are believed to have influenced the behavior of spending and aggregate production, thereby managing the inflationary process in a manner consistent with the proposed stabilization goals. This apparent success deserves a closer look, because, in the words of Robert Lucas (1996), "Central bankers and even some monetary economists talk knowledgeably of using high interest rates to control inflation, but I know of no evidence from even one economy linking these variables in a useful way."

Several earlier studies of the Chilean economy have confirmed the lack of solid empirical evidence of a systematic relationship between inflation and interest rates (see appendix B). Also, in those cases where some statistical support exists for such a relationship,

The authors thank Sergio Quintana for his cooperation in econometric issues and data processing. They also appreciate the comments of Klaus Schmidt-Hebbel and the attendees of the Third Annual Conference of the Central Bank of Chile and of a seminar at the Pontifical Catholic University's Economics Institute.

1. The central bank's ninety-day rate was used until 1995. The one-day interbank rate has been in use since then.

Monetary Policy: Rules and Transmission Mechanisms, edited by Norman Loayza and Klaus Schmidt-Hebbel, Santiago, Chile.

the transmission mechanism is not specified satisfactorily. It is frequently argued that increases in policy interest rates allow the gap between the growth rates of aggregate spending and GDP, or between actual and potential GDP, to be reduced, thereby decelerating inflation. However, monetary theory states that the path of inflation must be linked to a nominal variable. Therefore, in order to understand the connection between interest and inflation rates, it is necessary to study the transmission mechanism of monetary policy, including the relevant nominal variables.

This paper analyzes Chilean monetary policy during the 1986-97 period, identifying the instruments, intermediate targets, and goals defined by the central bank. This analysis allows us to determine and study the central bank's reaction function empirically. Different transmission mechanisms are reviewed in an effort to reach a better understanding of the central bank's reaction function; these mechanisms are empirically evaluated using the structural vector autoregressive (VAR) methodology. We have chosen VAR as our econometric tool in this paper in order to make our results comparable with those of a number of earlier studies. However, as will be explained in detail below, recent international literature shows categorically the need to complement the traditional VAR approach with identification assumptions based on theory and on institutional considerations, thereby creating what are now known as structural VAR systems.

The paper is organized as follows. Section 1 is a conceptual discussion of monetary policy administration and the reaction function used by the central bank during 1986-97. Section 2 analyzes different possible transmission mechanisms of Chilean monetary policy. Section 3 reviews the structural VAR methodology, presents empirical results, and offers some interpretations. Section 4 concludes.

1. Monetary Policy Management in Chile: Instruments and Goals

During the 1986-98 period Chilean monetary policy considered the use of various instruments and intermediate objectives in order to achieve certain goals. Instruments are those variables that the central bank can control directly. Intermediate objectives, in turn, are those variables not controlled closely by the monetary policymakers, but whose behavior may be altered, with a certain lag, by using the instruments. These intermediate objectives are supposedly closely related to the end goals that the central bank would like to achieve.

1.1 Goals

According to the law governing the central bank's operations, the goals of the central bank are currency stability, a stable internal payments system, and the normal operation of the external payments system. The first goal has been construed as meaning control of inflation, even though the law suggests that it should be conceived as price level stability.

The objective of a stable domestic payments system has been addressed through explicit guarantees granted to bank deposits (up to a certain limit). These guarantees, although not provided directly by the central bank, are backed by it as the lender of last resort.

Finally, external payments stability has been thought of as meaning the maintenance of a sustainable current account deficit.[2] Given the past experience of the Chilean and other economies, the central bank has theorized that this deficit should not exceed 3 to 4 percent of GDP on average. To do otherwise, the central bank believes, would sooner or later result in speculative attacks against the domestic currency and a capital outflow, forcing the country into a costly adjustment. In addition, the goal of external payments stability has been interpreted as maintaining a certain level of stability of the real exchange rate—the other side of the current account deficit coin.

Over the years the central bank has changed the relative importance it assigns to each of these goals, along with some degree of what might be called a "crisis mentality," which is a common element in monetary policy management.[3] Thus, after the debt crisis of 1982-83, the primary objective was to reduce the current account deficit, and this effort led to a huge adjustment of both private and public spending. At the same time, the objective of a "high and stable" real exchange rate was decided on, to strengthen the export sector and allow the country's huge foreign debt to be repaid. As a result, during the 1980s the objective of low inflation was secondary, subordinated

2. Such an interpretation is questionable. For example, Rosende (1998) argues that this objective cannot be achieved through monetary policy, and that therefore it should be interpreted as having a monetary policy that will not generate an exchange rate crisis or a balance of payments crisis.

3. See Bernanke and Mishkin (1992).

to that for the real exchange rate, until by the end of the decade voluntary capital flowed back in, thereby relaxing the external constraint.

Later, during the 1990s, the central bank's principal objective became the control and gradual reduction of inflation. However, the objectives for the real exchange rate and the current account have remained in place, as demonstrated by the central bank's sustained sterilized intervention in the exchange market during the period, together with the active implementation of controls on capital inflows. Nevertheless, the current account deficit, as corrected by the long-term trend in the terms of trade, has been continually deteriorating since 1993 (table 1).

1.2 Instruments

The variable selected by the central bank for its monetary policy instrument from the mid-1980s to April 1995 was the "UF" or past-CPI-indexed interest rate on its ninety-day obligations, which were auctioned at a fixed rate. The case for using an interest rate as an instrument, and in particular a real rate as opposed to the common central bank practice of using a nominal rate, is related to the variability of the demand for money and to the desire of the central bank to disclose certain information, as argued by Fontaine (1991). Fontaine argues that if the monetary policy objective is informational, then in an indexed economy the best instrument is a real interest rate, since it is clear that nominal rate movements are not always matched by changes in the real rate. Using the nominal rate as a monetary policy instrument in such a situation may give misleading signals to private economic agents. In contrast, the real interest rate is expected not only to determine the path of spending, but also to communicate the central bank's perceptions of the state of the economy in terms of domestic and external equilibrium. Although Fontaine recognizes that the demand for money is stable, its velocity is believed to be highly variable given the huge fluctuations in nominal interest rates caused by the UF mechanism. This makes the use of a monetary aggregate as a monetary policy instrument infeasible and therefore is believed to bias the decision in favor of the real interest rate.[4]

4. However, because the UF rate reflects lagged inflation, interest rates using this indexing mechanism do not strictly correspond to the real interest rate. See Calvo and Mendoza (1997).

Table 1. Current Account Deficit in Chile

Percent of GDP

Year	*Actual*	*Trend*[a]
1990	1.9	1.4
1991	−0.4	−1.1
1992	2.0	0.7
1993	5.6	3.6
1994	3.2	3.8
1995	2.1	5.0
1996	5.5	5.3
1997	5.3	6.5
1998	6.5	5.8

Source: Authors' calculations based on Central Bank of Chile data.
a. Using long-term trend in the terms of trade.

Most authors recognize that the instrument actually used has been an interest rate (see appendix A). However, Rosende and Herrera (1991) find that money supply movements are a better predictor of transitory fluctuations in GDP growth than is interest rate variation (see appendix B). This result suggests that, even when it is using the interest rate as an instrument, the central bank monitors the evolution of the money supply. In this regard, Rojas (1993) holds that the monetary authorities have not used a monetary aggregate as an intermediate objective because, although money does affect output in the short run, a stable relationship between money and nominal output exists only for the M2A and M3 aggregates, whose use as intermediate objectives is considered limited by the imperfect control that the central bank has over them.

In May 1995 the central bank decided to change its monetary policy instrument, dropping the ninety-day rate in favor of a shorter-term rate: the interbank one-day rate. The goal was to give the market a greater role in determining medium- and long-term interest rates. Thus the central bank auctions out its ninety-day obligations so that the market determines the interest rate. In this way, expected capital gains (or losses) are prevented from generating sharp changes in term composition, as used to occur when the ninety-day rate was fixed, causing liquidity management problems for the central bank.[5]

5. For a detailed analysis see Budnevich and Pérez (1995).

1.3 Intermediate Objectives

In accordance with the monetary policy transmission mechanisms discussed below, the central bank has used as its main intermediate objectives the spending-output gap and the gap between actual and potential output, both their levels and their growth rates (appendix A). The then-president of the central bank, Roberto Zahler, justified the 1995 interest rate increase with the following argument: "...we must not forget that both aggregates, that is the economic activity and the demand, continue to grow now for the fifth quarter in a row, significantly above conservative estimations on the economy's productive potential increase and, therefore, above its trend level, with the resulting pressures over domestic prices."[6]

On another occasion Zahler stated:

> "...it is important to differentiate between output and spending levels and growth rates. When the economy has had several years of growth above its potential, and it is also very near it, it is not enough to go back to growing at the potential output rate. If the appropriate levels are to be recovered, it is necessary to grow at a below-potential pace for some time.... This will permit us to return to the desired path in terms of output and spending levels and reduce inflationary pressures.... Regarding domestic demand, we must note that it has grown so strongly in the past few years that it has gone over the potential output level, pushing prices up and generating pressures on foreign accounts. An adjustment is needed, then, to take the domestic demand to more reasonable levels... we use all kinds of indicators to predict price behavior, such as the aforesaid gap between potential and actual output, the evolution of wages, exchange rates, government spending, credits, money supply, and others." (Zahler, 1994).

For these intermediate instruments to be operational, they must respond to the policy instrument in a predictable way. In other words, an interest rate increase must decelerate the growth rate of spending by more than that of output, in the case of the spending-output gap, and it must decelerate the growth rate of output directly or through slowing spending, in the case of the actual-potential output gap. Thus, for example, Eyzaguirre and Rojas (1996) argue that "Monetary policy

6. Speaking at a seminar on Latin American World Trade and Perspectives for the Year 2000, Santiago, May 9, 1996.

has been based, for over a decade, on the control of the interest rate of some of the financial instruments offered by the Chilean Central Bank. The grounds for this policy have been the influence that these rates have, directly or indirectly, over the expansion rhythm of aggregate spending and thereby on prices, especially of non tradables."

1.4 Intermediate Objectives and the Central Bank's Reaction Function

When setting its annual inflation goals and its implicit goals for the trend deficit in the current account (a maximum of 4 percent of GDP at trend prices), the central bank adjusts the interest rate instrument according to the evolution of the intermediate objectives just described. As already noted, the central bank has used as its intermediate objectives the rate of growth of spending with respect to the growth in output (the spending-output gap), and the evolution of actual GDP with respect to potential GDP, considering both their levels and their growth rate. Thus, whenever the monetary authorities have found spending to be growing faster than GDP, or actual GDP to be growing faster than potential GDP, over a few quarters, they have sought to adjust growth in spending through the interest rate instrument. In recent years the manipulation of the interest rate has been related to the application of the well-known Taylor rule (Taylor, 1993). According to this rule, the interest rate is adjusted upward when the inflation rate exceeds the target and/or output is above its potential level, and downward in the contrary case. This rule can be represented by the following equation:

$$\mathrm{d}R = \mathrm{a}Y + \mathrm{b}\left(\Pi - \Pi^{*}\right), \tag{1}$$

where dR is the first difference of the interest rate, Y is the output gap,[7] Π and Π^{*} stand for the inflation rate and the inflation target, respectively, and a and b are positive parameters.

On the other hand, the literature on inflation targeting emphasizes that the central bank's expected inflation (that is, its inflation forecast) is the intermediate objective par excellence (Masson, Savastano, and Sharma, 1997). Thus the monetary policy instrument responds to the

7. Measured as the percentage deviation from potential output, or as the spending-output gap.

difference between projected inflation and the inflation target for a specified period. Within this context, the central bank's reaction function is forward-looking, as distinguished from a reaction policy that responds to intermediate objectives as represented by past readings of certain variables. In this approach, the monetary policy's operating method can be depicted by the following function:

$$dI_t = \beta\left(\Pi^e_{t+j} - \Pi^*_{t+j}\right), \tag{2}$$

where dI_t is the change in the monetary policy instrument in period t, Π^e_{t+j} and Π^*_{t+j} and represent expected inflation and the inflation target for period $t+j$, respectively. Within this analytical framework, expected inflation is generated from a series of statistical models combining several indicators. Thus the basic difference between this monetary policy model and that described by equation (1) is that the former uses expected rather than past or present inflation to manage the policy instrument.

However, this inflation targeting scheme is compatible with Taylor's monetary rule inasmuch as it can be argued that the output gap is the principal determinant of the central bank's inflation forecasts. Massad (1998) suggests that monetary policy may actually be managed nowadays according to an inflation targeting scheme, considering activity and employment indicators, the spending-output gap, the current account balance, monetary aggregates, wage growth, and the yield curve. This set of indicators supposedly permits the central bank to develop a forecast of the path of core inflation and thereby adjust its instrument according to the gap between the forecasted and the targeted inflation rates.

2. Monetary Policy Transmission Mechanisms

The channels whereby the real interest rate can affect the final targets for inflation, the current account, and the real exchange rate can take a number of forms. Here we identify five possible transmission mechanisms: the Australian mechanism, the Phillips curve mechanism, the interest rate parity mechanism, the monetarist mechanism, and the credit mechanism.

2.1 The Australian Mechanism

The Australian mechanism takes the so-called Australian model as its theoretical framework.[8] The model's main assumptions are the following: the economy is a small, open economy that produces and consumes tradable and nontradable goods; capital is a specific factor in both sectors; labor is mobile between sectors and is subject to diminishing returns; the domestic price of the tradable good is determined according to purchasing power parity, the nominal exchange rate, and the international price; and the relative price of nontradables is determined by their supply and demand equilibrium. Within this context, the real exchange rate, defined as the relative price of tradables to nontradables, depends inversely on the level of aggregate spending with respect to output.[9] The reason is that an increase in spending over output will result in an increase in demand for both tradables and nontradables, thereby creating excess demand in both markets. In the tradable goods market, this will merely result in increased net imports and therefore in a drop in the trade account balance. The excess demand for nontradables, on the other hand, requires an increase in the relative price of those goods in order to achieve equilibrium in the nontradable sector, with a resulting appreciation in terms of the real exchange rate.

Taking a closer look at the version of this model presented in Kamin (1996), these considerations can be expressed algebraically as follows:

$$TCRE_t = \mathrm{a}_0 - \mathrm{a}_1 \left(\frac{G}{Y} \right)_t , \qquad \mathrm{a}_1 > 0 , \tag{3}$$

$$\pi_t^n = \mathrm{b}\left(TCR_{t-1} - TCRE_{t-1} \right) , \qquad \mathrm{b} > 0 . \tag{4}$$

Substituting equation (3) into equation (4), we have

$$\pi_t^n = -\,\mathrm{b}\mathrm{a}_0 + \mathrm{b}\,TCR_{t-1} + \mathrm{b}\mathrm{a}_1 \left(\frac{G}{Y} \right)_t . \tag{5}$$

8. See, for example, Dornbusch (1980).

9. The equilibrium real exchange rate here is the one that clears the nontradables sector. From a long-term perspective, however, it should also meet the prerequisite that the current account be equal to the sustainable capital account.

Equation (3) reflects the fact that the equilibrium real exchange rate (*TCRE*) in the Australian model is inversely related to the spending-output ratio (*G/Y*). Equation (4), in turn, indicates that, in the context of a predetermined nominal exchange rate and slow price adjustment, the convergence of the actual real exchange rate (*TCR*) toward equilibrium takes place through variations in the inflation of nontradables (π^n). From this it follows that inflation of nontradables will depend on the gap between *TCR* and *TCRE*. Finally, equation (5) shows that the evolution of nontradables inflation is determined by the spending-output ratio and by the actual real exchange rate lagged one period.

Within this analytical framework the exchange rate system will determine how the real exchange rate will adjust, and therefore the effect on the price-level path associated with changes in relative prices. Thus, in a fixed exchange rate system, the appreciation in terms of the real exchange rate takes place through the acceleration of inflation of nontradables.[10] In contrast, if the exchange rate floats, the reduction in the real exchange rate occurs through a nominal appreciation, reducing tradable goods inflation. Therefore the relationship between the spending-output gap and the inflation rate may be either positive or negative, depending on the exchange rate system.

Accordingly, in the context of this model, the relationship between the monetary policy instrument and the inflation rate must go through the spending-output relationship. Thus, if the long-term real interest rate determines the evolution of investment expenses and durable goods consumption, then the manipulation of the short-term interest rate by the central bank, through its effect on long-term rates, can reduce the spending-output gap and increase the equilibrium real exchange rate.[11] This, in turn, within a pre-fixed or indexed exchange rate system, will result in reduced inflationary pressures. In this sense it must be kept in mind that during the past

10. Strictly speaking, the exchange rate adjustment to a transitory demand shock may take place through an increase in the price level without a variation in trend inflation. However, in an indexed economy inflation has an inertial component, and therefore any price-level adjustment manifests itself in an increase in inflation. In particular, the inflationary effect associated with a relative price correction will appear especially strong in those cases where indexation affects the nominal exchange rate.

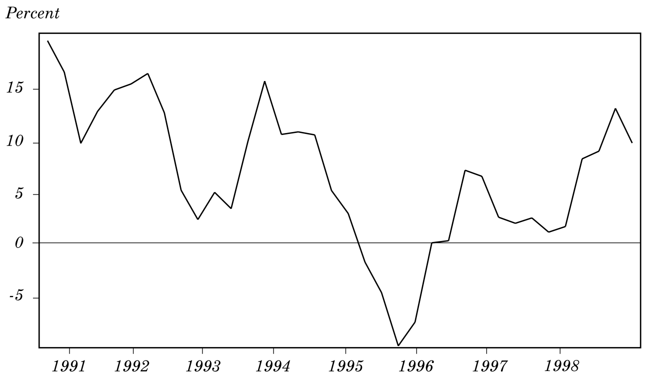
11. In the short run the deceleration in the growth of spending will also translate into reduced GDP growth.

ten years Chilean exchange rate policy has consisted of an exchange rate band whose midpoint adjusts to past inflation, together with corrections for foreign inflation and productivity. This introduces a significant degree of indexing of the nominal exchange rate.

As shown in figure 1, variation in the nominal exchange rate trended downward between the first quarter of 1990 and the second quarter of 1995, reflecting the gradual reduction in inflation and sporadic discrete revaluations through adjustments in the band's midpoint or in its width.[12] These corrections to the exchange rate rule permitted a growing fraction of the relative price correction associated with the evolution of the spending-output gap to be accomplished through the nominal exchange rate, instead of through inflation of nontradable goods.

The above analysis suggests that the gradual decline in inflation is tied to the path of the nominal exchange rate. In fact, as figure 2 shows, whenever the spending-output gap narrows, a deceleration of nontradables inflation follows, but in periods where the gap increases, inflation remains constant. This behavior can be explained by the fact that, whenever the gap increases, the growth rate of the nominal exchange rate decreases and even becomes negative in some periods, as can be seen in figure 1.

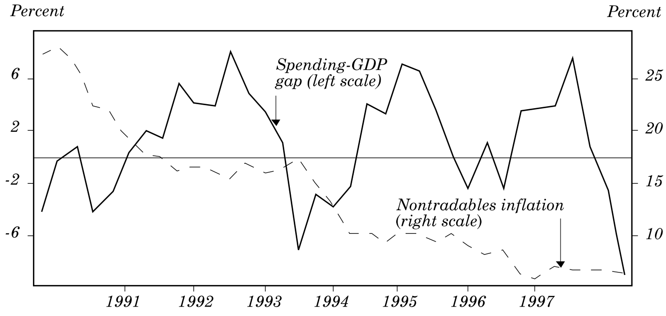
Figure 1. Changes in the Nominal Exchange Rate in Chile[a]



Source: Authors' calculations based on Central Bank of Chile data.
a. Change over the preceding twelve months.

12. The band's midpoint also takes into account the evolution of the Deutsche mark-dollar and Japanese yen-dollar parities. For a detailed analysis of Chile's exchange rate policy see Vergara (1994).

Figure 2. Changes in Inflation of Nontradables and the Spending-GDP Gap[a]



Source: Authors' calculations based on Central Bank of Chile data.
a. Change over the preceding twelve months.

2.2 The Phillips Curve Mechanism

The second transmission mechanism is based on the famous Phillips curve, augmented by inflation expectations (Friedman, 1976). According to this approach, if actual output (y) exceeds the economy's potential output (y_p), or if the natural rate of unemployment exceeds actual unemployment, then in the short run, actual inflation of wages and prices (π) will accelerate with respect to the expected rate (π^e). The inverse relationship, where causality goes from the inflation rate to the unemployment rate, results from a slow adjustment of inflation expectations, rigid prices and wages, or lack of policy credibility. Actually, a short-run Phillips curve is possible only if actual inflation differs from expected inflation. In the long run, therefore, there is no trade-off between unemployment and inflation, because the adjustment of expected inflation to actual inflation results in an unemployment rate equal to the natural rate and in actual GDP in line with potential GDP.

Equation (6) shows the Phillips curve augmented by inflation expectations:

$$\pi_t = \pi_t^{\varepsilon} + c\left(y - y_p\right), \qquad c > 0 . \tag{6}$$

Assuming static expectations (the basis of the accelerationist hypothesis of the Phillips Curve), $\pi_t^e = \pi_{t-1}$, and therefore the change in inflation will equal.[13]

$$d\pi_t = c\left(y - y_p\right). \tag{7}$$

What counts here is the level of actual output compared with its potential, because an economy can grow faster than its potential for some time without inflationary pressures emerging, if initial output is below potential.[14]

The transmission mechanism of monetary policy in this theoretical context can be described as follows. Whenever the trend of GDP growth is above that of potential GDP growth, after a while GDP will rise above its potential. Then an increase in the interest rate permits spending growth to decelerate, which in turn slows the growth of GDP until its level returns to that of potential GDP. In addition, the higher interest rate may have a direct effect on actual output by making working capital more expensive. Thus the deceleration of GDP growth may also reduce the inflation rate to the level determined by the nominal anchor (this may be the exchange rate, a monetary aggregate, or the inflation target determined by policymakers), which in steady state will equal expected inflation.

The output gap approach is widely used in the empirical literature on inflation determinants. As pointed out by Coe and McDermott (1997), the available evidence on industrial countries suggests that such a gap is an important determinant of inflation. For the Asian emerging economies as well, these authors find that the output gap plays a significant role in the evolution of inflation. However, for a large number of developing countries, the evidence shows no relationship between the output gap and inflation.[15] As for the Chilean case, Mendoza and Fernández (1994) show evidence favoring this relationship.

13. Naturally, expectations may be rational; however, the simplifying assumption of static expectations captures the essence of the transmission mechanism to be applied to empirical studies. See Coe and McDermott (1997).

14. Zahler (1994) has argued in favor of the levels of actual and potential output being more important than the growth rates. See the previous section.

15. On this matter see International Monetary Fund (1996).

2.3 The Interest Rate Parity Mechanism

The interest rate parity mechanism is based on international arbitrage of interest rates. Thus, whenever a country's domestic interest rate exceeds the foreign rate (corrected for devaluation expectations and country risk), it induces a capital inflow, a nominal appreciation of the domestic currency, a drop in inflation, and an increased current account deficit financed by a capital account surplus. Capital mobility thus ensures that the domestic interest rate cannot remain out of line with the foreign rate, and in a fixed exchange rate system, that same mobility also implies that the central bank loses its ability to set monetary policy autonomously. Here the question for policymakers is whether to stabilize the exchange rate and abandon monetary policy independence, or to retain the interest rate as a monetary policy instrument and settle for greater exchange rate variability.

In Chile during the 1990s the domestic real interest rate, adjusted for real exchange rate expectations and country risk, stayed consistently above the foreign rate. The resulting massive capital inflows were partially sterilized, in such a way that the central bank accumulated substantial reserves. This imposed significant losses on the central bank, because it issued bonds at a UF rate that was above the rate it obtained on its dollar-denominated assets. In order to reduce the effect of capital inflows, the central bank imposed a 30 percent reserve requirement on foreign credits and investments not of a "productive" nature. However, as Valdés and Soto (1998) concluded, this reserve requirement did not reduce the total amount of short-term capital but only affected its composition.[16]

According to the above, interest rate arbitrage has resulted in a changed portfolio composition, with the private sector borrowing in foreign currency and acquiring UF-denominated assets, while the opposite has happened with the central bank's portfolio. So, supposedly, there has been no direct effect on the level of aggregate spending, and therefore the real exchange rate has not been affected by the spending-output gap mechanism.[17] However, this did not necessarily prevent a transitory real appreciation of the peso through a nominal

16. Recently, in the wake of the Asian crisis, the central bank has reduced the reserve requirement to zero.

17. In the medium and the long run, the increase in the domestic interest rate should increase the real exchange rate, in accordance with the spending-output relationship.

appreciation, and thus a drop in tradables inflation may have been generated. Actually, the accumulation of international reserves may have led to the currency appreciating within its band.[18] This, together with a relatively slower price adjustment of goods than of the exchange rate, may have caused, in the short run, a real appreciation and a deflationary trend in the prices of nontradable goods.

On the other hand, with the exchange rate remaining close to the band's floor for long periods, the resulting continued accumulation of reserves and a number of discrete modifications to the exchange rate band have taken their toll on its credibility. This has led to expectations of a nominal revaluation, which, in the presence of price inflexibilities, would also mean a real appreciation, at least in the short run. This has further strengthened the incentives for capital inflows, causing the central bank to have to endure several episodes of speculative attacks. Often it has been forced to validate the market's expectations, either by extending the band's limits or by realignment of its midpoint. For example, toward the end of 1994 the central bank accumulated over $2 billion in just two months, requiring it to modify the exchange rate band in November, thereby permitting a substantial appreciation.

In addition, to the extent that the announcement of a decreasing inflation target determines a certain expected path for nominal exchange rate variation, implying a reduced real exchange rate, high domestic interest rates become irresistibly attractive for capital inflows.[19] In this context, short-term real exchange rate swings induced by the nominal appreciation will be out of equilibrium, and therefore the actual and the equilibrium exchange rate will become misaligned. This, in turn, will introduce new deflationary pressures on nontradables.

However, an alternative hypothesis cannot be ruled out, namely, that nominal appreciation only accommodates the equilibrium real appreciation. In this case individuals would expect a real appreciation based on the evolution of fundamental variables (relative sector productivity, the spending-output ratio, government spending, the terms of trade, and the like). The result would be to increase the gap

18. On the effects of sterilized intervention on the exchange rate, see Edison (1993).

19. On this matter see Rosende (1998).

between domestic and foreign interest rates and to stimulate capital inflows to validate these expectations.[20]

2.4 The Monetarist Mechanism

The monetarist transmission mechanism is based on the monetarist hypothesis of the economic cycle, according to which an unanticipated change in the nominal money supply affects inflation and output in the short run. In contrast to the Keynesian approach, this theoretical scheme not only considers the interest rate as a transmission mechanism, but also contemplates the effects thereof through a set of asset prices and real wealth. Thus, in this approach, variations in the money supply affect interest rates and the prices of stocks, land, and durable goods. All these variations in relative prices will affect consumption and investment through multiple wealth effects and substitution effects.

Under the interest rate policy that the central bank has been following over the last fifteen years, an interest rate increase results in a smaller monetary expansion during the process of adjusting to the new equilibrium. This has a negative effect on prices of other assets and, ultimately, on spending, output, and the rate of inflation.

It is often argued that, whenever monetary policy uses the interest rate as its instrument, nominal money will be endogenous, so that observed variations in the nominal money supply will respond to movements in the demand for money. However, whenever the central bank chooses to change the level of the interest rate, it does so through exogenous changes in the money supply. Certainly, once the new equilibrium has been reached, money supply movements become endogenous again.[21]

20. Zahler (1997) argues in favor of this hypothesis: "we cannot overstate that the real appreciation of the Chilean peso during the nineties, around 4.5% per year, was the result of an equilibrium process, that responded to the structural changes of the Chilean economy over the past years, and not to an exchange rate manipulation with the purpose of artificially reducing the inflationary trend." On the other hand, Rosende (1998) believes that the interest rate policy stressed the downward trend of the real exchange rate.

21. Unpublished results of the authors indicate that some correlation exists between money market imbalances and an acceleration of GDP. For Rosende and Herrera (1991), money market imbalances can be attributed to the fact that the relative prices that the central bank attempts to stabilize (the interest rate or the exchange rate) are far from their equilibrium, thereby generating endogenous movements in the money supply.

2.5 The Credit Mechanism

Empirical findings of international studies have not supported the hypothesis of a negative relationship between the interest rate and aggregate spending. Therefore research on the monetary policy transmission mechanism has turned to what has been termed the credit mechanism.[22] This approach emphasizes the role of the banking system as a source of financing for small and medium-sized companies, for which the problem of asymmetric information is most important. Two transmission channels are proposed, namely, the bank credit channel and the balance sheet channel.

In the credit channel model, an interest rate increase resulting in reduced money growth, bank reserves, and deposits will have a contractionary effect on bank credits, depressing investment expenditure and, in turn, GDP. However, as explained above, in an open economy a higher domestic interest rate may generate an incentive for capital inflows, which can be intermediated by the banking sector, thus leading to an increase in loans.

The balance sheet channel operates through a deterioration of companies' cash flow resulting from the interest rate increase. This magnifies problems of adverse selection and moral hazard, thereby reducing corporate lending.[23] This, in turn, has a negative effect on investment and, as a result, on GDP. This transmission mechanism, together with the Phillips curve or the Australian mechanism, suggests that an increase in the interest rate will reduce inflationary pressures by reducing the spending-output gap or the gap between actual and potential output.

One example of the application of this approach is Edwards and Végh (1997). These authors hold that, in both Chile and Mexico, the banking sector played a fundamental role in intermediating capital flows, which ended in an explosive growth in consumption (in Chile in the 1980s and in Mexico in the 1990s). When capital withdrew from these countries, banks were left with severe financial problems, which deepened the recessions the countries were then suffering. The authors build a model in which fixed exchange rate stabilization generates output and employment cycles through changes in deposit-credit spreads and in bank

22. Examples can be found in Mishkin (1995) and Bernanke and Gertler (1995).

23. Bernanke and Gertler (1995) argue that this effect should be applied not only to corporate investment expenses but also to individuals' expenditure on durable goods.

credits. In their empirical analysis, the authors use a widening of the spread between interest rates for credits and for deposits as a proxy for a shock to the banking system, and they find that such a shock negatively affects economic activity.

3. Empirical Evaluation of Alternative Transmission Mechanisms

3.1 Methodology

A review of the relevant literature indicates that a large majority of recent studies on the effects of monetary policy use vector autoregression (VAR) as their econometric tool of choice.[24] However, this methodology has been subjected to strong criticism, on the grounds that it lacks a sufficient theoretical basis and on the grounds that its identification procedure is questionable.With respect to the first criticism, it is arguably a matter of personal preference, since none of the econometric methodologies currently in use is totally immune from criticism on this score. Although economic theory does establish certain relationships between variables, it seldom provides accurate predictions of the dynamics of those relationships or distinguishes between endogenous and exogenous variables. This forces a choice between imposing "arbitrary" constraints on the joint dynamics of the set of variables and in selecting endogenous variables, on one hand, and adopting a totally empirical approach on the other, whereby the data "reveal" their joint dynamic process and all variables are treated symmetrically.[25] The latter is the option implicit in the VAR methodology.

To understand the nature of the second type of criticism, consider the following example:

$$y_t + \mathrm{b}_{12} z_t = \mathrm{b}_{10} + \gamma_{11} y_{t-1} + \gamma_{12} z_{t-1} + \varepsilon_y \ , \tag{8}$$

$$z_t + \mathrm{b}_{21} y_t = \mathrm{b}_{20} + \gamma_{21} y_{t-1} + \gamma_{22} z_{t-1} + \varepsilon_z \ , \tag{9}$$

24. Some examples are the works of Rosende and Herrera (1991), Bernanke and Blinder (1992), Mendoza and Fernández (1994), Leeper, Sims, and Zha (1996), Valdés (1997), Bernanke and Mihov (1998), Cochrane (1998), and Garretsen and Swank (1998).

25. On this matter the classic reference is Sims (1980).

where variables *y* and *z* follow a stochastic process as described by equations (8) and (9) and ε_y and ε_z are innovations or "white noise." This system of equations, known as the structural VAR, may be described as shown below:

$$B_0 x_t = \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t \ , \tag{10}$$

where $E\left(\varepsilon_t \varepsilon_t'\right) = \Sigma$.

When both sides of equation (10) are premultiplied by B_0^{-1}, the autoregressive vector is obtained in its reduced form:

$$x_t = A_0 + A_1 x_{t-1} + e_t \ , \tag{11}$$

where

$$x_t' = \left[y_t \quad z_t \right] ,$$

$$A_0 = B_0^{-1} \Gamma_0 \ ,$$

$$A_1 = B_0^{-1} \Gamma_1 \ ,$$

$$e_t = B_0^{-1} \varepsilon_t \ ,$$

$$\Omega = E\left(e_t e_t' \right) = B_0^{-1} \Sigma \left(B_0^{-1} \right)'.$$

Here the main fact worth singling out is that, given $e_t = B_0^{-1} \varepsilon_t$, every element in the residuals vector of the reduced system is a linear combination of all the structural innovations that affect the endogenous variables that make up the system. Therefore, the dynamic response (impulse response function) of these endogenous variables to a shock to one of the system's error vector components in its reduced form cannot be linked to any structural innovations in particular.

In the traditional VAR methodology the identification problem is solved by placing constraints on the contemporary effects of the variables and on their variance-covariance matrix. These constraints, associated with Cholesky's decomposition, assume a recursive process, where the first variable included in the VAR system is not affected contemporaneously by any of the remaining endogenous variables, the second one is affected contemporaneously only by the first, and so on.

If the theoretical constraints applicable to the structural dynamic model are such that the B_0 matrix is inferior triangular, with unit coefficients in the principal diagonal, and matrix Σ is diagonal, where the values in its diagonal are the structural innovations' variances, this model will be appropriately identified using the traditional procedure. In this case, estimates of the parameters (B_0, Γ, Σ) through the full-information maximum likelihood (FIML) method can be obtained by maximizing the likelihood function with respect to the estimated parameters of the reduced form. The FIML estimation of B_0 allows us to calculate the orthogonalized residuals through the relationship $\varepsilon_t = B_0 e_t$, which corresponds to the vector of structural disturbances. Similarly, the orthogonalization of the impulse response function's coefficients will generate the dynamic consequences of structural innovations. In general, however, the constraints will not be the "true constraints" imposed by economic theory. Thus a more flexible identification procedure is needed, to allow the incorporation of constraints consistent with the theoretical model being tested.[26]

Given the above, in a second development stage of the VAR methodology more attention was paid to the identification of variables based on economic theory; the result was the so-called structural VAR. The leaders of this line of research were Christopher Sims, Olivier Blanchard, Mark Watson, and Ben Bernanke. The rationale of the structural VAR methodology is that any identification constraints being imposed on matrixes B_0 and Σ must come from economic theory. Once such constraints are established, it is possible to estimate values of the structural coefficients that will both satisfy and meet the condition given by the last of the equations above. For that purpose the FIML method is used.[27]

One last methodological issue worth noting relates to the existence of conflicting ideas about whether the variables included in a

26. For further details of the VAR estimation methodology, see Hamilton (1994).

27. See Hamilton (1994).

VAR system must be previously filtered so that they are all stationary, or whether they must simply be included in their "natural form." Some authors, such as Sims (1980) and Doan (1992), argue against variable differentiation even when the variables have a unit root. Their main argument is that the objective of the structural VAR is to find any interrelationships that may exist between the variables included in the system, and not the estimated values of parameters per se. Similarly, they argue against variable filtering because this may imply a loss of information about joint movements of the variables, such as the possible existence of cointegration relationships between them. However, the majority of the other authors hold that the variables must be used in such a way that the VAR can imitate the true data-generating process, and therefore the variables included must be stationary.

3.2 Identification Criteria Used

In keeping with the arguments in the previous section, the characteristic element of the structural VAR methodology adopted here is the use of identification assumptions explicitly based either on economic theory or on institutional aspects inherent in the economy under analysis. Therefore we first describe in detail the identification assumptions used to estimate the various models considered here:

- Because the data being used are monthly, the first assumption is that the monetary policy instrument (the rate on the central bank's ninety-day instrument) does not respond contemporaneously to variables that are not observable within the month, such as activity variables (production and spending). However, the instrument can respond contemporaneously to variables observed in the very short term, such as monetary and financial variables and prices.
- Financial variables (such as the exchange rate, market interest rates, and asset prices) can respond contemporaneously to any information, including nonobservable information.[28]

28. Because financial variables are not the result of the decision of any one player but arise from the interaction of many actors within their respective markets, they can be affected by variables that, without being directly observable, do alter the equilibrium of those markets. They can also be affected by the actors' expectations regarding the future path of the relevant variables.

• Activity variables (such as spending, output, and the spending-output gap) respond to all the other variables with a lag; exceptions are days worked and, in the case of GDP, the response to spending itself.[29]

• Prices of goods (as reflected in the overall CPI and the CPI for nontradables) respond contemporaneously only to those variables that affect them directly, such as the exchange rate and international prices.[30]

• The real exchange rate responds contemporaneously only to variables affecting it directly (the nominal exchange rate, international prices, and the CPI for nontradables). This assumption is a direct extension of the previous one.

• In the case of the monetary credit model, credit from the financial sector is assumed to respond contemporaneously to interest rates and money (which affect the credit supply), because this is the central transmission mechanism of monetary policy according to this model. Credit may also respond contemporaneously to aggregate spending, which affects the demand for credit.

3.3 Principal Results

As we have seen, the need for the variables included in a structural VAR to be stationary remains controversial. Therefore, as a way to check the robustness of the results obtained, all the estimated models were estimated in three versions (except for the reaction function and the Phillips curve, which were estimated only in two versions): as levels, as levels and growth rates over twelve months,[31] and as levels and first differences (of levels or of the twelve-month variation rate, depending on the type of variable).[32] This also allows

29. This assumption is intended to incorporate into the models' empirical estimation the existence of lags in the production and spending decisionmaking processes or in their implementation. Such lags may arise from delays in the generation and disclosure of information on which the decisions are based, from difficulties in their interpretation because of uncertainties (for example, with respect to whether shocks are permanent or transitory), or from the presence of rigidities (contractual or other) that may hinder instantaneous reactions.

30. This is one of the standard assumptions used in Keynesian models to allow for the existence of real effects in response to nominal shocks.

31. The twelve-month variation was used in those cases where it makes economic sense, for example with price indexes and production and spending figures.

32. This version of the models attempted to make all the variables included comply with the seasonality condition; this was checked using the Dickey-Fuller and Phillips-Perron tests.

our results to be compared with a broader range of previous studies. Appendix B summarizes the main results for the Chilean economy reported by other authors.

For reasons of space, only the results of the version with the most theoretical basis (the one combining variables in levels and twelve-month growth rates) are shown, since these results are easier to interpret. Also, and for the same reasons, only the impulse response functions considered to be the central hypotheses associated with each of the models estimated are discussed.[33]

The Central Bank's Reaction Function. Table 2 describes the estimated model. The upper panel of figure 3 shows the response of the monetary policy rate to a 1-percentage-point increase in the cyclical component of GDP. As the figure shows, the response is positive and strongly significant after the fifth month from the shock. The response peaks around 13 basis points, 15 months after the shock.

Table 2. Characteristics of the Models

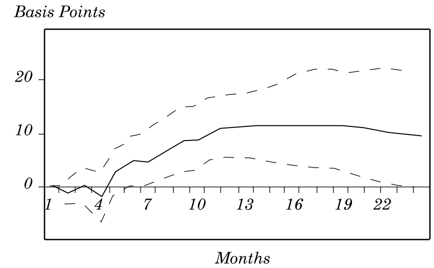
Model	*Variables included[a]*	*Lags*	*Sample period*
Central bank's reaction function	TASA BC; CICLO; V12WUC; V12IPCSUB; seasonal dummies; deterministic trend	Five	January 1986 to December 1996
Australian model	LTTUC; TASABC; TBE; CICLO; LTCN; LIPCNT; LTCRINE; seasonal dummies; deterministic trend	Four	April 1989 to June 1997
Credit model	LTTUC; TASABC; TBE; V12M1A; V12COLOC; V12GASTO; V12PIB; V12TCN; V12IPCSUB; V12DHAB; seasonal dummies; deterministic trend	Three	January 1987 to June 1997
Monetary model: asset prices	LTTUC; TASABC; TBE; V12M1A; V12IGPA; V12GASTO; V12PIB; V12TCN; V12IPCSUB; V12DHAB; seasonal dummies; deterministic trend	Three	January 1987 to June 1997
Phillips curve model	LTTUC; TASABC; TBE; CICLO; DV12TCN; DV12IPCSUB; seasonal dummies; deterministic trend	Five	February 1986 to December 1996
Interest rate parity model	TASABC; LIBOR; VTCREXPOST; V3TCN; V3IPC; seasonal dummies; deterministic trend	Six	January 1987 to December 1997

a. See appendix C for definitions of the variables.

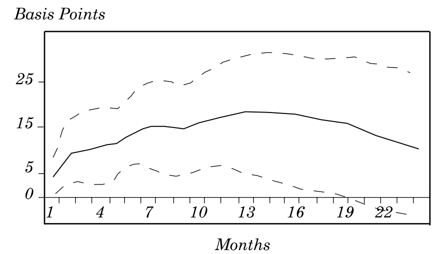
33. A complete report of the impulse response functions of this and the other models estimated is available from the authors.

Figure 3. Impulse Response Functions for the Central Bank's Reaction Function

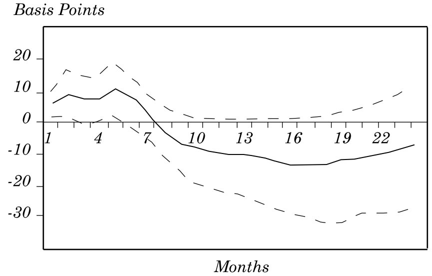
Response of Policy Rate to Change in Cyclical Component of GDP



Response of Policy Rate to Change in Nominal Wage Variation



Response of Policy Rate to Change in Core Inflation



Source: Authors' calculations.

The middle panel of figure 3 shows the response of the monetary policy rate to a 1-percentage-point increase in the twelve-month variation rate of nominal wages. A positive, strongly significant response of the policy rate to a positive shock to this variable is observed. This response reaches its maximum intensity, nearly 20 basis points, fifteen months after the shock.

Finally, the bottom panel of figure 3 depicts the response of the monetary policy rate to a 1-percentage-point increase in core inflation. It can be concluded that the response is positive and significant in the period from one to seven months after the shock, and that the maximum response appears around month 5 after the shock, when it amounts to slightly more than 10 basis points.

The Australian Model. Table 2 again describes the main characteristics of the model. The top left panel of figure 4 shows the response of the spending-output gap to a positive shock of 50 basis points in the monetary policy interest rate. Three conclusions can be drawn. First, the response is negative but not large enough to be significant. Second, this negative response extends from month 1 to month 13 after the shock. And third, at its maximum, the reduction in the gap is 1 percentage point.

On the other hand, the next two panels of figure 4 shows the response of the CPI for nontradables to an increase of 50 basis points in the monetary policy interest rate. The results indicate that when the *level* of the CPI for nontradables is used, the response is negative and significant (at the 10 percent level). However, when the twelve-month variation in the CPI for nontradables is used, the familiar “price puzzle” appears,[34] in that the response is positive. However, this response is not large enough to be statistically significant.

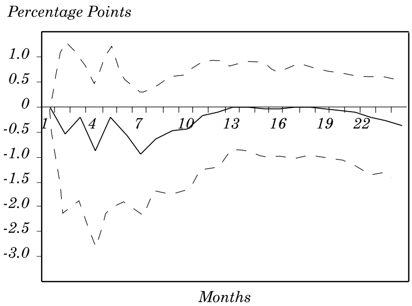
The next panel of figure 4 depicts the response of the (logarithm of the) real exchange rate to a 50-basis-point shock to the monetary policy interest rate. A first main conclusion is that the level of the real exchange rate increases after the fourth month, and this response is marginally significant (at the 10 percent level). A second is that after two years the real exchange rate is about 2 percentage points above its trend level.

The last panel of figure 4 shows the response of the real exchange rate to a 5-percentage-point shock in the spending-output gap. The response is negative and significant. Two years after the shock, the real exchange rate is 1.3 percentage points below its trend level.

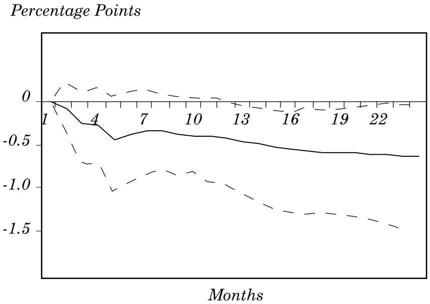
34. See Bernanke and Blinder (1992) and Leeper, Sims and Zha (1996) for more on this subject.

Figure 4. Impulse Response Functions for the Australian Model

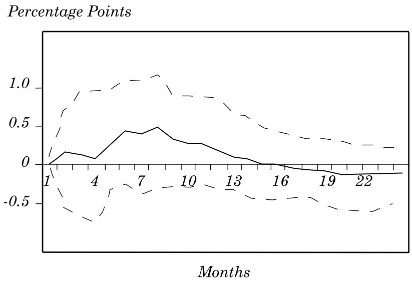
Response of Spending-Output Gap to Change in Policy Rate



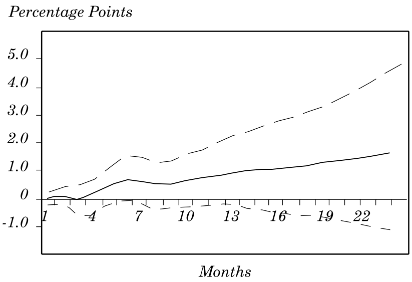
Response of Nontradables CPI to Change in Policy Rate



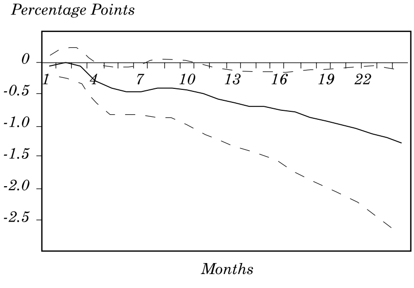
Response of Change in Nontradables CPI to Change in Policy Rate



Response of Real Exchange Rate to Change in Policy Rate



Response of Real Exchange Rate to Change in Spending-Output GAP



The Credit Model. Table 2 again describes the main characteristics of the model. The top left panel of figure 5 shows the response of the monetary aggregate M1A to a 50-basis-point increase in the monetary policy interest rate. It can be concluded that the response is negative, that the largest effect is reached six months after the shock, and that at its maximum the response is marginally significant at the 10 percent level.

The top right panel in figure 5 depicts the response of annual growth in financial system credit to a 50-basis-point increase in the monetary policy rate. The response is negative, very persistent, and significant at the 10 percent level. The response is at its greatest eighteen months after the shock, at which point the annual growth rate of credit has been reduced by 0.60 percentage point.

The left-hand panel in the second row of figure 5 shows the response of aggregate spending to a 50-basis-point shock in the monetary policy rate. A lagged negative response is detected beginning in the fourth month after the shock. However, this response is not significant at the 10 percent level.

The right-hand panel in the second row of figure 5 shows the response of the core CPI to an increase of 50 basis points in the monetary policy rate. The response is positive, revealing again the presence of the "price puzzle," which has been found in other studies of the Chilean economy.[35] However, the response is not significant at the 10 percent level.

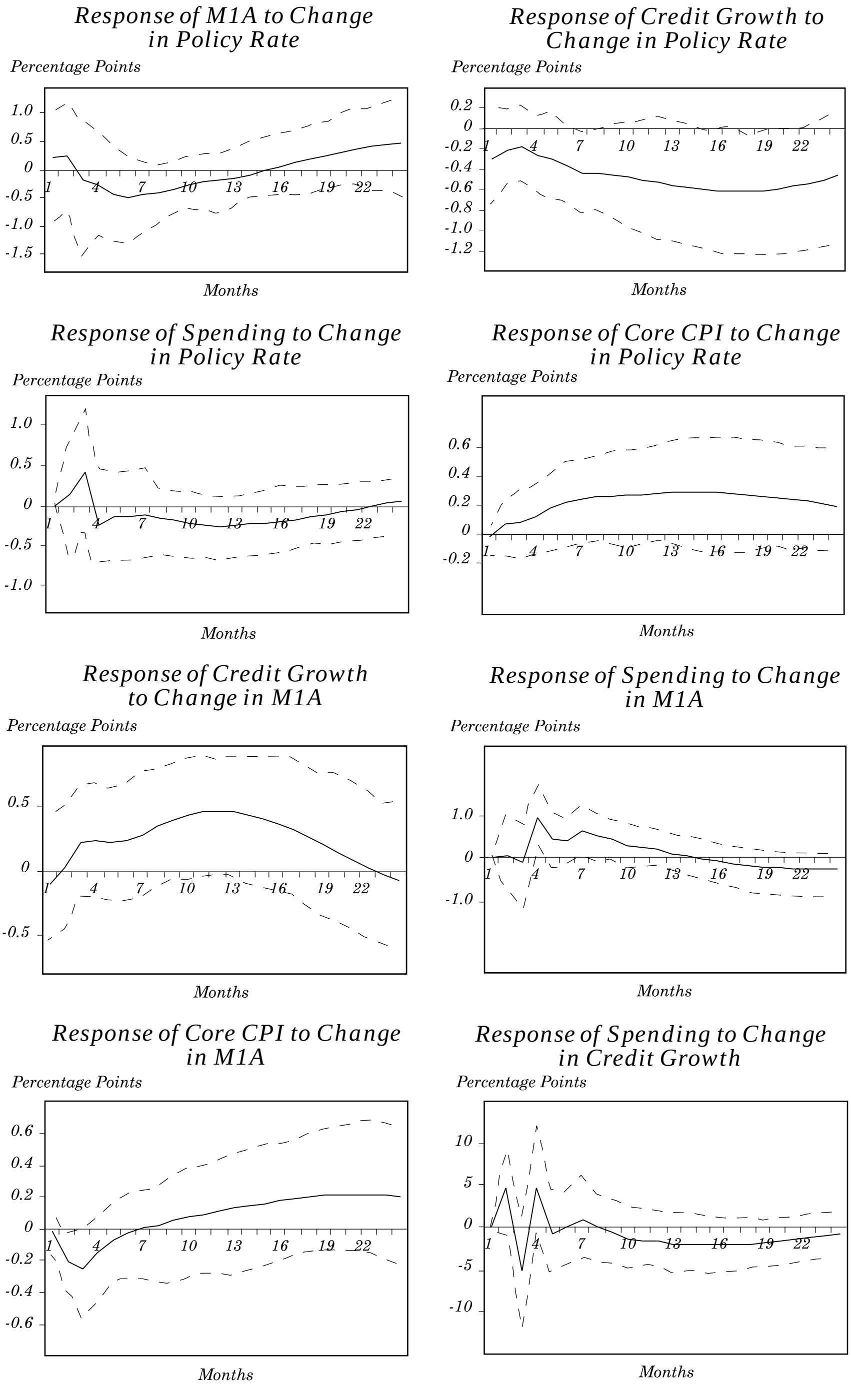
The left-hand panel in the third row of figure 5 depicts the response of financial system credit to a positive shock to M1A of 5 percent. The response is positive and achieves significance at the 10 percent level between ten and thirteen months after the shock. The response peaks at twelve months after the shock, at which point it is near 0.5 percentage point.

The right-hand panel in the third row of figure 5 shows the response of aggregate spending to a positive shock to M1A of 5 percent. The response is positive and significant at the 10 percent level and occurs between four and thirteen months after the shock, peaking near 1 percentage point.

The bottom left panel of figure 5 shows the response of core CPI to a positive shock to M1A of 5 percent. A negative response is observed between the second and the fourth month after the shock, which is

35. See Valdés (1997) and Mendoza and Fernández (1994).

Figure 5. Impulse Response Functions for the Credit Model



Source: Authors' calculations.

significant at the 10 percent level. This result can be interpreted as another indication of the so-called price puzzle. Subsequently, at the fifth month after the shock a positive response from prices appears, but it is not large enough to be significant.

Finally, the bottom right panel of figure 5 shows the response of aggregate spending to a 5 percent positive shock to annual growth in financial system credit. The response is somewhat erratic, but it is positive in the second and fourth months after the shock, and marginally significant at the 10 percent level. The magnitude of the response is relatively large, peaking at around 5 percentage points.

The Monetary-Asset Price Model. Table 2 shows the main characteristics of the model that we have labeled the "monetary-asset price model." The top left panel of figure 6 shows the response of M1A to an increase of 50 basis points in the monetary policy interest rate. The response becomes negative at month 5 after the shock. The largest negative effect is reached at seven months; it is significant at the 10 percent level and amounts to almost 1.5 percentage points.

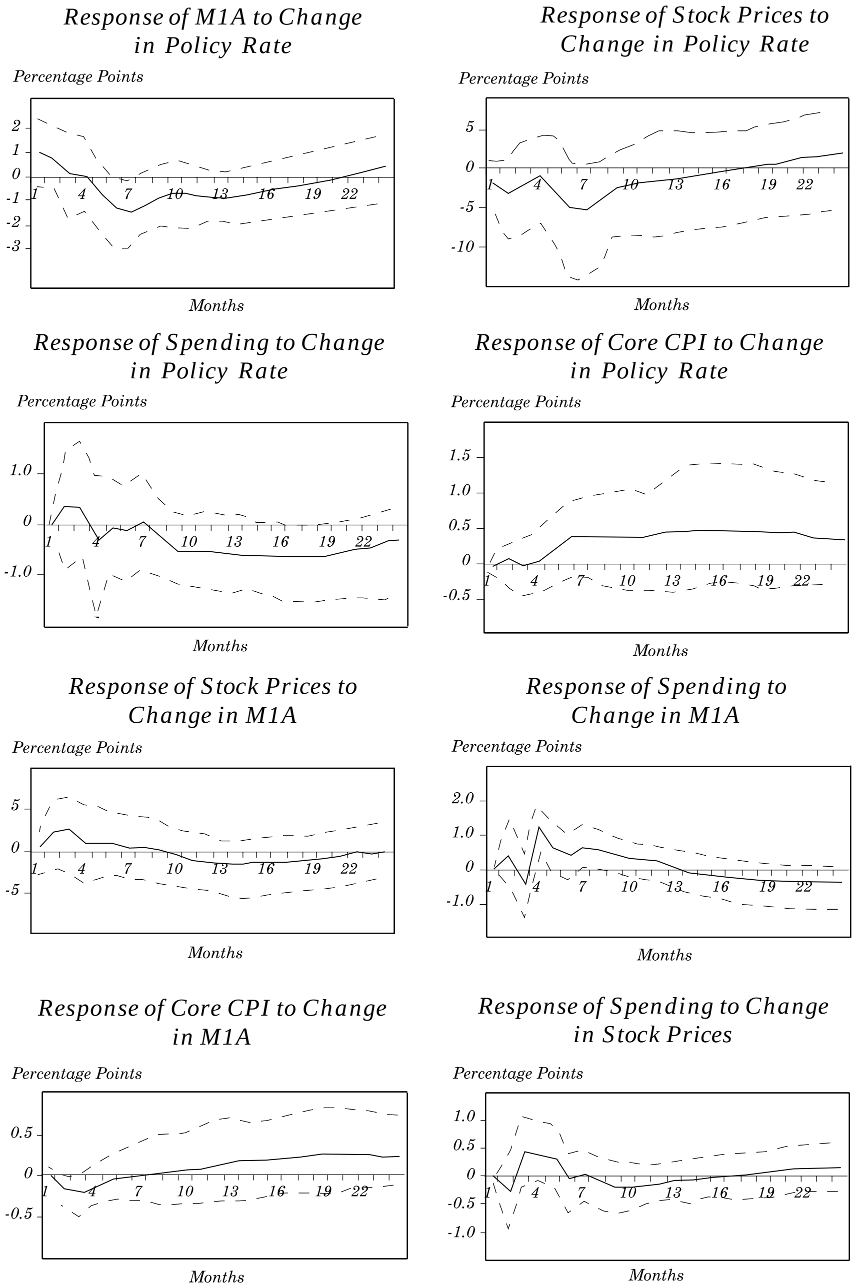
The top right panel of figure 6 shows the response of the Chilean general stock price index (IGPA) to a positive shock of 50 basis points in the monetary policy rate. The response is negative and significant at the 10 percent level. The maximum response is achieved between six and seven months after the shock, when it equals 5 percentage points.

The left-hand panel in the second row of figure 6 shows the response of aggregate spending to a positive shock of 50 basis points to the monetary policy rate. A negative response appears at month 8 after the shock and is significant at the 10 percent level. The maximum effect is reached between fifteen and eighteen months after the shock and amounts to 0.6 percentage point.

The right-hand panel in the second row of figure 6 shows the response of the core CPI to a 50-basis-point increase in the monetary policy rate.As in the credit model case, this model finds a positive response indicative of the traditional "price puzzle." However, in this case as well, the response does not reach significance at the 10 percent level.

The left-hand panel in the third row of figure 6 shows the response of the IGPA to a positive shock of 5 percentage points to M1A. A positive response is observed between one and nine months after the monetary shock, but it is not significant.

Figure 6. Impulse Response Functions for the Monetary-Asset Price Model



Source: Authors' calculations.

The right-hand panel in the third row of figure 6 depicts the response of aggregate spending to a 5 percent positive shock to M1A. The response is positive and significant at the 10 percent level. It occurs between four and thirteen months after the shock and peaks at about 1 percentage point.

The bottom left panel of figure 6 shows the response of the core CPI to a 5 percent positive shock to M1A. A negative response is observed between the second and the fourth month after the shock, which is marginally significant at the 10 percent level. Once again this result can be interpreted as a manifestation of the "price puzzle." Subsequently, a positive response of prices appears, but it is not significant.

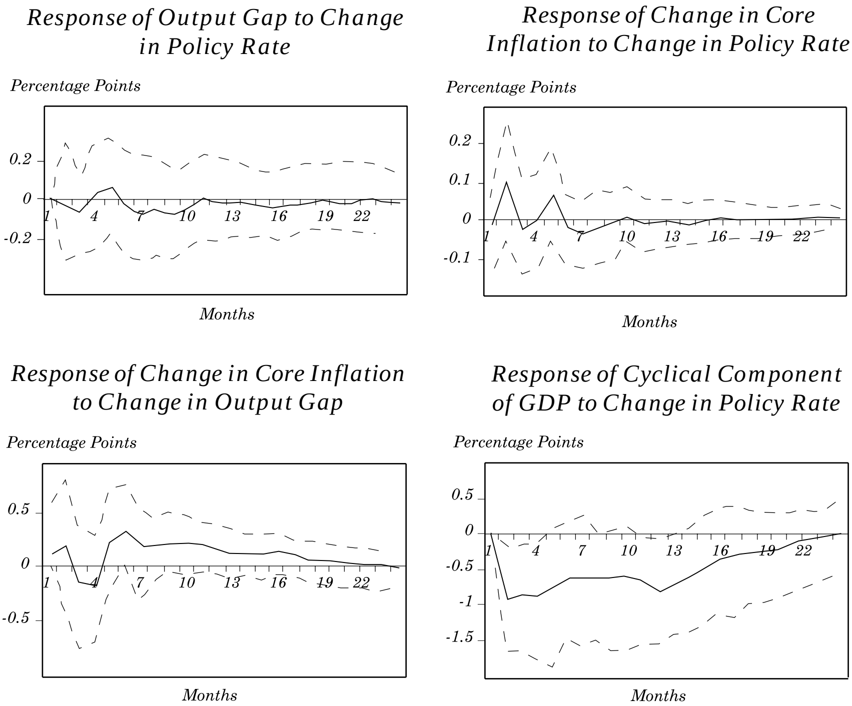
Finally, the bottom right panel of figure 6 shows the response of aggregate spending to a positive shock of 10 percent to the IGPA. A positive response is observed, which is marginally significant between months 3 and 6 after the shock.

The Phillips Curve Hypothesis. Table 2 again describes the main characteristics of the model. The top left panel of figure 7 shows the response of the discrepancy between actual and potential output (that is, the business cycle) to an increase of 50 basis points in the monetary policy rate. The response is far from significant, and so, under this specification of the model, no systematic response of the cyclical component of GDP to a shock in the monetary rate can be identified.

The top right panel of figure 7 shows the acceleration in core inflation in response to a 50-basis-point increase in the monetary policy rate. Although the observed response is basically positive during the periods immediately following the shock, it is far from significant. Thus, in this case the "price puzzle" that appears is of a lesser degree than in the other models estimated.

The bottom left panel of figure 7 shows the acceleration in core inflation in response to a 5-percentage-point increase in the discrepancy between actual and potential output. Although at the beginning (between months 3 and 4 after the shock) a negative response is detected, it is not significant, and from month 5 onward a clearly positive and marginally significant (at the 10 percent level) response can be seen. This indicates the presence of a positive effect from the cyclical component of GDP on core inflation, and therefore of

Figure 7. Impulse Response Functions for the Phillips Curve Model



Source: Authors' calculations.

what is commonly called "overheating."[36] The graph also shows that, at its peak in month 6, the magnitude of this response is about 0.40 percentage point, and this positive effect remains until the eighteenth month after the shock.

Finally, the bottom right panel of figure 7 shows the response of the cyclical component of GDP to a 5-percentage-point increase in inflation acceleration. A clearly negative response is observed, which is significant at the 10 percent level. At its peak, this response reaches almost 1 percentage point, and it stays negative

36. On this matter see Zahler (1994). The international academic literature generally uses the term "gap model" to describe the empirical inflation models that emphasize the existence of this effect. One example is Coe and McDermott (1997). The existence of this effect supports the use of the GDP's cyclical component as one of the elements in the central bank's reaction function.

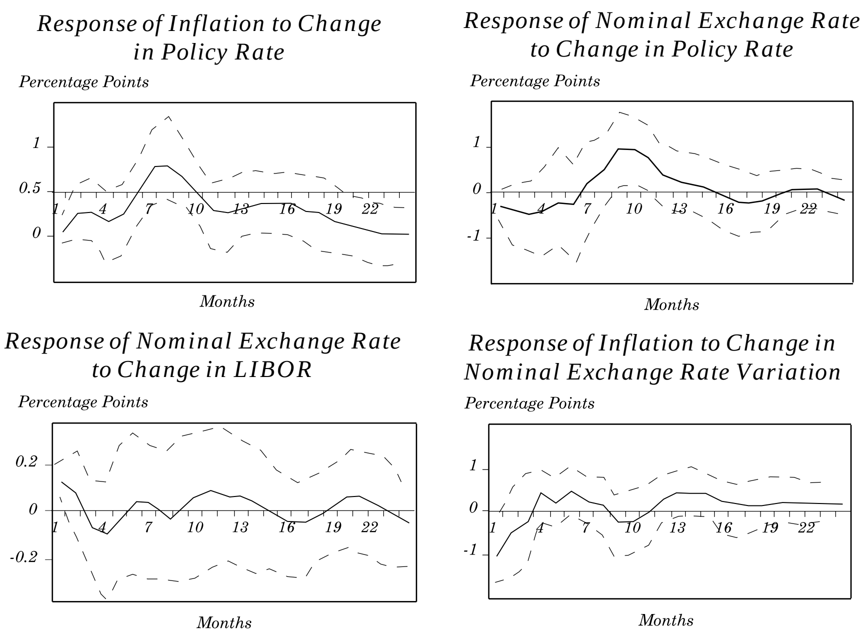
during the first twenty-four months following the shock. This evidence runs counter to the hypothesis implicit in the so-called Lucas supply model, according to which innovations in the inflation rate will have a positive effect on aggregate output.

The Interest Rate Parity Model. The results for this model must be interpreted carefully. Lack of sufficient information made it impossible to include in the estimated model either a country risk premium or an adjustment for foreign credit reserves held less than one year. Therefore a model specification problem may have arisen because of omitted variables, which could alter the results.

Table 2 again describes the main characteristics of the model. The top left panel of figure 8 shows the response of inflation to an increase of 50 basis points in the policy interest rate. Again there is strong evidence of a “price puzzle,” since the estimated response is positive and highly significant.

The top right panel of figure 8 shows the response of the nominal exchange rate to a 50-basis-point increase in the policy interest rate.

Figure 8. Impulse Response Functions for the Interest Rate Parity Model



Source: Authors’ calculations.

Although, as predicted by the interest rate arbitrage hypothesis, the initial response of the exchange rate is negative, it is far from significant. By the seventh month after the shock, moreover, a significant positive response of the exchange rate is detected, which parallels the behavior of the inflation response. This reveals that some degree of nominal exchange rate indexation exists.

Similarly, the bottom left panel of figure 8 shows the response of the nominal exchange rate to an increase of 50 basis points in the London interbank offered rate (LIBOR). In this case some slight evidence in favor of the interest rate arbitrage hypothesis is detected, since in the month of the shock itself there is a positive, significant response. Afterward, however, the response fluctuates around zero and is far from significant.

Finally, the bottom right panel of figure 8 shows the response of the rate of inflation to a positive 5-percentage-point shock in the rate of variation of the nominal exchange rate. A positive, marginally significant response is seen after three months. This reveals that exchange rate fluctuations have affected the path of inflation over the period under study.

3.4 Lessons for the Effectiveness of Monetary Policy

The results just presented lead to a number of conclusions with respect to the effects of monetary policy on several macroeconomic variables. Here we will focus on the effects on four such variables: inflation, output, spending, and the real exchange rate.

Monetary Policy and Inflation. The results associated with the Australian model indicate that a positive innovation of 50 basis points in the monetary policy interest rate will provoke a negative deviation of the CPI for nontradable goods from its trend. The magnitude of this deviation is around 0.4 percentage point after one year and 0.6 percentage point after two years. These results are similar to those obtained by Rosende and Herrera (1991). They estimate that an increase of 120 basis points in the interest rate on bank deposits provokes a global price-level deviation from its trend in the range of 0.43 to 0.75 percentage point, with an estimated duration of roughly six quarters.[37] Our results also seem generally consistent with those of Eyzaguirre and Rojas (1996), who estimate that a 100-basis-point increase in the interest rate on bank credit will reduce inflation of nontradables by 0.3 percentage point after one year, and by 1 percentage point after one year and a half.[38]

In contrast, the papers by Valdés (1997) and Mendoza and Fernández (1994) find a positive response of inflation to a shock of the same sign in the interest rate. Mendoza and Fernández point out that, although there appears to be no systematic effect of the interest rate on inflation, sharp increases in that rate (such as that observed in Chile between 1988 and 1992) have a negative effect on inflation with a nine-month lag. On the other hand, Valdés finds a negative effect of the interest rate on the difference between actual and targeted inflation. However, in our opinion the procedure Valdés used is inadequate, because the reported result implies that an increase in the interest rate would provoke an increase in the targeted rate of inflation, which makes no economic sense. (Moreover, this increase would be larger than that observed in actual inflation, in such a way as to reduce the differential.) Another problem is Valdés' use of inflation projections by a local consulting firm as a proxy for target inflation, which is very questionable. Therefore we reconstructed the inflationary differential using the targets reported by the central bank itself from 1991 on (see Magendzo, 1997) and incorporated it into different VAR systems; we found no systematic effect of the interest rate on this variable.

A "price puzzle" emerges in many of the models estimated in this paper. However, a global evaluation of our results suggests that, as stated by Leeper, Sims, and Zha (1996), this puzzle may

37. Considering that the magnitude of the shock used in our estimate is only about four-tenths that of Rosende and Herrera's shock, and that the share of nontradables in the overall CPI is 50 percent, it can be concluded that the responses calculated in both studies are very similar in size. However, this conclusion holds only if the CPI for tradables is independent from that for nontradables, a condition that is not met in the presence of any degree of exchange rate indexation.

38. In both Rosende and Herrera (1991) and Eyzaguirre and Rojas (1996), the shock analyzed does not originate from the true monetary policy instrument; hence interpreting these shocks as monetary is dubious.

be the result of wrong identification assumptions and of specification problems in the VAR system.[39]

Monetary Policy and Economic Activity. As for the monetary policy effects on activity indicators, our results show very weak negative responses of aggregate spending, GDP, and the cyclical component of GDP to positive shocks in the interest rate used as a monetary policy instrument. Only in the case of the gap between the growth rates of spending and output is a stronger negative response detected. That response lasts 13 months and reaches a maximum (around month 8) of somewhere between 1 and 2 percentage points, in response to an increase of 50 basis points in the policy interest rate.

On the other hand, our results show significant positive responses of both GDP and aggregate spending to positive innovations in the nominal money supply. In the case of aggregate spending, the response is observed between the fourth and the thirteenth month after a shock of 5 percentage points to M1A and reaches a magnitude of 0.5 to 1 percentage point.

Rosende and Herrera (1991) find a positive effect of nominal money on the deviation of GDP from its trend. According to their estimates, a 3.2-percentage-point increase in the money supply will generate a positive deviation of GDP ranging between 0.36 and 0.89 percentage points over four quarters. Similarly, they find that an increase of 120 basis points in the interest rate on price-level-adjustable one-year bank deposits reduces the deviation in output by an estimated 0.97 to 1.25 percentage points after four quarters, an effect that fades out in the seventh quarter after the shock.[40] More consistent with our results on this matter, Mendoza and Fernández (1994) find no systematic effect of the interest rate on one-year bank credits on the gap between actual and potential GDP, but they do observe Granger causality from M1A to this gap.

39. When identifying assumptions consistent with our results are used, a substantial mitigation of the anomalous response of inflation appears in comparison with the VAR systems with the traditional recursive identification (nonstructural VAR). In addition, our results show that the strength of the "price puzzle" varies inversely with the estimated model's global adjustment.

40. Unfortunately, Rosende and Herrera do not report the significance bands associated with the impulse response functions, so it is not possible to determine whether or not these effects are statistically significant.

Along the line of Rosende and Herrera's results, Eyzaguirre and Rojas (1996) find that an increase of 100 basis points in the interest rate on one-year bank credits reduces the growth rate of aggregate spending by an estimated 1 percentage point in the short run. This effect reaches an estimated 1.5 percentage points after five to six quarters.

Finally, Valdés (1997) also finds a negative effect of the interest rate on ninety-day central bank obligations on the growth rate of output (specifically, on an approximation of IMACEC, a monthly indicator of economic activity). Such an effect is observed for an estimated four to fifteen months after the shock and amounts to about 0.5 percentage point following an increase of 30 basis points in the interest rate.

A global evaluation of these results leads to the conclusion that the estimated response of spending and aggregate production to shocks in the interest rate appears to be strongly influenced by the VAR system specification used. In contrast, the effects of monetary innovations appear to be more robust.

Monetary Policy and the Real Exchange Rate. The version of the Australian model reported here shows that a positive shock of 50 basis points in the monetary policy rate provokes a positive deviation of the real exchange rate from its trend. After a year this deviation amounts to 1 percentage point, and after two years it is near 2 percentage points.

The results reported by Eyzaguirre and Rojas (1996) tend to support our own. They find a positive effect of the interest rate on the real exchange rate and state that, after three quarters from the shock to the interest rate, it explains around an estimated 20 percent of the forecast error of the model with respect to the real exchange rate.[41] In contrast, Mendoza and Fernández (1994) and Valdés (1997) find no significant response of the real exchange rate to shocks in the interest rate.[42]

41. Unfortunately, these authors report no estimates of the magnitude of the real exchange rate response.

42. It must be noted that the real exchange rate definitions used by these authors differ from the one used here, which is the same as that used by Eyzaguirre and Rojas. Rosende and Herrera (1991) report no results on the effect of monetary policy on the real exchange rate.

4. Conclusions

The most robust results of our research are those on the central bank's reaction function. Here the evidence shows that, during the period analyzed, the monetary authorities responded systematically to signs of "overheating" (a discrepancy between actual and potential GDP, or a spending-output gap),[43] and to direct inflation indicators (nominal wages and the CPI), by increasing the interest rate used as an instrument.

Paradoxically, the results yield weak evidence in favor of hypotheses whereby spending and output respond negatively to the monetary policy instrument. Here the greatest response is found for the spending-output gap. However, spending and output do seem to respond systematically to shocks to the nominal money supply. An obvious question arises about the possible convenience of redefining the variable used as the monetary policy instrument.

Still more paradoxical is the evidence showing that, in the large majority of the models estimated, inflation responds positively to an increase in the monetary policy rate (the "price puzzle"). However, regarding the results offered by traditional VAR systems, the use of "structural" identification assumptions allows this anomaly to be reduced substantially, making it insignificant in most cases. Also, within the context of the Australian model, a response that has the expected negative sign and is significant is detected. One can therefore speculate that the "price puzzle" phenomenon is associated not only with the wrong selection of identification assumptions, but also with specification problems in the VAR system. The anomalous result is observed with greater strength in those models that tend to be rejected by the data in general terms.

As for the theoretical transmission mechanisms, the one that gets the most support is that associated with the Australian model, in that the results show a (weak) negative effect of the monetary policy rate on the spending-output gap.[44] Also, a negative effect of

43. Although this report of our analyses shows only the results obtained regarding the response of the monetary instrument to innovations in the cyclical component of GDP, the impulse response functions obtained with the Australian model give evidence of a positive and significant response to shocks to the spending-output gap.

44. However, from a strict econometric point of view, the correct way to compare the estimated models is to use nested tests. Unfortunately, this could not be done because of lack of data.

monetary policy on the price level of nontradables and a positive effect on the level of the real exchange rate are detected. Finally, the evidence shows a negative effect of the spending-output gap on the real exchange rate (both its level and its rate of acceleration).

Monetary models, in contrast, get mixed support under both the credit approach and the asset price approach. Consistent with the models' predictions, the empirical evidence shows that the monetary policy rate has a negative effect on M1A, on financial system credit in real terms, and on stock prices (real IGPA). However, the evidence also shows that the positive relationships between monetary shocks (M1A), real financial system credit, and stock prices are weak.

Also consistent with the monetarist hypotheses, most of the models estimated show a strong positive effect of a shock in nominal money balances on aggregate spending. Moreover, the results obtained consistently show positive effects on aggregate spending associated with shocks to both financial system credit and stock prices.

Nevertheless, the monetarist view does not receive full support for its predictions, because the evidence provides weak support of the presumption of a negative effect of the monetary policy rate on aggregate spending. Also, the results show the existence of a "price puzzle," although the anomalous response is insignificant more often than not.

The evidence reported here is adverse for the Phillips curve hypothesis. The results do not allow one to propose that a "Lucas supply" phenomenon exists, since innovations in inflationary acceleration provoke a clearly negative effect on the cyclical component of GDP. Nor is a significant effect of shocks to the monetary policy instrument detected in the cyclical component of GDP. In addition, the same evidence shows the presence of a "price puzzle," but as in most of the other cases where this result appears, it is not statistically significant.

However, the evidence on the model that we call the Phillips curve model does show a strong positive effect on the acceleration of core inflation resulting from a shock to the cyclical component of GDP. This is the primary prediction arising from the empirical inflation models based on the "overheating" hypothesis (the gap model), which for many is another version of the Phillips curve.[45]

45. See Coe and McDermott (1997).

The hypothesis that gets the least empirical support from the models estimated is the interest rate parity hypothesis.[46] The results show that the sign of the nominal exchange rate's response to shocks to the domestic interest rate is the opposite of the expected one. In addition, its response to shocks to the foreign interest rate is very weak. Finally, in the estimated versions of this model the presence of the "price puzzle" is strong.

Finally, the above comparison of the models indicates that there is no presumption that the transmission mechanisms analyzed are intrinsically incompatible with each other. Indeed, theory shows that, in general, they can appear simultaneously. Rather the true purpose of our comparison has been to determine which of the theoretical transmission channels have manifested themselves with the greatest strength over a specific period of Chile's economic history.

46. As mentioned above, this may be due to specification problems in the model because of the limited data available.

APPENDIX A

Essential Features of Monetary Policy according to Selected Authors

Author(s)	*Instrument*	*Intermediate objective*	*Goal*	*Transmission mechanism*
R. Valdés (1997)	90-day PRBC interest rate (1985 to April 1995); interbank rate (from May 1995 on)	Gap between growth rates of actual and potential output	Current account (1985-89); inflation (from 1989 on)	Not disclosed
Mendoza and Fernández (1994)	90-day PRBC interest rate	M1A growth rate; gap between actual and potential output (trend)	Inflation	PRBC rate affects market rates and M1A growth rate. This affects the spending-output gap, thereby determining inflation. The authors propose as an alternative mechanism one whereby unexpected inflation affects output trend deviations and inflation
Eyzaguirre and Rojas (1996)	90-day PRBC interest rate (1985 to April 1995); interbank rate (from May 1995 on)	Spending expansion rate	Current account deficit no greater than 3 to 4 percent of GDP; gradual reduction of inflation	PRBC rate affects market credit rates, which influence the expansion of aggregate spending. This ultimately affects price and wage inflation
Budnevich and Pérez (1995)	90-day PRBC interest rate (1985 to April 1995); interbank rate (from May 1995 on)	Spending-potential output gap	In the 1980s, real exchange rate; in the 1990s, real exchange rate, current account deficit no greater than 3 to 4 percent of GDP, and inflation	Market rates are closely linked to central bank's short rate. Market rates affect spending and thereby affect the inflation rate
Magendzo (1997)	90-day PRBC interest rate (1985 to April 1995); interbank rate (from May 1995 on)	Spending-output gap	"High" real exchange rate and current account (1985-89); medium- and long-term equilibrium of real exchange rate (1990s); inflation; current account deficit no larger than 3 to 4 percent of GDP	The rate has informational properties and affects the spending-output gap, which determines the inflationary trend
Zahler (1994)	90-day PRBC interest rate.	Actual output-potential output gap; gap between growth rates of spending and potential output.	Inflation; medium- and long-term current account deficit no larger than 3 to4 percent of GDP.	Interest rate affects spending growth, which in turn affects inflation.

Appendix B

Empirical Results of Selected Studies of Monetary Policy in Chile

Author	Effect of monetary policy: On inflation	On economic activity	On the real exchange rate	Methodology
Rosende and Herrera (1991)	A 120-basis-point increase in the interest rate has a negative effect on price-level deviation from trend in the range of 0.43 to 0.75 percentage point and lasts around six quarters After four quarters, 45 percent of the variance in price-level deviations is attributable to shocks on real exchange rate, and 12 percent to shocks to the interest rate. Money explains a mere 0.64 percent of variance	A 120-basis-point increase in the interest rate reduces the deviation of output from its trend by 0.97 to 1.25 percentage points after four quarters. This effect is transitory, lasting roughly six quarters A positive 3.2-percentage-point shock to the money supply increases the deviation of output from its trend by an estimated 0.36 to 0.89 percentage point over four quarters. After four quarters, shocks to money explain an estimated 22 percent of the variance of GDP, whereas shocks to the interest rate explain 14 percent. In the medium run (eight to sixteen quarters) the real exchange rate explains nearly 43 percent of output variance	No results from the VAR relating to the effects of monetary variables on the real exchange rate are reported.	The 90- to 365-day inflation-adjustable deposit rate is used as a proxy for the monetary policy instrument Quarterly data are used for the period from 1978 Q1 to 1990 Q2 A VAR system is estimated that includes the exchange rate, interest rate, the real exchange rate (central bank), CPI, M1A, GDP Variable deviations from the trend are used (Kydland and Prescott's filter)
Mendoza and Fernández (1994)	The interest rate has no Granger causality on the inflation rate for twelve months M1A has no Granger causality on inflation, but inflation does cause M1A. Weak evidence exists that the gap between actual and potential output has a Granger causality on inflation	The interest rate has no Granger causality on the output gap The M1A's twelve-month growth rate has Granger causality on the output gap, but not vice versa Unexpected inflation has Granger causality on the output gap (impulse response analyses show that the relationship is negative) No systematic effect is found of the UF interest rate on the output gap Only sharp interest rate increases (1988-92) induce an output gap reduction, with a lag of nine months	No systematic responses to shocks in the UF interest rate or to the growth-rate of M1A are reported.	The 90- to 365-day inflation-adjustable deposit rate is used as a proxy for the monetary policy instrument Quarterly data are used for the period from January 1986 to March 1994 Granger causality test: interest rate-intermediate objectives (money, output gap); intermediate objectives- inflation; interest rate- inflation. VAR: interest rate;

APPENDIX B (continued)

Author	Effect of monetary policy: On inflation	On economic activity	On the real exchange rate	Methodology
Mendoza and Fernández (1994) (continued)	No systematic effect is found on inflation from an increased interest rate (in fact, the VAR shows an initial positive response) Only sharp interest rate increases (1988-92) induce a drop in inflation, with a nine-month lag			twelve-month variation rate of M1A; actual seasonally adjusted output gap-trend; twelve-month inflation rate; real exchange rate; terms of trade (exogenous variable)
Eyzaguirre and Rojas (1996)	A 1-percentage-point increase in the spending-output gap increases nontradables inflation by 0.25 percentage point during the two to three months following the shock. This effect amounts to an estimated 0.5 to 0.6 percentage point after five to six quarters A 100-basis-point increase in the credit interest rate reduces nontradables inflation by 0.3 percentage point after one year, accumulating a 1-percentage-point reduction after eighteen months from the shock Innovations in the spending-output gap explain an estimated	An increase of 100 basis points in the credit rate is expected to reduce the growth rate of spending by 1 percentage point in the short run. This effect increases to 1.5 percentage points after five to six quarters. Innovations in the credit rate explain 25 percent of variance in spending, and the greatest impact occurs after the third quarter	After three quarters, innovations in productivity, the credit rate, and the spending-output gap explain 20 to 24 percent each of the variance of the real exchange rate. In contrast, the differential between domestic and foreign rates explains no significant fraction of the variance	The 30- to 90-day inflation-adjustable deposit rate is used as a proxy for the monetary policy instrument Quarterly data from 1998 Q1 to 1995 Q4 Simple correlation analysis between the 90-day PRBC rate, the 30- to 365-day bank credit rate, and a hybrid foreign interest rate (looking for association) Decomposition of the variance of the 90-day PRBC rate, the 90- to 365-day bank credit rate, and a hybrid foreign interest rate (looking for causality) OLS regression of first difference of spending against own lags and disposable income, the credit rate, and the foreign rate. Variance analysis of spending forecast error OLS regression of nontradables inflation against own lags and lags of the

APPENDIX B (continued)

	Effect of monetary policy			
Author	*On inflation*	*On economic activity*	*On the real exchange rate*	*Methodology*
Eyzaguirre and Rojas (1996) (continuation)	50 percent of variance in nontradables inflation after four quarters			spending-output gap, wages, the exchange rate, and tradables inflation; variance analysis of nontradables inflation forecast errors OLS regression of real exchange rate against mean productivity lags, the credit rate, the domestic-foreign rate differential, and the spending-output gap; variance analysis of the real exchange rate forecast error
R. Valdés (1997)	The monetary policy rate has a reported negative transitory effect (between months 6 and 12) on the gap between core and target inflation. A 30-basis-point rise in the rate reduces the gap by 0.4 percentage point after nine months Insignificant positive effect on the level of core inflation.	Transitory negative effect (between months 4 and 15) on the growth rate of the IMACEC. A 30-basis-point increase in the interest rate reduces the IMACEC's growth rate by 0.5 percentage points (maximum effect after seven months) Transitory negative effect (between months 7 and 18) on spending-output gap.	No significant effect	Monthly data: January 1985 to August 1996 The 90-day PRBC rate and the interbank rate are used as a proxy for the monetary policy instrument "Semistructural" VARs: interest rate; core-target inflation gap; IMACEC twelve-month variation rate; real exchange rate twelve-month variation rate; M1A twelve-month variation rate; spending's twelve-month variation rate.

Appendix C

Variable Nomenclature and Description

BRECHA	Difference between the twelve-month percentage variation of spending and output (from the Central Bank of Chile)
CICLO	Difference between the logarithms of seasonally adjusted GDP and potential GDP
DTASABC	First difference of ninety-day PRBC
DTBE	First difference of eight-year PRC
DV12IPCSUB	First difference of the twelve-month percentage variation in the IPCSUB
DV12TCN	First difference of the twelve-month percentage variation in the TCN
DV12IPCNT	First difference of the V12IPCNT variable
DV12TCRINE	First difference of the V12TCRINE variable
LCOLOC	Logarithm of real actual credit of the financial system (from the Superintendency of Banks and Financial Institutions)
LDHAB	Logarithm of working days (authors' calculations)
LGASTO	Logarithm of aggregate spending in millions of 1986 pesos (from the Central Bank of Chile)
LIBOR	Ninety-day London interbank offered rate deflated by U.S. inflation (from the Central Bank of Chile)
LIGPA	Logarithm of the real general stock price index (IGPA)
LIPCNT	Logarithm of the nontradables price index (from the National Institute of Statistics)
LM1A	Logarithm of the money aggregate M1A (from the Central Bank of Chile)
LIPCSUB	Logarithm of the core price index (from the Pontifical Catholic University data base)
LPIB	Logarithm of GDP in millions of 1986 pesos (from the Central Bank of Chile)
LTCN	Logarithm of the nominal exchange rate (from the Central Bank of Chile)
LTCRINE	Logarithm of the real exchange rate, defined as the ratio of the price index for tradables to that for nontradables (from the National Institute of Statistics)
LTTUC	Logarithm of the terms of trade (from the Pontifical Catholic University data base)
TASABC	Ninety-day PRBC rate (from the Central Bank of Chile)

Appendix C (continued)

TBE	Eight-year PRC rate (from the Central Bank of Chile)
VTCREXPOST	Ninety-day ex post variation of the real exchange rate, defined as the ninety-day ex post variation of the TCN, plus the ninety-day variation of the U.S. CPI, less the ninety-day ex post variation of the Chilean CPI (“ex post” refers to the variables being advanced by one quarter)
V3IPC	Ninety-day percentage variation in the CPI
V3TCN	Ninety-day percentage variation in the TCN
V12COLOC	Twelve-month variation in actual credit in real terms
V12DHAB	Twelve-month variation in working days
V12GASTO	Twelve-month variation in spending
V12IGPA	Twelve-month variation in the real IGPA
V12IPCNT	Twelve-month percentage variation in the nontradables CPI
V12IPCSUB	Twelve-month variation in the core CPI
V12M1A	Twelve-month variation in the money aggregate M1A
V12PIB	Twelve-month variation in GDP
V12TCN	Twelve-month variation in the nominal exchange rate
V12TCRINE	Twelve-month variation in the real exchange rate
V12WUC	Twelve-month variation in nominal wages (from the National Institute of Statistics)

References

Bernanke, B., and A. Blinder. 1992. "The Federal Funds Rate and the Channels of Monetary Transmission." *American Economic Review* 82(4): 901-21.

Bernanke, B., and M. Gertler. 1995. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission." J*ournal of Economic Perspectives* 8(4):27-48.

Bernanke, B., and A. Mihov. 1998. "Measuring Monetary Policy." *Quarterly Journal of Economics* 113 (3): 869-902.

Bernanke, B., and F. Mishkin. 1992. "Central Bank Behavior and the Strategy of Monetary Policy: Observations from Six Industrialized Countries." In *NBER Macroeconomics Annual*, edited by O. Blanchard and S. Fischer. Cambridge, Mass.: MIT Press.

Budnevich, C., and J. Pérez. 1995. "Política Monetaria: La Reciente Experiencia Chilena." *Estudios Públicos* (Winter): 283-322.

Calvo, G., and E. Mendoza. 1997. "Empirical Puzzles of Chilean Stabilization Policy." Paper prepared for the conference on Chile: Development Lessons and Challenges, organized by the Development Institute of the World Bank, Washington, December 17-18.

Cochrane, J. 1998. "What do the VARs Mean? Measuring the Output Effects of Monetary Policy." *Journal of Monetary Economics* 41 (2): 277-300.

Coe, D., and C. McDermott. 1997. "Does the Gap Model Work in Asia?" *International Monetary Fund Staff Papers* 44(1): 59-80.

Doan, T. 1992. RATS *User's Manual*. Evanston, Ill.: Estima.

Dornbusch, R. 1980. *Open Economy Macroeconomics*. New York: Basic Books.

Edison, H. 1993. "The Effectiveness of Central Bank Intervention: A Survey of the Literature after 1982." Special Papers in International Economics18. Princeton, N.J.: Princeton University (July).

Edwards, S., and C. Végh. 1997. "Banks and Macroeconomic Disturbances under Predetermined Exchange Rates." NBER Working Paper 5977. Cambridge, Mass.: National Bureau of Economic Research.

Eyzaguirre, N., and P. Rojas. 1996. "Restricciones al Flujo de Capitales y Política Macroeconómica: El Caso Chileno." Paper prepared for a conference on "El Retorno de los Capitales Privados a América Latina" (The Return of Private Capital to Latin America), Santiago, Chile, July 30-31.

Fontaine, J. A. 1991. "La Administración de la Política Monetaria en Chile, 1985-89." *Cuadernos de Economía* 28(83): 109-129.

Friedman, M. 1976. *Price Theory*. Chicago: Aldine.

Garretsen, H., and J. Swank. 1998. "The Transmission of Interest Rate Changes and the Role of Bank Balance Sheets: A VAR-Analysis for the Netherlands." *Journal of Macroeconomics* 20(2): 325-339.

Hamilton, D. 1994. *Time Series Analysis*. Princeton, N.J.: Princeton University Press.

International Monetary Fund. 1996. *World Economic Outlook*. Washington.

Kamin, S. 1996. "Real Exchange Rate and Inflation in Exchange Rate Based Stabilization: An Empirical Examination." International Finance Discussion Papers 554. Washington: Board of Governors of the Federal Reserve System (June).

Leeper, Eric, C. Sims, and T. Zha (1996): "What Does Monetary Policy Do?" *Brookings Papers on Economic Activity* 2: 1-78.

Lucas, R. 1996. "Nobel Lecture: Monetary Neutrality." J*ournal of Political Economy* 104(4): 661-82.

Magendzo, I. 1997. La Política Monetaria en Chile en la Década de los Noventa: Objetivos, Herramientas e Indicadores. Serie Estudios Económicos 41. Santiago: Banco Central de Chile

Massad, C. 1998. "La Política Monetaria en Chile." *Economía Chilena* 1 (1): 7-28.

Masson, P., M. Savastano, and S. Sharma. 1997. "The Scope for Inflation Targeting in Developing Countries." IMF Working Paper 130. Washington: International Monetary Fund.

Mendoza, E., and F. Fernández. 1994. "Monetary Transmission and Financial Indexation: Evidence from the Chilean Economy." IMF Paper on Policy Analysis and Assessment. Washington: International Monetary Fund.

Mishkin, F. 1995. "Symposium on the Monetary Transmission Mechanism." *Journal of Economic Perspectives* 9(4): 3-10.

Rojas, P. 1993. "El Dinero como un Objetivo Intermedio de Política Monetaria en Chile: Un Análisis Empírico." *Cuadernos de Economía* 30 (90): 139-78.

Rosende, F. 1998. "Política Monetaria en Chile en los Noventa: Un Ejercicio "no Neutral." *Perspectivas en Política, Económa y Gestión*. 2 (1): 157-185.

Rosende, F., and L. Herrera. 1991. "Teoría y Política Monetaria: Elementos Para el Análisis." *Cuadernos de Economía* 28 (83): 55-93.

Sims, C. 1980. "Macroeconomics and Reality." *Econometrica* 48(1): 1-48.

Taylor, J. 1993. *Macroeconomic Policy in the World Economy: From Econometric Design to Practical Operation*. New York: W. W. Norton.

Valdés, R. 1997. "Efectos de la Política Monetaria en Chile." *Cuadernos de Economía* 35 (104): 97-125.

Valdés, S., and M. Soto. 1998. "The Effectiveness of Capital Controls: Theory and Evidence from Chile." *Empirica* 25(2): 133-164.

Vergara, R. 1994. "Política Cambiaria en Chile: La Experiencia de una Década (1984-1994)." Estudios Públicos 56: 133-164.

Zahler, R. 1994. Speech at a meeting of the Asociación de Industrias Metalúrgicas, Santiago (July).

————. 1997. "La Política Macroeconómica de Chile en los Años Noventa: La Visión del Banco Central." Unpublished manuscript Santiago: Comisión Económica para América Latina y el Caribe.