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Chile: Selected Issues

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CHILE

Selected Issues

Prepared by S. Lizondo (Head), M. Kaufman,
F. Nadal De-Simone, S. Phillips (all WHD)
and J. Zettelmeyer (RES)

Approved by the Western Hemisphere Department

June 21, 2000

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Chile: Basic Data

I. Social and Demographic Indicators

Area (thousand sq. km.)	756.1	GDP (1999)	Ch$ 34,321 billion US$ 67.4 billion
Population		GDP per capita (US$), 1999	4,490
Total 1999 (est., million)	15.02		
Urban population (in percent of total)	85.4	Health	
Density (per sq. km)	19.9	Population per physician (1998)	840
Annual rate of growth, 1996-99 (percent per year)	1.5	Population per hospital bed (1997)	472
Population characteristics (1997)			
Life expectancy at birth (years)	75.2	Access to electricity (1996)	
Crude birth rate (per thousand)	18.7	Percent of dwellings	
Crude death rate (per thousand)	5.4	Urban	99.4
Infant mortality rate (per thousand live births)	10.0	Rural	74.8
Mortality rate between ages 1 and 4 (per thousand)	0.5		
		Access to safe water	
Income distribution (1998)		Percent of population (1995)	91
Percent of total income received:		Urban	99
By richest 10 percent of households	41.0	Rural	47
By poorest 20 percent of households	4.1		
Gini coefficient	0.57	Education	
		Adult literacy rate (1995)	95.37
Distribution of labor force, in percent of total (1998)		Gross enrollment rates, in percent (1997)	
Agriculture and fishing	14.4	Primary education	101.3
Mining	1.5	Secondary education	74.9
Industry	15.8	Tertiary education	31.0
Construction	8.3		
Services and Trade	60.0		

II. Economic Indicators, 1996-1999

	1996	1997	1998	1999
	(In percent of GDP)			
Origin of GDP				
Agriculture, forestry, and fishing	7.9	7.3	7.3	7.3
Mining and quarrying	8.4	8.4	8.5	10.0
Manufacturing	15.6	15.3	14.6	14.7
Construction	5.3	5.3	5.1	4.7
Commerce	17.0	17.3	17.6	17.1
Transport, storage, communications	7.8	8.2	8.8	9.2
Other	38.0	38.1	38.1	37.0
	(Annual percent changes, unless otherwise indicated)			
National accounts and prices				
Real GDP	7.4	7.4	3.4	-1.1
Real GDP per capita	5.9	5.9	2.0	-2.4
GDP deflator	1.7	4.0	2.7	3.6
Consumer price index (period average)	7.4	6.1	5.1	3.3
Consumer price index (end of period)	6.6	6.0	4.7	2.3
Unemployment rate (in percent)	6.5	6.1	6.2	9.7
	(Ratios to GDP)			
Gross domestic investment	26.9	27.2	26.5	21.1
Of which: public investment	6.1	5.8	5.8	5.2
Gross national savings	21.8	22.3	20.8	21.0
External savings	5.1	5.0	5.7	0.1
Private consumption	65.0	65.0	66.6	65.2
Public consumption	10.3	10.5	11.1	11.8

Chile: Basic Data (Continued)

	1996	1997	1998	1999
Public finances				
Central government				
Total revenues	24.2	23.9	23.0	22.1
Total expenditures	21.6	21.8	23.1	24.4
Of which: interest	0.6	0.5	0.7	0.4
Savings	6.1	5.7	3.7	1.8
Primary balance	2.0	1.6	-0.8	-2.7
Overall balance	2.6	2.1	-0.1	-2.4
Consolidated public sector 1/				
Primary balance	2.0	0.4	-1.6	-3.2
Overall balance	1.4	-0.1	-2.3	-3.6
(12-month percentage changes, unless otherwise indicated)				
Money and credit				
Liabilities to private sector	16.9	16.3	9.7	15.7
Of which:				
Narrow Money (M1A)	10.5	16.6	-5.5	22.6
Quasi-money	26.2	11.9	13.1	0.3
Net domestic assets of financial system 2/	7.9	6.9	12.5	3.9
Of which:				
Credit to nonfinancial public sector (net)	-0.2	-2.0	2.1	2.6
Credit to private sector	12.6	11.7	4.1	2.0
Liabilities to the private sector, in percent of GDP	89.3	93.0	96.3	109.2
Three-month inflation-indexed interest rate (in percent)	7.3	6.8	9.6	6.0
(In billions of U.S. dollars, unless otherwise indicated)				
Balance of payments				
Current account	-3.5	-3.7	-4.1	-0.1
Merchandise trade balance	-1.1	-1.6	-2.5	1.7
Exports (f.o.b.)	15.4	16.7	14.8	15.6
Imports (f.o.b.)	-16.5	-18.2	-17.3	-14.0
Services and transfers (net)	0.2	0.6	0.3	0.1
Of which: interest	1.3	1.4	1.5	1.5
Capital and financial account	5.3	7.4	3.3	-0.8
Foreign direct investment	3.5	3.4	2.2	4.4
Portfolio investment	1.1	2.4	-0.8	0.1
Other capital (net)	0.7	1.6	1.9	-5.3
Errors and omissions	-0.7	-0.4	-1.2	0.2
Overall balance	1.2	3.2	-2.1	-0.7
Exports (in percent of GDP)	28.7	28.1	26.9	29.1
Imports (in percent of GDP)	30.9	30.9	31.0	27.3
Current account (in percent of GDP)	-5.1	-5.0	-5.7	-0.1
Merchandise exports (in US$, annual percentage change)	-3.9	8.2	-11.0	5.3
Merchandise imports (in US$, annual percentage change)	12.7	10.5	-4.8	-19.6
Terms of trade (annual percentage change)	-15.5	2.6	-12.6	0.9
Real effective exchange rate (12-month perc. change)	3.9	9.6	-6.1	-5.1
International reserve position and external debt (as of December 31)				
Gross official reserves	15.5	17.8	16.0	14.7
(in months of imports of goods)	11.3	11.8	11.1	12.7
Net official reserves	15.5	17.8	16.0	14.7
Net reserves of the banking system	-1.8	0.4	0.9	3.9
Outstanding external debt, in percent of GDP 3/	33.5	35.6	43.6	50.4
Public	7.5	6.8	7.9	8.6
Private	26.0	28.8	35.7	41.8

Chile: Basic Data (Concluded)

	1996	1997	1998	1999
Total debt service ratio (in percent of exports)	31.9	20.8	20.6	25.2
Of which: interest	7.0	6.8	8.0	7.8
Gross reserves/short-term debt (in percent) 3/	347.6	496.4	403.7	376.9
IMF data (as of March 31, 2000)				
Membership status:				Article VIII
Quota				SDR 856.1 million
Fund holdings of Chilean pesos (as percent of quota)				SDR 565.1 million
Outstanding purchases and loans				None
SDR Department				
Net cumulative allocation				SDR 121.9 million
Holdings				SDR 14.9 million

Sources: Chilean authorities; World Bank, IMF, and Fund staff estimates.

1/ Includes central bank losses.
2/ Changes as percent of liabilities to the private sector at the beginning of the period. Flows based on end-of-period exchange rates.
3/ Excludes short-term trade credit.

I. Overview

1. This paper presents, in Chapters II–V, four studies on selected issues of the Chilean economy. The first two studies address matters relevant to the implementation of monetary policy, motivated in part by Chile's recent adoption of an enhanced framework for inflation targeting. Chapter IV considers the degree of external vulnerability of the Chilean economy, drawing heavily on international evidence. Chapter V turns to fiscal policy, examining whether tax rates set to vary with the business cycle could improve an economy's welfare. Finally, this paper also includes a statistical appendix, and three annexes summarizing certain aspects of Chile's economic policy regime.

2. Forecasting inflation is an essential element of any inflation targeting regime, and Chile's central bank uses a variety of models for this purpose. The chapter "**Forecasting Inflation in Chile Using State-Space Models**" provides an additional forecasting framework, one which is particularly useful for studying relationships that might change significantly over time. This framework not only generates its own inflation forecast but also provides estimates of "unobserved" variables, such as the output gap, that could be fed into other forecasting models, including those currently employed by the Chilean authorities.

3. This chapter presents two models of Chilean inflation which are estimated and used to generate out-of-sample forecasts. The first model is based on a Phillips curve with time-varying parameters; the second one is a reduced form model of a small open economy. The forecasts from these models are compared with those of simple benchmark (Box-Jenkins) models. The main findings: (i) including the pre-announced official inflation target as an explanatory variable improves the forecast performance of the models; (ii) the out-of-sample forecasting performance of the time-varying Phillips curve model is better than that of the small open economy model; and (iii) although the simple Box-Jenkins models tend to do better than the other two models for very short-term forecasts, their superiority deteriorates rapidly in longer forecasts. The paper cautions, however, that these results were obtained on the basis of estimations over the 1990s, a period of declining inflation. The relative merits of these models may change as Chile enters into a period of stable low inflation.

4. The chapter "**The Impact of Monetary Policy on the Exchange Rate: International Evidence with Relevance for Chile**" argues that the floating of the peso and the adoption of an enhanced inflation targeting framework has increased the importance of understanding the effect of monetary policy on the exchange rate. Since the floating exchange rate is now part of the regular monetary transmission mechanism, the authorities need a sense of how the exchange rate reacts to monetary policy actions in order to assess their impact on the final target (inflation). Moreover, the authorities may wish to avoid violent swings in the exchange rate to limit the risks to the financial system: thus, it is relevant to ask whether interest rate defenses of the exchange rate have been successful in other floating rate regimes, in the sense of either mitigating or reversing the effects of an attack. As the Chilean experience with exchange rate floating is very recent, the paper analyzes monetary policy events in Australia, Canada, and New Zealand, three countries with inflation targeting. Focusing on short-term responses to these events, the methodology circumvents the usual problems of policy endogeneity.

5. Findings from these three countries are similar; on average, a monetary policy shock that moves the three-month interest rate by 1 percentage point will move the exchange rate by 2–3 percent in the direction traditionally predicted—appreciating after contractions, and depreciating after expansions. Moreover, interest rate defenses in times of turbulence are generally successful: in all cases in which the intraday reaction of the exchange rate could be clearly established, the currency appreciated after a contraction following a speculative attack. However, the appreciation was often not enough to reverse the original attack.

6. The chapter "**Assessing External Vulnerability: The Case of Chile**" is motivated by recent experiences of crises in other fast-growing emerging markets and by the substantial new research and development of data standards of the last few years. The study compares Chile with other high-rated emerging markets and with certain advanced economies, for a wide range of liquidity and solvency indicators. It also documents differences across countries in the response of several market-based indicators to the 1998 ("Russia") crisis. In addition to the cross-country comparisons, Chile's position is discussed in terms of various qualitative factors and the adequacy of the data available for vulnerability assessment.

7. On the basis of those comparisons, Chile's external position appears stronger than most other high-rated emerging markets, and not far behind that of the higher-income countries, on average. Chile was not immune to the Russia crisis, but in some ways its response looked more like a higher-income country than a emerging market. Among Chile's strengths are the level of international reserves in relation to short-term debt, banking system soundness, and a low level of public sector debt. The size of the private sector's external debt is a potential issue, though this needs to be considered against its foreign assets; the latter are thought to be substantial, but further International Investment Position data would be helpful.

8. The possibility of modifying tax rates systematically to alleviate the business cycle is a topic that has been present in academic and policy discussions in Chile in the last few years. The chapter "**Fiscal Policy Through Time-Varying Tax Rates**" uses a theoretical framework to examine whether tax rates set to vary with the business cycle could improve welfare; it also discusses whether such policy can effectively be implemented in practice. Two situations are presented in which time-varying taxes have the potential to improve welfare: "under-consumption," arising from credit constraints, and "over-consumption," arising from time-inconsistency in the way consumers allocate their consumption over time.

9. While, in principle, variable taxes could improve welfare in some cases, the paper highlights the very particular circumstances that need to prevail for such a result to follow. Under temporary negative shocks and liquidity constraints, a consumption-tax break is likely to be more effective than an income-tax break in boosting consumption and improving welfare; more importantly, the welfare effect ultimately depends on the degree of tax distortions relative to the burden of the credit constraints. Under time-consistency problems in the allocation of consumption, a hike in consumption taxes can be used to restrain consumption and improve welfare. The paper cautions, however, that in practice the use of variable tax rates would likely be subject to serious implementation problems.

II. Forecasting Inflation in Chile Using State-Space Models[1]

A. Introduction

10. The Central Bank of Chile (CBCH) currently uses a variety of models to forecast inflation. One is the *Quarterly Projection Model (Modelo Trimestral de Proyección)* in two versions. The first version comprises various modules, such as the aggregate demand module and the output gap module, with some forward-looking elements. The second version is more comprehensive as it includes a well-defined supply side sector, takes into account some stock-flows relationships, and has a more disaggregated aggregate demand. The CBCH is also developing a quarterly general equilibrium model, and a real business cycle model which stresses the effects of different shocks and relates the parameters of the model to actual time series behavior. The CBCH uses VARs, filters, and leading indicators as well, and is currently exploring the possibility of developing a calibrated model for inflation projections and policy analysis.

11. The main objective of this paper is to add to the CBCH's set of inflation-forecasting models the framework offered by state-space models. This framework is useful not only because it provides its own forecast inflation, but also because it offers a powerful method to estimate important unobserved economic variables that could be used in the inflation-forecasting models already employed by the CBCH. Therefore, the purpose of this paper is not to enter into a horse race with the inflation-forecasting models of the CBCH, and thus, it only briefly compares the out-of-sample forecasts obtained using state-space models with those generated by a simple Box-Jenkins univariate time series approach. Moreover, Granger (2000) suggests that whenever there are close model specifications—as it is arguably the case of some of the models used in the CBCH and in this research—it is optimal to find their outputs related to the purpose of the models, such as their forecasts, and pool their values.

12. State-space models are particularly useful for estimating relationships that might have been subject to important changes within the estimation period. In the last two decades, the Chilean economy has undergone significant structural changes that have affected the allocation of resources and its potential output growth. Those reforms have affected the output mix between tradables and nontradables, the allocation of consumption, the sources of financing of production and consumption activities, the legal framework for the allocation of leisure and work effort, and for the use of domestic and foreign capital. Similarly, the formulation and implementation of monetary policy has been changed as the country moved

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[1] Prepared by Francisco Nadal-De Simone. This research would have not been possible without the help of Chang-Jin Kim. I also thank Jim Hamilton for his insights. I am grateful to Pablo García, Martín Kaufman, Steven Phillips, Klaus Schmidt-Hebbel, Rodrigo Valdés, and Jerónimo Zettelmeyer for their comments on an earlier version of this paper. I thank Saul Lizondo for his challenging observations. Last but not least, I am indebted to the Central Bank of Chile for its prompt and diligent provision of the data. Any errors and omissions are my own responsibility.

steadily toward an orthodox inflation targeting regime. A central feature of Chilean monetary policy in the 1990s has been the newly acquired autonomy of the CBCH and the pre-announcement of a 12-month point inflation target for the following calendar year starting in September of 1990. The inflation target has been attained with high precision. In September 1999, the CBCH announced that starting in 2001, it will target CPI inflation between 2 and 4 percent per annum permanently. It is likely, therefore, that the arguments, and possibly the functional form of the loss function of the CBCH, have changed over time. Similarly, these developments have probably had a large effect on the functioning of markets and on the determination of inflation expectations.

13. The experience of other countries that have undergone reforms as important as those underwent by Chile indicates (as theory predicts) that the parameters that describe the system's dynamics and variance change. While under normal circumstances optimizing economic agents are expected to regularly revise their estimates of the coefficients of the system when new information becomes available, in cases of large structural reforms they may also have to change the set of equations describing that economic system[2]. As a result, macroeconomic policymakers in general, and central banks in particular, have found that in-sample re-fitting of traditional, fixed-parameter models to the data generating process becomes a regular exercise in rapidly changing economies. This notwithstanding, the out-of-sample forecasting ability of models tends to be poor. This has practical implications. For example, the structural instability of the models' parameters, as well as the uncertainty about the "true" model of the economy, have produced biased forecasts of inflation and have even been signaled out by some observers as one possible cause of a central bank's breach of its inflation target, such as it occurred in New Zealand in 1995.

14. The next section of the paper discusses the state-space framework proposed. Section C describes the data used, and tests for unit roots and breaks in the sample. Section D presents the estimation results and the out-of-sample forecasts of the models. The last section concludes the paper.

B. Models for the Forecasting of Inflation in Chile

15. Figure 1 displays annual inflation measured as the log difference in the average of each quarter CPI with respect to the average of the same quarter of the previous year. It is obvious that there has been a significant change in the level and in the variability of inflation over the sample period. This points to the difficulty of fitting a model of inflation in Chile during the 1990s, and thus, of forecasting inflation.

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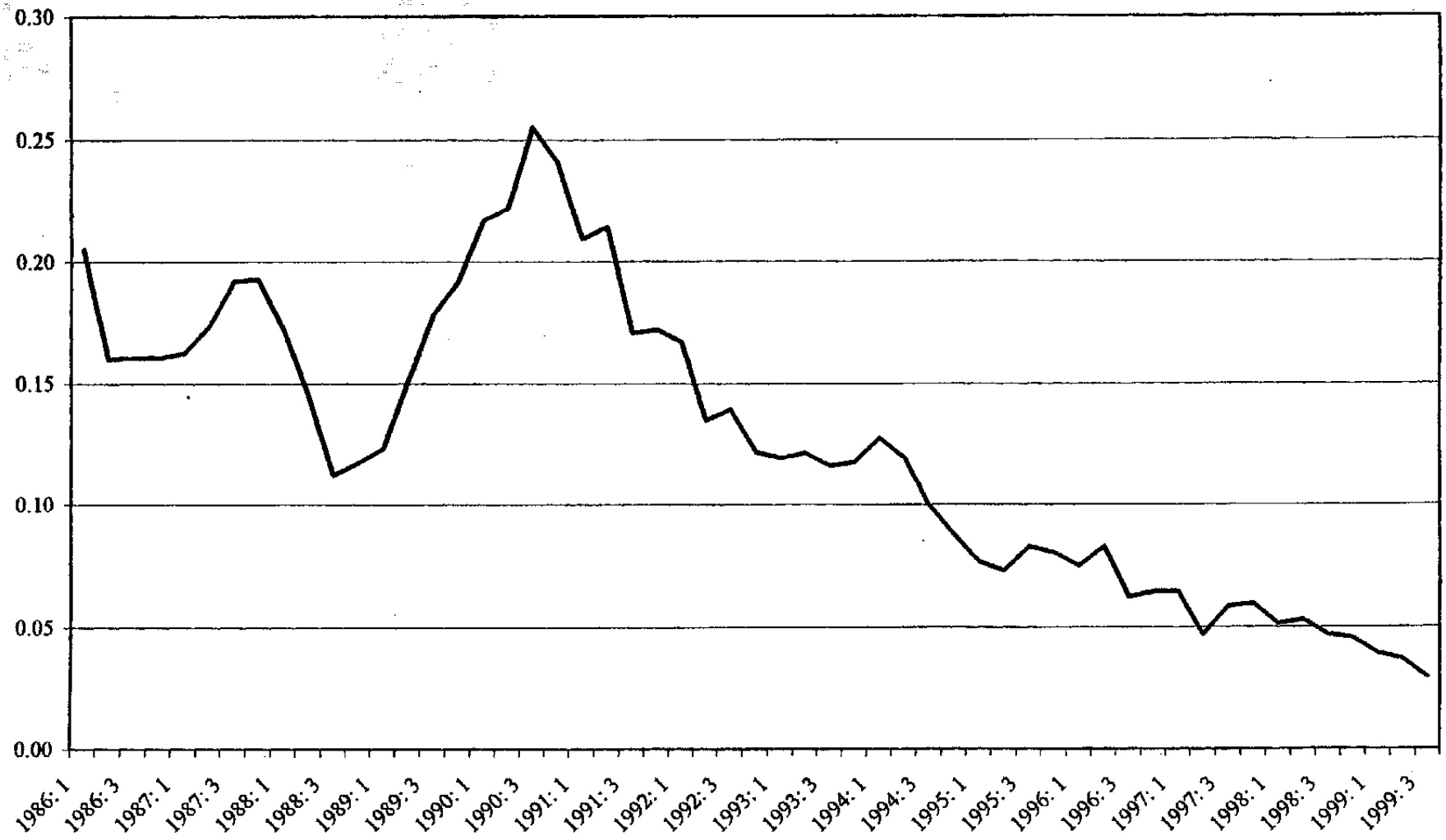
[2] Wong (2000) finds that the responses of output and price levels to monetary shocks were quite variable in the U.S. in the sample period 1959:1–1994:12. Wong suggests the use of time-varying parameter models to analyze the variability in the effects of monetary policy on economic activity and prices; simple time-invariant linear VAR models may be misleading.

Figure 1. Log Differenced CPI

(Annual rates)



16. This paper starts from the premise that structural changes have altered and continue to alter the behavior of economic agents. This implies, among other things, that there will likely be instability in any econometric model that one wishes to fit to the data. The approach proposed in this paper will be, therefore, to deal with structural and regime changes by using state-space models[3]. This opens a number of possibilities with different degrees of complexity.

17. This paper will estimate two models of inflation for Chile. The first model is a time-varying Phillips curve model of inflation and the second model is a reduced form model of inflation in a small open economy that does inflation targeting. In turn, the first model will be estimated excluding the pre-announced official inflation target—henceforth, version one—and including the pre-announced inflation target—henceforth, version two.

A time-varying Phillips Curve model of inflation

18. The first model of inflation is based on an expectations-augmented Phillips curve derived from Lucas' (1973) supply function in the usual manner.[4] In contrast to the standard expectations-augmented Phillips curve, the model allows the parameters to vary over time (in agreement with Lucas' (1973) well-known conclusion). In Chile, the variation of parameters over time could be interpreted as reflecting the learning process of economic agents as reforms unfolded, and the monetary policy framework approached its steady state.[5]

The time-varying Phillips curve is:

$$\pi_t = \mathrm{E}_{t-1}\pi_t + \beta_t(L)x_t + e_t, \qquad (1)$$

---

[3] Appendix I briefly describes state-space models.

[4] As shown in the literature (e.g., McCallum (1989) and Turnovsky (1997)), Lucas' (1973) supply function (his equation (7)) can be transformed into a standard expectations-augmented Phillips curve.

[5] Whether the time-varying Phillips curve is consistent with the suggestion that the Phillips curve is non-linear and asymmetric (e.g., Clark et al (1995) and Razzak (1995)) depends on the rationale given for that non-linearity and asymmetry. For instance, the view that the non-linearity and asymmetry of the Phillips curve is mostly due to time-varying, central bank's weights on inflation and output variance, would be consistent with the rationale for the time-varying Phillips curve given in this paper. In that case, the institutional changes that made the CBCH independent, and made price stability its primary goal, should minimize the importance of that cause of the Phillips curve's non-linearity and asymmetry over time. However, there are other rationalizations for the non-linearity and asymmetry of the Phillips curve that may be more difficult to reconcile with the rationale for the time-varying Phillips curve given in this paper.

where π_t is inflation at time t; E_{t-1} is the mathematical expectation operator based on the information set available at time t-1; β_t is parameter that is allowed to vary over time; x_t is a measure of the output gap, and L is the lag operator; e_t is a stochastic process zero mean and variance σ_e^2. It is assumed that the roots of $\beta_t(L)x_t$ lie outside the unit circle.

19. Notice that the regressors of equation (1) are unobservable variables. To deal with that feature of the model, the strategy followed is the following. First, based on the assumption (econometrically tested below) that the inflation series has been subject to changes in its intercept as well as in its slope, the unobserved expected inflation is assumed to follow a random walk. Normally, structural shifts are best modeled as discrete shifts. However, in a context in which it is assumed that agents adjust their forecasts only when new information is received, modeling discrete changes using a random walk is a good approximation.[6] Thus,

$$E_{t-1}\pi_t = E_{t-2}\pi_{t-1} + \tau_t, \qquad (2)$$

where τ_t is a stochastic process zero mean and variance σ_τ^2. Second, following Clark (1987), the output gap is estimated assuming a local linear trend and an autoregressive process of order two for output behavior. The model is described in Appendix II. Equations (1)–(2) can be used to calculate expected inflation as an unobserved variable, and to forecast inflation in periods t+s for $s \geq 1$.

20. Given the significant reforms underwent by Chile (including changes to the monetary policy framework of the CBCH), the time-varying parameter β_t represents the learning process of economic agents. Therefore, the time-varying Phillips curve model captures the uncertainty introduced into the inflationary process by those changes.

21. Note that equation (1) is not identified because it is not possible to generate simultaneously an estimate of the output gap and an estimate of the time-varying parameters β_i. The alternative of estimating simultaneously the unobserved components of real GDP (i.e., a stochastic trend and a cyclical component) and a *standard expectations-augmented Phillips curve with constant β_s* was not feasible. Estimates either displayed significant serial correlation or the information matrix was singular, an indication that the model may not be identified.[7] Therefore, a two-step approach is followed by which first a series for the output

[6] This insight is owed to Kim.

[7] Different versions of the model were tried, e.g., using different lags in the output gap, or using an ARMA representation for the output gap, or using two constants different from zero for the processes describing the cyclical parts of real GDP and inflation. During estimation of the models, difficulties were encountered either in inverting the matrix of second derivatives of the log likelihood function, or the estimation did not converge. According to Rothenberg (1971), this may indicate that a model is

(continued...)

gap is estimated, and then, the output gap so generated is used to estimate the time-varying parameter model (1)–(2). The price to pay for this approach is an efficiency loss due to the use of the generated regressor x_t when estimating the expectations-augmented Phillips curve with time-varying parameters.

A small open economy model of inflation

22. An alternative to specifying a random walk process for expected inflation as in equation (2), is to substitute the set of state variables (predetermined) suggested by a structural model for expected inflation. The set of state variables is determined from a rational expectations model of a small open economy that does inflation targeting. The model is briefly described in Appendix III.[8] The inflation process can thus be represented by the following reduced form equation:

$$\pi_t = F(g_t, g_t^*, r_t^*, p_t^*, d_t, f_t, c_t) + \tau_t, \qquad (3)$$

where g_t is domestic productivity, g^*_t is the rest of the world's productivity; r^*_t is the cost of foreign financing faced by the Chilean economy (including the risk premium); p^*_t is an index of the country's terms of trade; d_t is a measure of fiscal impulse; f_t is the nominal exchange rate, c_t is the pre-announced official inflation target, and τ_t is a white noise process.

23. Note , however, that the estimation will be done without imposing the set of cross-equations restrictions that result from the solution of the model of Appendix III. There are simply not enough data to estimate all the parameters. Moreover, the model does not provide guidance on the time-varying combinations of parameters implied by the cross-equation restrictions.

C. Data Analysis

24. The data used in this paper were provided by the CBCH. The data set comprises the following variables: Chilean real GDP (y_t), an index of real economic activity in partner countries (y_t^*), Chilean annual inflation as measured by the CPI (π_t), annual inflation in partner countries (π_t^*), the cost of financing for the Chilean economy (i.e., the three-month LIBOR rate plus a country risk premium) (r_t^*), an index of terms of trade (p_t^*), the nominal exchange rate defined as the number of pesos exchanged for one U.S. dollar (f_t), a measure of the fiscal impulse (d_t), and the pre-announced point inflation target for the following calendar

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not locally identified, i.e., that more than one set of values for the parameters can give rise to the same value of the log likelihood function; the data cannot discriminate among the possible values.

[8] This draws on Nadal-De Simone (1999), which contains the analytical solution and simulations of a very similar model using New Zealand data.

year since 1991 (c_t).[9] The data is quarterly. It starts in 1986:1 and finishes in 1999:3. The data used in the estimations is always in natural logarithms with the exception of interest rates. Series π_t, π_t^*, r_t^*, and f_t are quarter averages. The seasonal component of the series has been removed.

25. The variables are tested for the presence of unit roots during two different sample periods: 1986:1–1999:3 and 1990:1–1999:3. The Perron (1997) test for breaks in the inflation series for the sample period 1986:1–1999:3 is also performed. Results are presented in Tables 1a and 1b.

26. Given that inflation and real output seem to have a stochastic trend, the unit-root test used is the modified Dickey-Fuller t-test ($DFGLS^{\tau}$) proposed by Elliott, Rothenberg, and Stock (1996), a point-optimal invariant test which has a substantially improved power when an unknown mean or trend is present in the data. Table 1a shows that, in the period 1986:1–1999:3, the null of a unit root with a constant and a linear trend cannot be rejected for any variable.[10] Changes in all the variables are stationary. In the period 1990:1–1999:3, the null of unit root with a constant and a linear time trend cannot be rejected for any of the variables except annual inflation and the terms of trade. Changes in all the other variables are stationary.

27. Given the nonstationarity of inflation in the period 1986:1–1999:3, the inflation series as well as changes in it, are tested using Perron (1997) test which allows for a shift in the intercept of the trend function and/or a shift in the slope; the date of the possible change is not fixed a priori but it is endogenously determined. Table 1b shows the results for 2 models. The "innovational outlier model" (model 1) allows only a change in the intercept under both the null and the alternative hypothesis, and the "additive outlier model" (model 2) allows a change in both the intercept and the slope. Two methods are used to determine the break point (T_b): the first method selects as breaking point the one that minimizes the t-statistic for testing the null of unit root ($t_{\hat{\alpha}}$) while the second one minimizes the t-statistic on the parameter associated with the change in the intercept (model 1) ($t_{\hat{\theta}}$), or the change in the slope (model 2) ($t_{\hat{\gamma}}$). The lag parameter is chosen following a general-to-specific recursive procedure so that the coefficient on the last lag in an autoregression of order k is significant, and that the last coefficient in an autoregression of order greater that k is insignificant, up to a maximum order k max.

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[9] Quarterly figures for the pre-announced official inflation target were calculated assuming a constant rate of decline from each yearly inflation target to the following one.

[10] The lags used in the unit-root tests are chosen using the Schwarz Information Criterion and checking that the residuals are white noise using the Box and Pierce's Q statistics.

Table 1a. Chile: Elliot, Rothenberg, and Stock Test for Unit Roots

Statistics for $\rho = 0$

Variables	1986:1–1999:3 Lags	1986:1–1999:3 DFGLS $^{\tau}$	1990:1–1999:3 Lags	1990:1–1999:3 DFGLS
y	3	-2.57	1	-1.53
y*	1	-1.79	1	-2.27
π	4	-1.65	3	-3.45*
r*	1	-1.62	1	-1.49
p*	1	-2.06	1	-3.07*
f	1	-1.37	1	-1.68
Δy	2	-3.10*	1	-4.02*
Δy*	1	-4.25*	1	-3.58*
$\Delta\pi$	1	-4.95*	n.a.	n.a.
Δr*	1	-6.00*	1	-5.44*
Δp*	3	-3.73*	n.a.	n.a.
Δf	1	-4.50*	1	-3.92*

All variables, except interest rates, are measured in natural logarithms. Lags are determined according to Schwarz information criterion and checking that the residuals are white noise.
The DFGLS $^{\tau}$ has a null of unit root with a constant and a linear trend. The 5 percent critical value is –2.89.

Table 1b. Chile: Perron (1997) Unit Root Test For Annual Inflation and Changes in Annual Inflation

(1986:1–1999:3)

γ	T_b	K	$\hat{\alpha}$	$t_{\alpha}^{\wedge}$	$\hat{\theta}$	$t_{\theta}^{\wedge}$
$Model 1: y_t = u + \theta DU_t + \beta_t + \delta D(T_b)_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t$						
Π	1988:4	9	0.54	-4.78		
Π	1988:2	4			0.72	-4.00
ΔΠ	1992:1	9	-1.98	-5.10		
ΔΠ	1990:2	8			-0.10	-4.48
γ	T_b	K	$\hat{\alpha}$	$t_{\alpha}^{\wedge}$	$\hat{\theta}$	$t_{\theta}^{\wedge}$
$Model 2: y_t = u + \theta DU_t + \beta t + \delta DT_t + \delta D(T_b)_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t$						
Π	1988:3	3	0.61	-6.54*		
Π	1988:3	3			0.61	-6.54*
ΔΠ	1990:2	3	-0.32	-7.98*		
ΔΠ	1990:3	3			-0.30	-6.77*

The inflation rate is measured as the natural logarithm of the consumer price index of each quarter with respect to the same quarter of the previous year. The first T_b is the value that minimizes the t-statistic for testing $\alpha = 1 (\hat{\alpha}, t_{\alpha}^{\wedge})$, and the second T_b is the value chosen to minimize the t-statistic on the parameter associated with model 1 or model 2. Lags are chosen following the Schwarz information criterion and checking that the residuals are white noise.

28. Model 1 does not reject the null hypothesis of a unit root either in the inflation series or in its changes using any of the two methods for choosing the break point T_b. The tests show a change in the intercept of inflation in 1988, and a change in the intercept of changes in inflation either in 1992, or in 1990, depending on the method chosen to estimate the break point.

29. Model 2 strongly rejects the null hypothesis of a unit root in the inflation series and in its change independently of the method used to choose the break point T_b. The break point in the intercept and/or slope of inflation is in 1988 while the break point in the intercept and/or slope of changes in inflation is in 1990.

30. Therefore, the Perron (1997) test indicates that the inflation rate is stationary in the entire sample period when allowance is made for changes in the intercept and the slope.

D. The State-Space Representation of the Models and Results

Estimation of the output gap series

31. As stated above, estimation of the model (1)–(2) requires an estimate of the output gap. This is done using the entire sample period 1986:1–1999:3. The state-space representation of the estimated unobserved components model of output is:

$$y_t = \begin{bmatrix} 1 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} T_t \\ X_t \\ X_{t-1} \\ g_t \end{bmatrix}, \tag{4}$$

$$\begin{bmatrix} T_t \\ X_t \\ X_{t-1} \\ g_t \end{bmatrix} = \begin{bmatrix} 1 & \sim 0 & \sim 0 & \sim 1 \\ 0 & \sim \theta_1 & \sim \theta_2 & \sim 0 \\ 0 & \sim 1 & \sim 0 & \sim 0 \\ 0 & \sim 0 & \sim 0 & \sim 1 \end{bmatrix} \begin{bmatrix} T_{t-1} \\ X_{t-1} \\ X_{t-2} \\ g_{t-1} \end{bmatrix} + \begin{bmatrix} h_t \\ l_t \\ 0 \\ w_t \end{bmatrix}. \tag{5}$$

32. Once the model is in the state-space form, it can be estimated using the Kalman filter.[11] Table 2 shows the estimated variances σ_h^2 and σ_l^2, as well as the fixed parameters of the autoregressive process of order 2 assumed for the cyclical component of real GDP, i.e., θ_1 and θ_2. The estimation was constrained such that the roots of the characteristic equation of the process $\theta(L)X_t$ lie outside the unit circle, and that the variances σ_h^2 and σ_l^2 are positive numbers. All parameters are significant at the usual significance levels. The Q-statistic tests for serial correlation as well as the Kolmogorov-Smirnov periodogram test of the

[11] For a thorough description of the Kalman filter, see Hamilton (1994).

Table 2. Chile: Parameter Estimates of the Unobserved Components Model of Real GDP

(1986:1–1999:3)

Variables	Estimates	Standard Errors
σ_h	0.0119	0.0033
σ_l	0.0089	0.0035
θ_1	1.4468	0.0111
θ_2	-0.5233	0.0079
Log likelihood	95.0212	

Q-statistics for standardized forecast errors Q(8) = 9.73 Q(16) = 16.19 Q(24) = 25.05 Q(32) = 41.94	Kolmogorov-Smirnov statistic for standardized errors (K–S) Nobs = 32 Rejection limit (10%) = 0.2157 K–S = 0.0999
Q-statistics for the squares of standardized forecast errors Q(8) = 9.79 Q(16) = 16.47 Q(24) = 25.29 Q(32) = 42.45	Kolmogorov-Smirnov statistic for squares of standardized errors (K–S) Nobs = 32 Rejection limit (10% = 0.2157 K–S = 0.0991

standardized forecast errors and the squared of the standardized forecast errors, cannot reject the white noise null hypothesis.

33. Figures 2–4 show the log of real GDP and its stochastic trend component, its cyclical component, and its productivity growth component, respectively.[12] The cyclical component profile seems to match the standard description of the Chilean business cycles of the 1990s. Three points are noteworthy. First, during the 1990s, the area covered by the negative part of the cyclical component of output was larger than the area covered by the positive part of the cyclical component of output. This is consistent with the steady decline in inflation sought, and successfully obtained, by the monetary authorities during that period. Second, the cyclical component of output seems to have peaked in 1998:1, i.e. before the monetary policy tightening of the second half of 1998. Finally, average productivity growth[13] seems to have declined steadily from a quarterly average growth rate of 2.12 percent in 1992–94 to 2.05 percent in 1995–96, to 2.0 percent in 1997, and to 1.9 percent in 1998. This trend seems consistent with the view held by some observers that the potential output growth of the Chilean economy in this decade may not reach the levels of the 1990s due to the completion of one-time gains from past structural reforms. Recent policy measures to widen and deepen the domestic capital and money markets, to further liberalize the capital account, as well as to continue the unilateral trade liberalization and education reforms, may reverse that downward trend. In any case, the relevant point is that productivity growth will be shown to be an important factor in the forecasting of inflation in Chile.

Estimation of the time-varying Phillips Curve model of inflation

34. The state-space representation of the time-varying parameter Phillips curve model of inflation is:

$$\pi_t = [\,1 \quad x_t \quad x_{t-1}\,] \begin{bmatrix} E_{t-1}\pi_t \\ \beta_{1t} \\ \beta_{2t} \end{bmatrix} + e_t, \tag{6}$$

$$\begin{bmatrix} E_{t-1}\pi_t \\ \beta_{1t} \\ \beta_{2t} \end{bmatrix} = \begin{bmatrix} 1\sim 0\sim 0 \\ 0\sim 1\sim 0 \\ 0\sim 0\sim 1 \end{bmatrix} \begin{bmatrix} E_{t-2}\pi_{t-1} \\ \beta_{1t-1} \\ \beta_{2t-1} \end{bmatrix} + \begin{bmatrix} \tau_{0t} \\ \tau_{1t} \\ \tau_{2t} \end{bmatrix}. \tag{7}$$

---

[12] The first 16 observations were used to eliminate the influence of the "wild guess" made for the nonstationary $\beta_{0|0}$ (initial values). Large values were given to the diagonal elements of the covariance matrix of β_t ($P_{0|0}$) so as to assign most of the weight in the updating equation to the new information contained in the forecast error.

[13] As mentioned in Appendix II, productivity growth includes changes in factor endowments.

Figure 2. Chile Real GDP (-) and Its Trend Component (---)

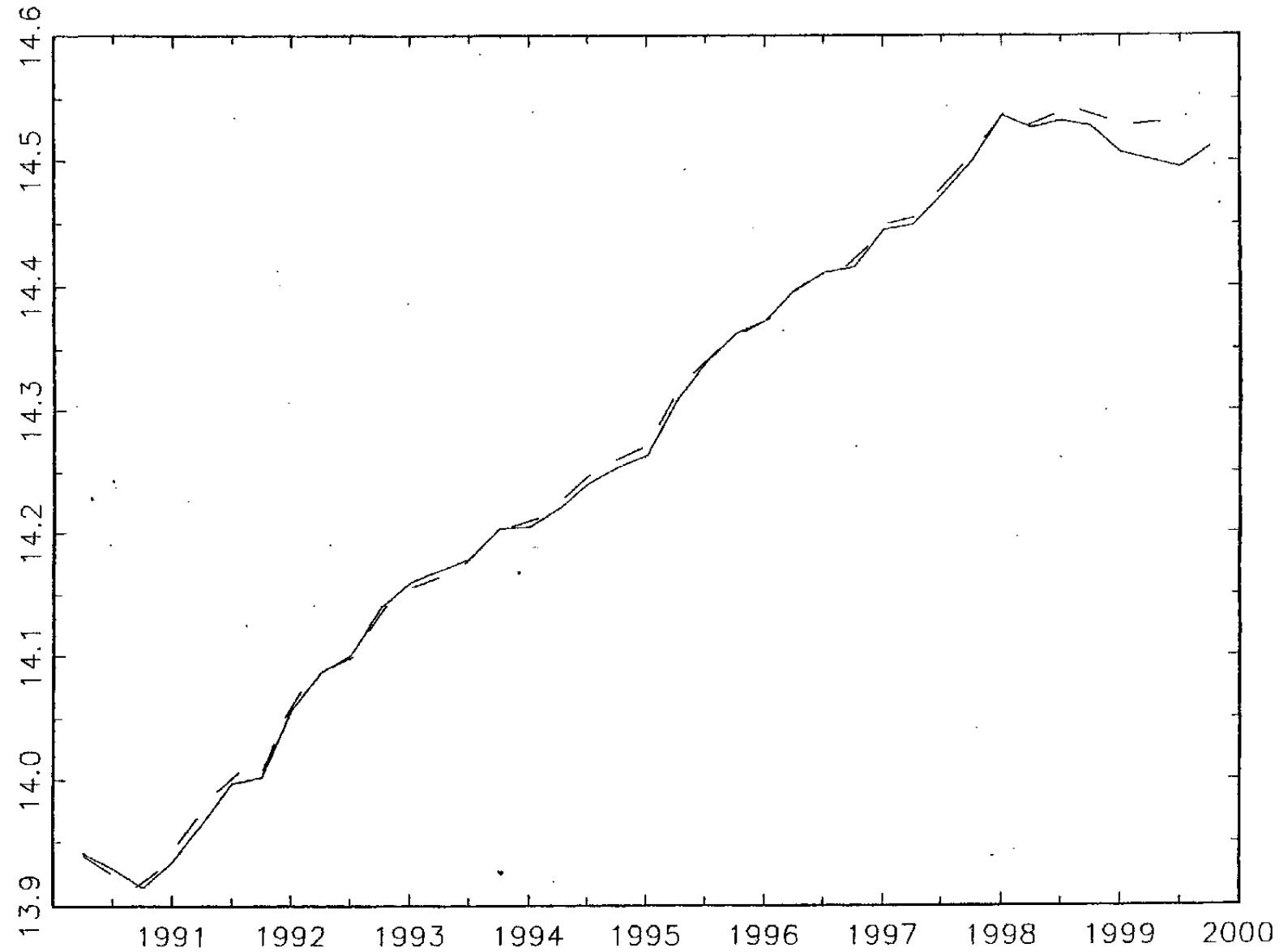

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Figure 3. Chile: Cyclical Component of Real GDP

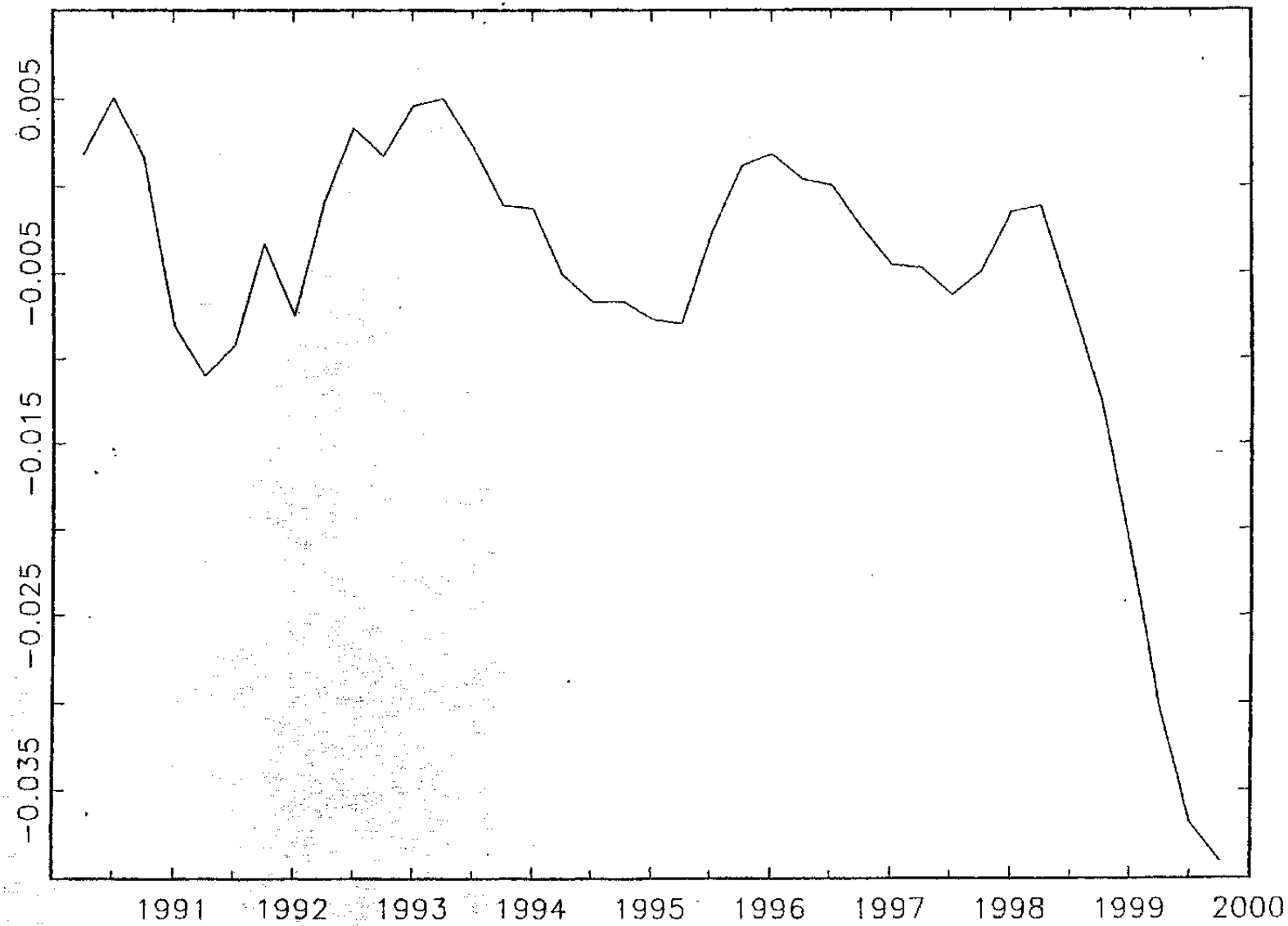
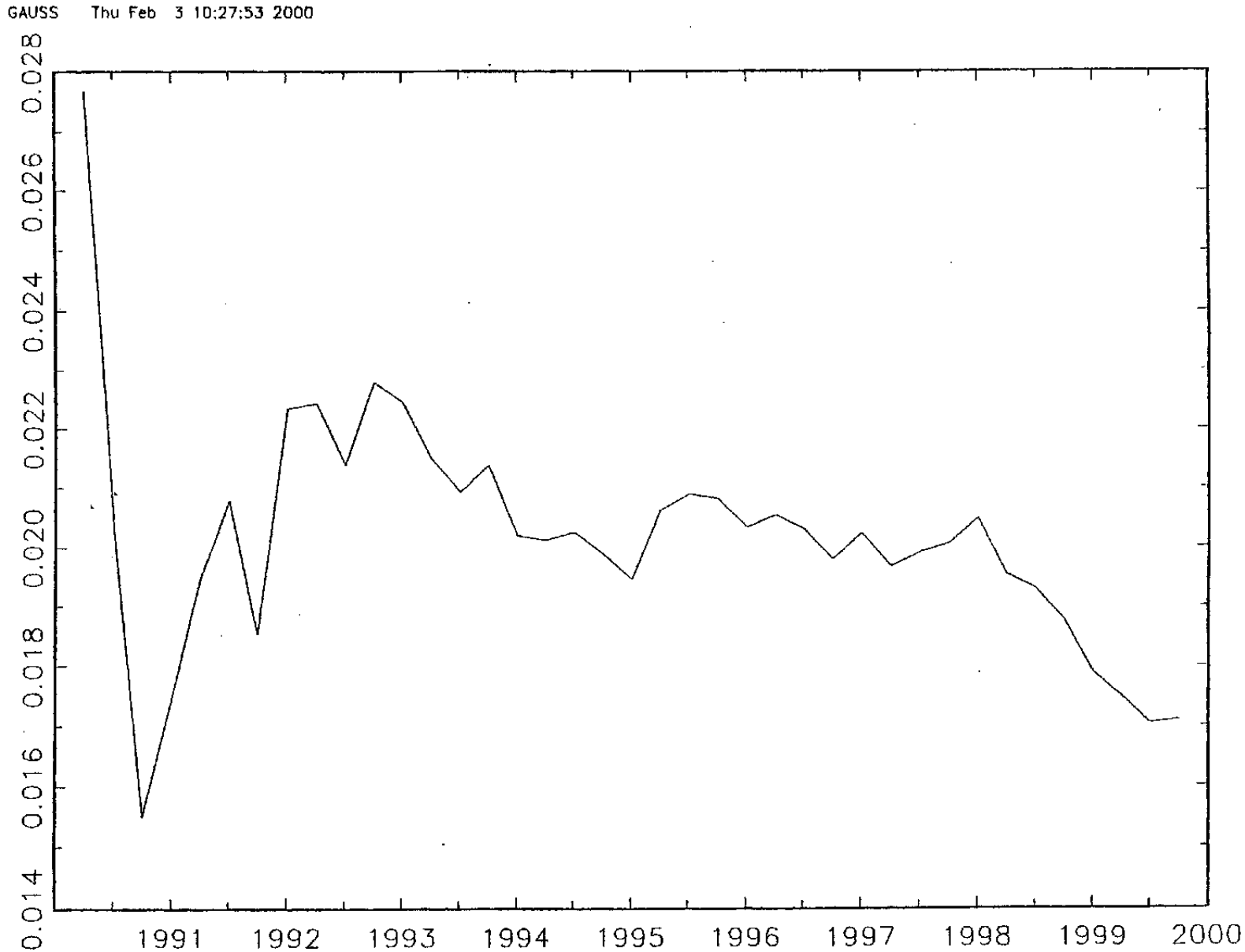


Figure 4. Chile: Productivity Growth Component of Real GDP



35. The model is both locally and globally identified.[14] It seems relevant to recall, however, that identification should not be approached in a rigid manner as it is possible for an equation (or system of equations) to be identified according to the strict rules of identification but the equation may have very little predictive power if the predetermined variables in the equation have little variance. From this point of view, the relatively good forecasting performance of the models (see below) is encouraging.

36. Table 3 shows two sets of estimates of the time-varying Phillips curve model: the first one, excludes the pre-announced official inflation target while the second one includes it. In the second one, the dependent variable is measured as inflation deviations from the official target. The results suggest that although the estimation of the model that includes the pre-announced official inflation target displays some additional serial correlation, this version is to be preferred because it achieves a better forecasting performance than the model in terms of actual inflation without the information provided by the official pre-announced inflation target.

37. In both versions of the time-varying Phillips curve model, all parameters are significant at the usual confidence levels. The log-likelihood function of version two of the model is relatively higher. However, there is serial correlation in the standardized forecast errors of version two of the model. In contrast, the Q-statistic tests for serial correlation of the standardized forecast errors of version one of the model show some serial correlation at the 90 percent significance level only for Q(16) and Q(24). The Q-statistic tests for serial correlation of the squares of the standardized forecast errors show no serial correlation in any of the two versions.

38. Table 3 also shows the out-of-sample forecasts for 1, 2, 3, and 4 quarters and the actual values of inflation. Version two of the model achieves a considerable reduction in Theil's inequality coefficient as the value of the statistics for version two is between 19 to 64 percent of its value for version one of the model. A similar picture is offered by the root mean-square forecast percent error or the mean forecast percent error. Figure 5 shows actual and expected inflation, and Figure 6 shows actual and expected deviations from the pre-announced official inflation target, during the sample period. From both figures two observations seem important. First, the pre-announced official inflation target point was below the predicted level of inflation over two thirds of the time. Second, actual inflation was closer to the target point than to the predicted level of inflation just over half of the time.[15]

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[14] Rothenberg (1971) showed that local identification at β_0 requires that the information matrix be nonsingular in a neighborhood around β_0. This criterion was used for testing for local identification of the model described by equations (1)–(2), and also of the model described by equation (3). In no case there was any difficulty in inverting the matrix of the second derivatives of the log likelihood functions. Global identification was tested working directly with the state-space representation of the model, as suggested by Burmeister et al (1986).

[15] This is not statistically different from 50 percent.

Table 3. Chile: Parameter Estimates of the Time-Varying Phillips Curve Model of Chilean Inflation (1990:1–1999:3)

	Excluding Official Target		Deviations from Official Target	
Variables	Estimates	Standard Errors	Estimates	Standard Errors
σ_e	1.0029	(0.0035)	0.9954	(0.0018)
$\sigma_{E_{t-1}\pi_{t-1}}$	0.9893	(0.0022)	1.0080	(0.0019)
σ_{x_t}	1.0000	(0.2567)	1.0000	(0.1307)
$\sigma_{x_{t-1}}$	1.0000	(0.1482)	1.0000	(0.1232)
Log likelihood	93.4305		97.41180	

Q-Statistics for the Standardized Forecast Errors	Q-Statistics for the Standardized Forecast Errors
Q(8) = 12.79	Q(8) = 23.11
Q(16) = 26.35	Q(16) = 33.91
Q(24) = 33.56	Q(24) = 41.93
Q(30) = 34.46	Q(30) = 43.06

Q-Statistics for the Squares of Standardized Forecast Errors	Q-Statistics for the Squares of Standardized Forecast Errors
Q(8) = 3.52	Q(8) = 11.40
Q(16) = 10.73	Q(16) = 18.51
Q(24) = 15.62	Q(24) = 28.88
Q(30) = 21.19	Q(30) = 33.34

Out-of-Sample Forecasts

Periods Ahead	Inflation	Forecast	Theil's Inequality Coefficient	Forecast	Theil's Inequality Coefficient
1. 1998:4	4.57	5.34	0.078	4.71	0.015
2. 1999:1	3.94	4.79	0.087	4.57	0.051
3. 1999:2	3:68	4.28	0.084	4.15	0.054
4. 1999:3	2:93	3.97	0.098	3.44	0.058

Root Mean-square Forecast Percent Error	Mean Forecast Percent Error	Root Mean-square Forecast Percent Error	Mean Forecast Percent Error
0.169	0.169	0.031	0.031
0.193	0.192	0.115	0.095
0.184	0.183	0.119	0.106
0.238	0.226	0.134	0.123

Figure 5. Expected Inflation, Inflation, and Official Inflation Target

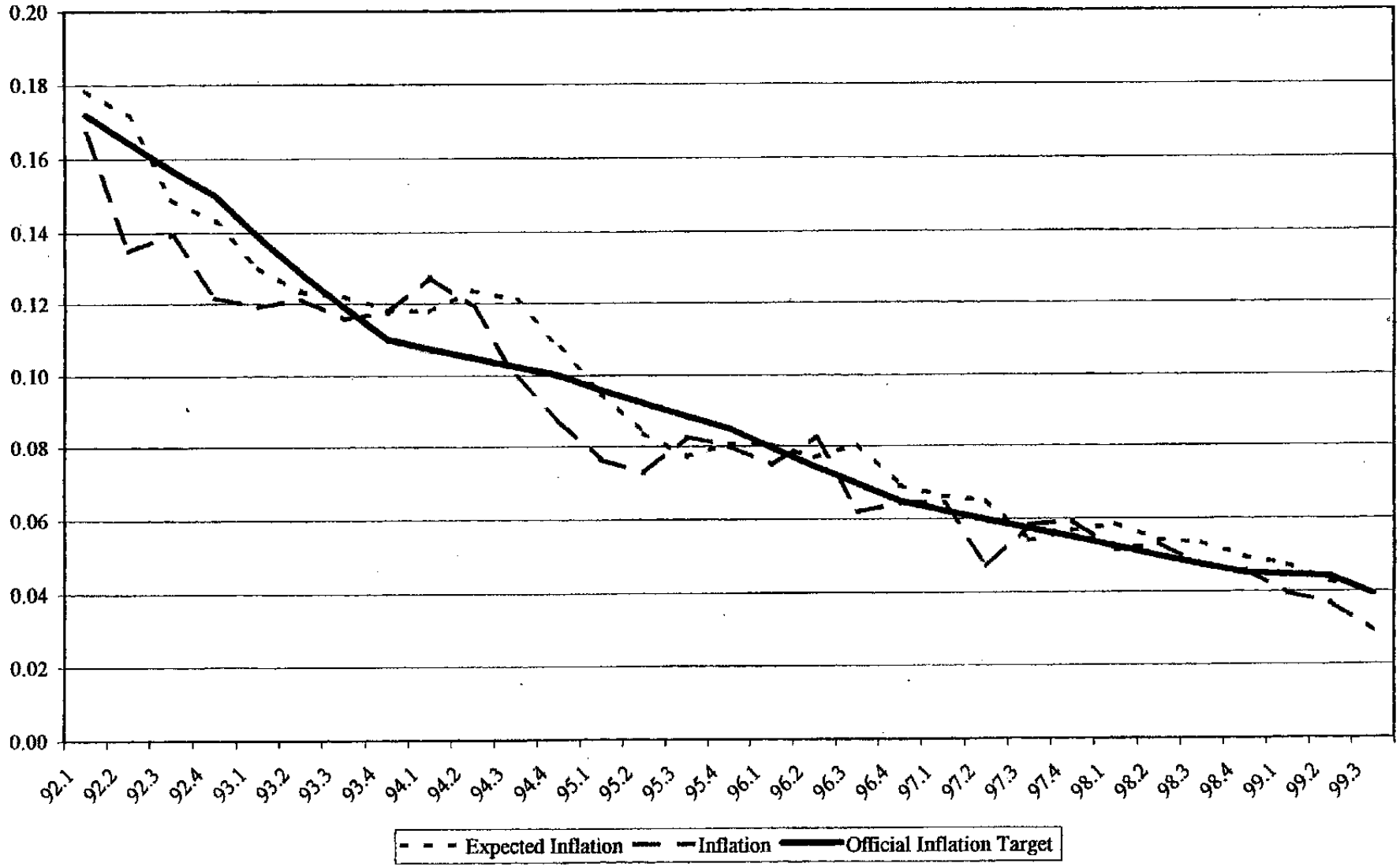
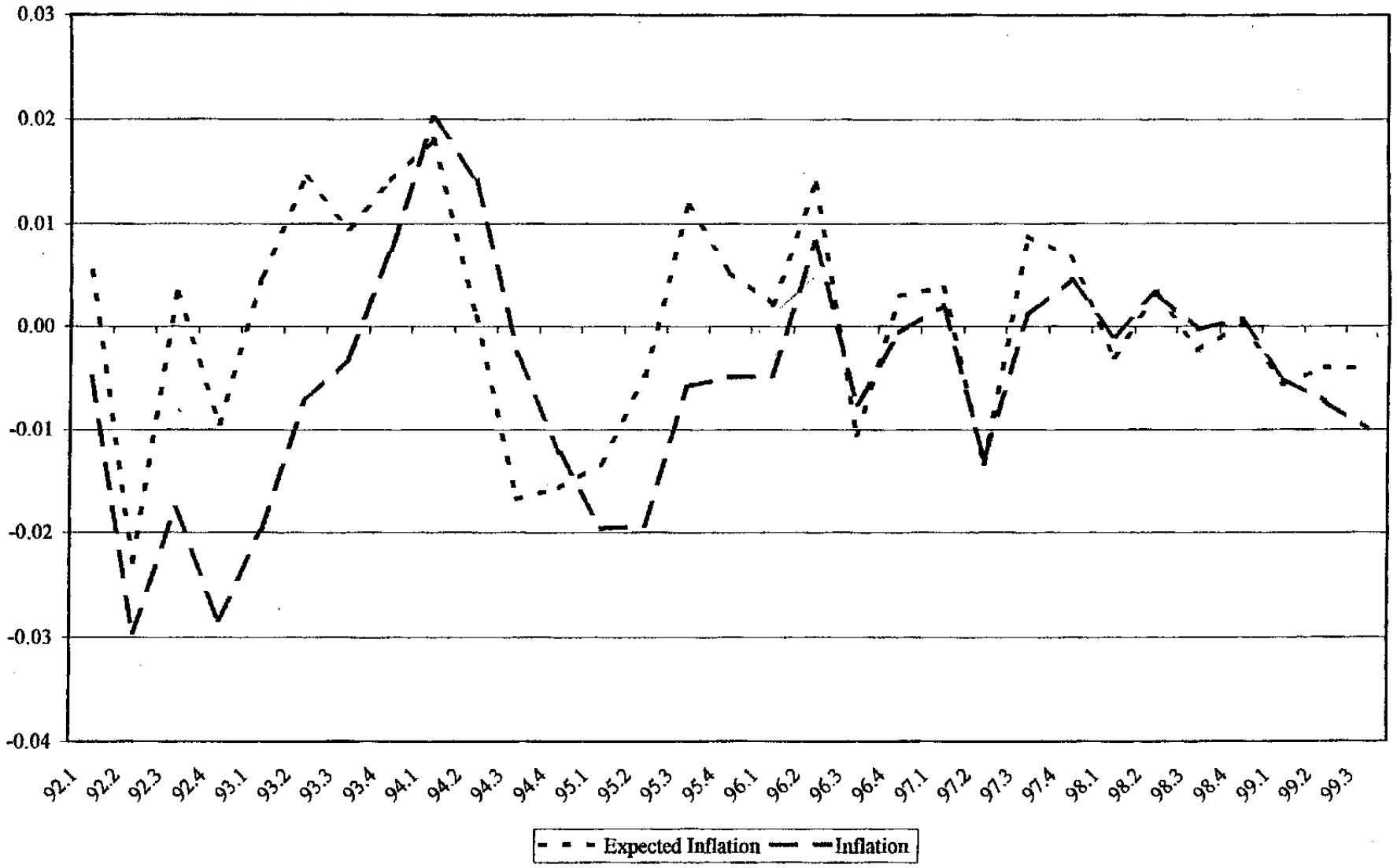


Figure 6. Expected and Actual Deviations of Inflation from the Official Inflation Target



While the first observation is consistent with Morandé and Schmidt-Hebbel (2000), the second is not necessarily. However, given that the framework used in this paper explicitly considers the expectations-updating process by economic agents, all results can be interpreted in the same manner the authors do, i.e., as evidence that the inflation targeting regime contributed to enhance the credibility of the CBCH and, thus, played a role in reducing inflation in Chile. The inflation target announced, and always accomplished with a great deal of accuracy, offset inflationary inertia over time.

39. Figures 7 and 8 show the *smoothed*[16] time-varying parameters of the contemporaneous and first lag of the output gap of version two of the model. There seems to be a tendency for the variability of the parameter values to fall over time. The absolute value of the contemporaneous parameter of the output gap also falls over time. Given that the CBCH was successful in its inflation targeting strategy over the sample period, this result should not come as a surprise because hitting the inflation target implies that the output gap variance should be reduced over time. Given private sector's expectations, inflation targeting implies inflation *forecast* targeting (Svensson, (1997)). As the implicit loss function of the independent monetary authority includes the inflation target as the primary objective of monetary policy, one of the sources for a nonzero output gap (i.e., changes in the relative weights attached by the monetary authority to output and inflation variance), and thus for inflation uncertainty, is removed. All the other forces that open an output gap are, certainly, still operational.[17, 18]

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[16] As the state vector is given a structural interpretation in model (1)–(2), it is important to form an inference about the value of the state vector based on the full sample. Therefore, the value of the contemporaneous and lagged coefficients of the output gap have been calculated based on the full set of data collected by moving through the sample backward starting with t = T-1. Therefore, the time-varying parameters have been smoothed.

[17] Given the profession's lack of agreement on the interrelation between nominal and real variables, other interpretations are certainly possible. For instance, efficiency wage theories of wage determination would suggest that given a constant markup, the effect of the output gap on wages and hence on inflation would be smaller with about 3 percent average inflation in 1997 than with about 15 percent average inflation in 1992. However, the sum of the estimated output gap coefficients falls until mid-1995, to increase thereafter. As indicated by Wong (2000) in his study for the U.S., no single theory of the monetary transmission mechanism seems capable of explaining the changing response of output and prices to monetary policy; one should rather search for a combination of economic and institutional factors.

[18] Version two of the time-varying Phillips curve model was estimated allowing for uncertainty derived not only from the economic agents' updating of the model's parameters but also for uncertainty derived from heteroskedasticity of the disturbance terms using a Markov-switching process. In this model, the conditional variance of the forecast error can be decomposed into conditional variance due to the unknown regression coefficients, and conditional variance due to the heteroskedasticity of the disturbance term. During most of the sample period, the first source of

(continued...)

Estimation of the small open economy model of inflation

40. The state-space representation of the solution of the open economy model is:

$$\pi_t = x_t \beta_{t\,i} + e_t, \quad (8)$$

$$\beta_{t\,i} = I_k \beta_{t-1\,i} + r_{t\,i}, \quad (9)$$

where the x_t are the k-1 observed state variables of the open economy model, i.e., domestic productivity, foreign productivity, the real cost of financing of the Chilean economy, an index of the terms of trade, a fiscal impulse measure, the nominal exchange rate with respect to the U.S. dollar, and the pre-announced official inflation target. I_k is a k-order identity matrix.

41. Table 4 shows the results of the estimation of the open economy model represented by equations (8)–(9).[19] This model of inflation has a somewhat higher likelihood function than version two of the time-varying Phillips curve model. Serial correlation is only present between lags 16 and 24.[20]

42. All variables are highly significant at standard confidence levels with the exception of foreign productivity. The out-of-sample forecasts are less accurate than those produced by the time-varying Phillips curve model but are more stable (the Theil's inequality coefficient deteriorates less as the out-of-sample forecasting period is lengthened).

43. Figures 9–14 show the *smoothed* time-varying parameters of the model. There is a number of interesting observations. First, the coefficient on the cost of foreign capital is negative and its value increases until 1995. In standard models of exchange rate determination, a reduction in the cost of foreign financing is expected to increase domestic expenditure thereby pushing up inflation in non-tradable goods, other things equal. This is the real-sector channel of the monetary transmission mechanism. However, a reduction in the cost of foreign financing is expected to also appreciate the domestic currency, and translate

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conditional variance was far more important than the second source (Nadal-De Simone, 2000). There seems to be little to gain from including uncertainty due to heteroskedasticity of random shocks during the period of the sample. However, once the inflation targeting regime is in its steady state, this is an issue that will require revisiting.

[19] The model is estimated without imposing the cross-equation restrictions that result from solving the model of Appendix III.

[20] This model was not estimated allowing for a Markov-switching process to account for possible heteroskedasticity in the residuals. This route was not pursued at this stage given that the forecasts statistics are very stable.

Figure 7. Chile: Smoothed Contemporaneous Output Gap Coefficient

(Model 1, Version 2)

Figure 8. Chile: Smoothed Lagged Output Gap Coefficient

(Model 1, Version 2)

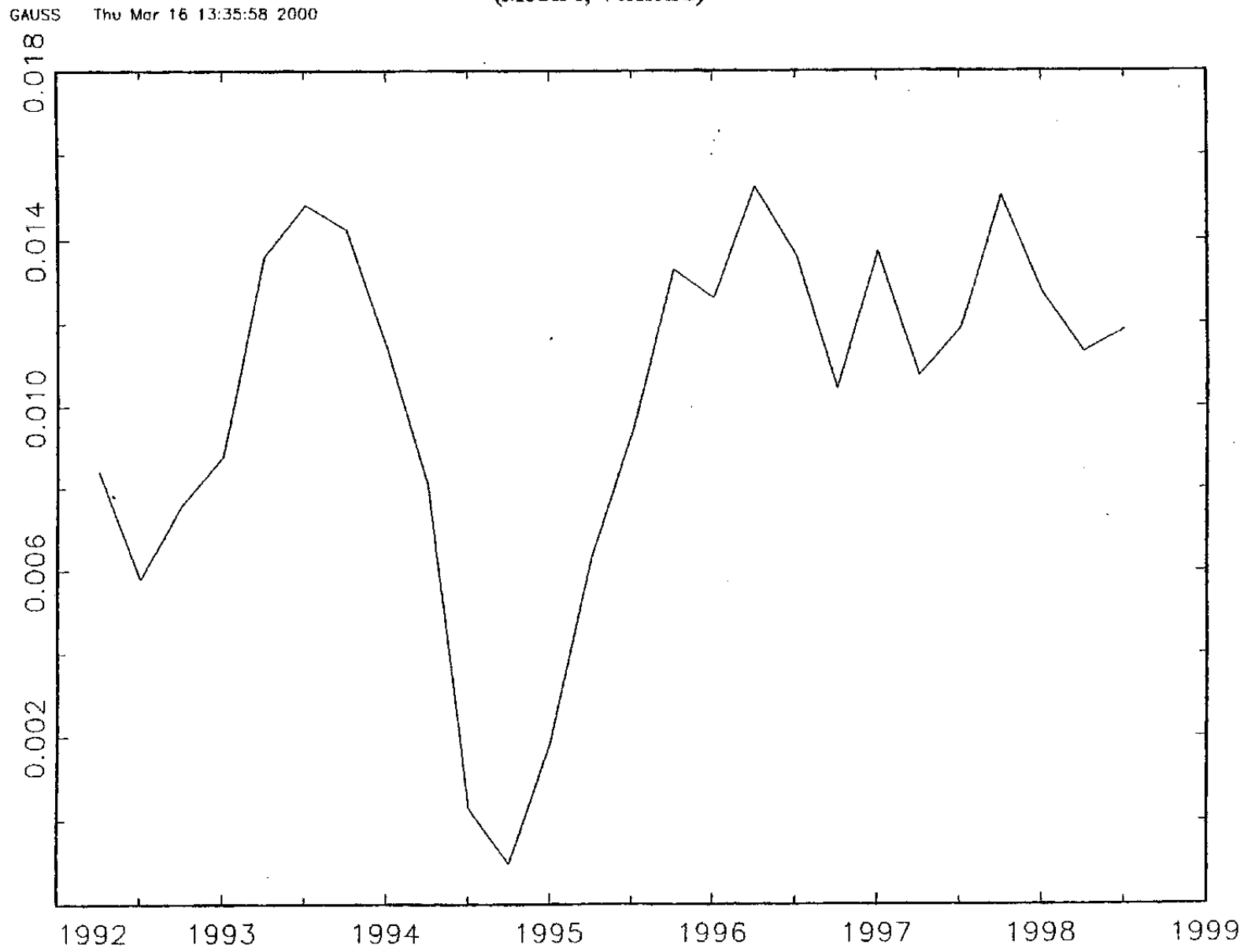


Table 4. Chile: Parameter Estimates of the Open Economy Time-Varying Parameter Model with Official Target of Chilean Inflation (1990:1–1999:3)

Variables	Estimates	Standard Errors
σ_e	0.9963	(0.0013)
σ_g	1.0000	(0.0507)
σ_{g^*}	19.3396	(35.9559)
σ_{r^*}	1.0000	(0.1108)
σ_{p^*}	1.0188	(0.0120)
σ_d	0.7311	(0.0825)
σ_f	1.0000	(0.0413)
σ_c	0.9942	(0.0237)
Log likelihood	98.2820	

Q-Statistics for the Standardized Forecast Errors	Q-Statistics for the Squares of the Standardized Forecast Errors
Q(8) = 12.63	Q(8) = 17.25
Q(16) = 16.84	Q(16) = 22.98
Q(24) = 35.39	Q(24) = 36.82
Q(30) = 40.14	Q(30) = 38.20

Out-of-Sample Forecasts

Periods Ahead	Inflation	Forecast	Theil's Inequality Coefficient	Root Mean-Square Forecast Percent Error	Mean Forecast Percent Error
1. 1998:4	4.57	4.77	0.022	0.045	0.045
2. 1999:1	3.94	5.52	0.120	0.285	0.223
3. 1999:2	3:64	4.61	0.120	0.275	0.233
4. 1999:3	2:93	3.91	0.122	0.291	0.258

Figure 9. Chile: Smoothed Domestic Productivity Growth Coefficient

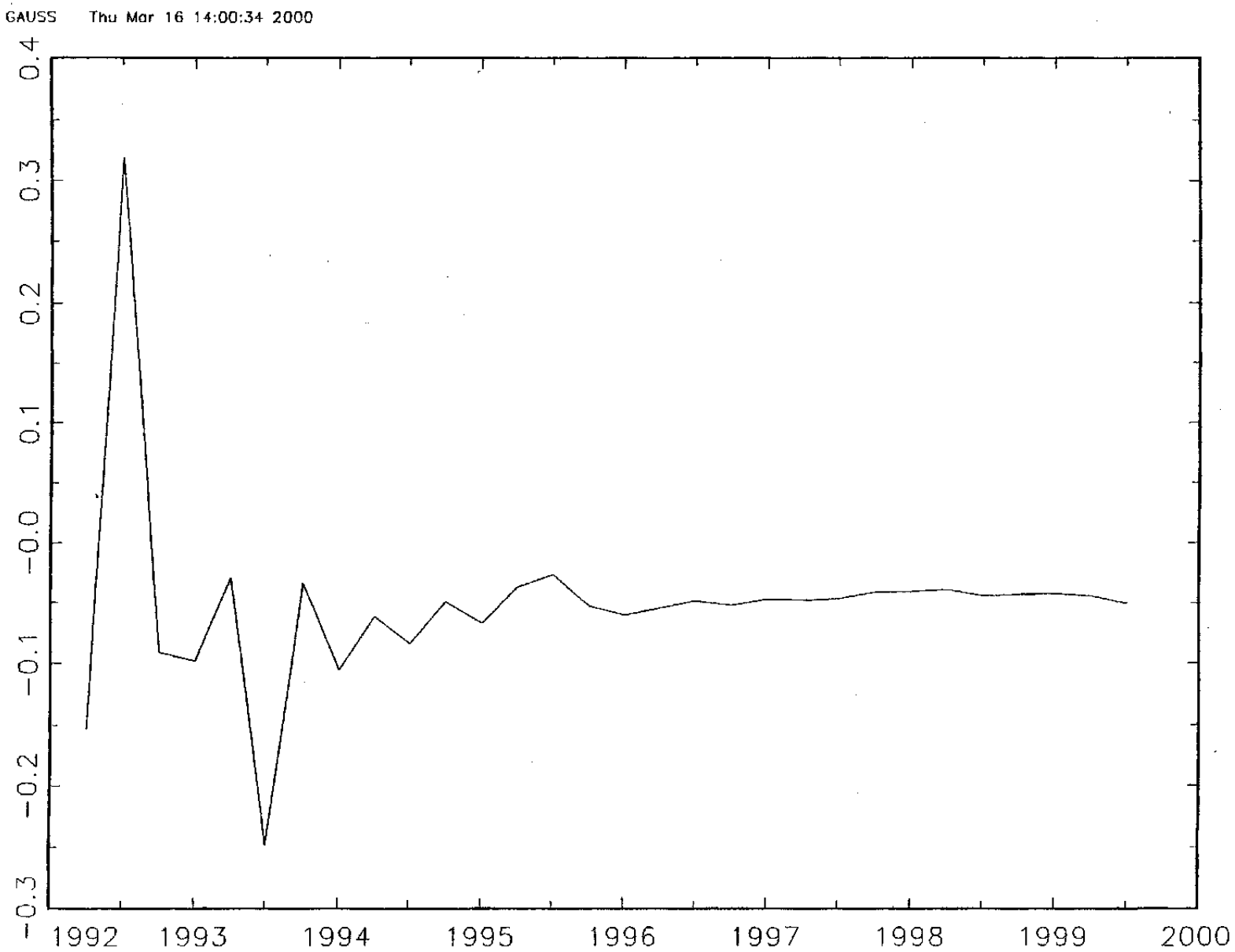


Figure 10. Chile: Smoothed Cost of Foreign Capital Coefficient

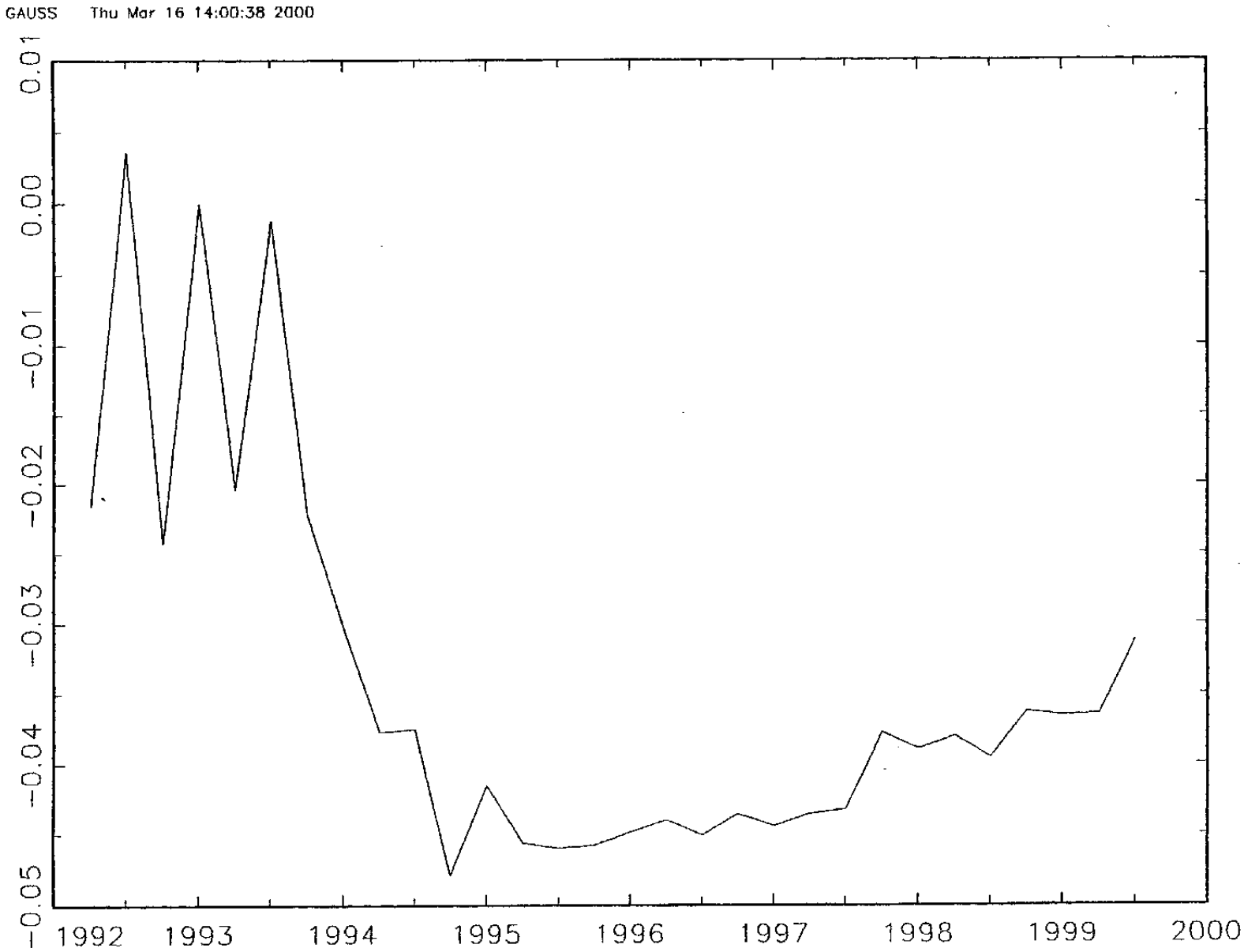


Figure 11. Chile: Smoothed Terms of Trade Coefficients

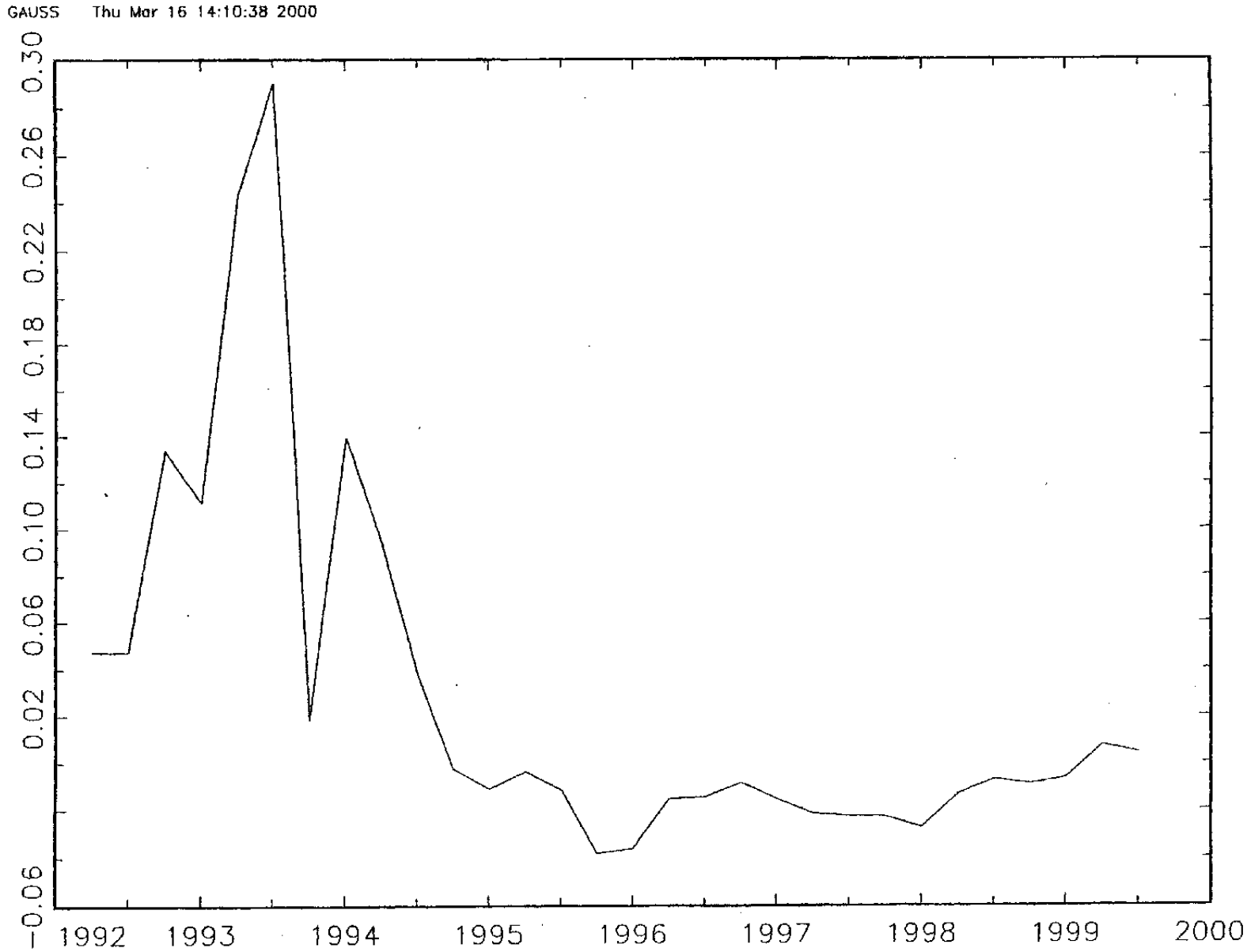


Figure 12. Chile: Smoothed Fiscal Impulse Coefficient

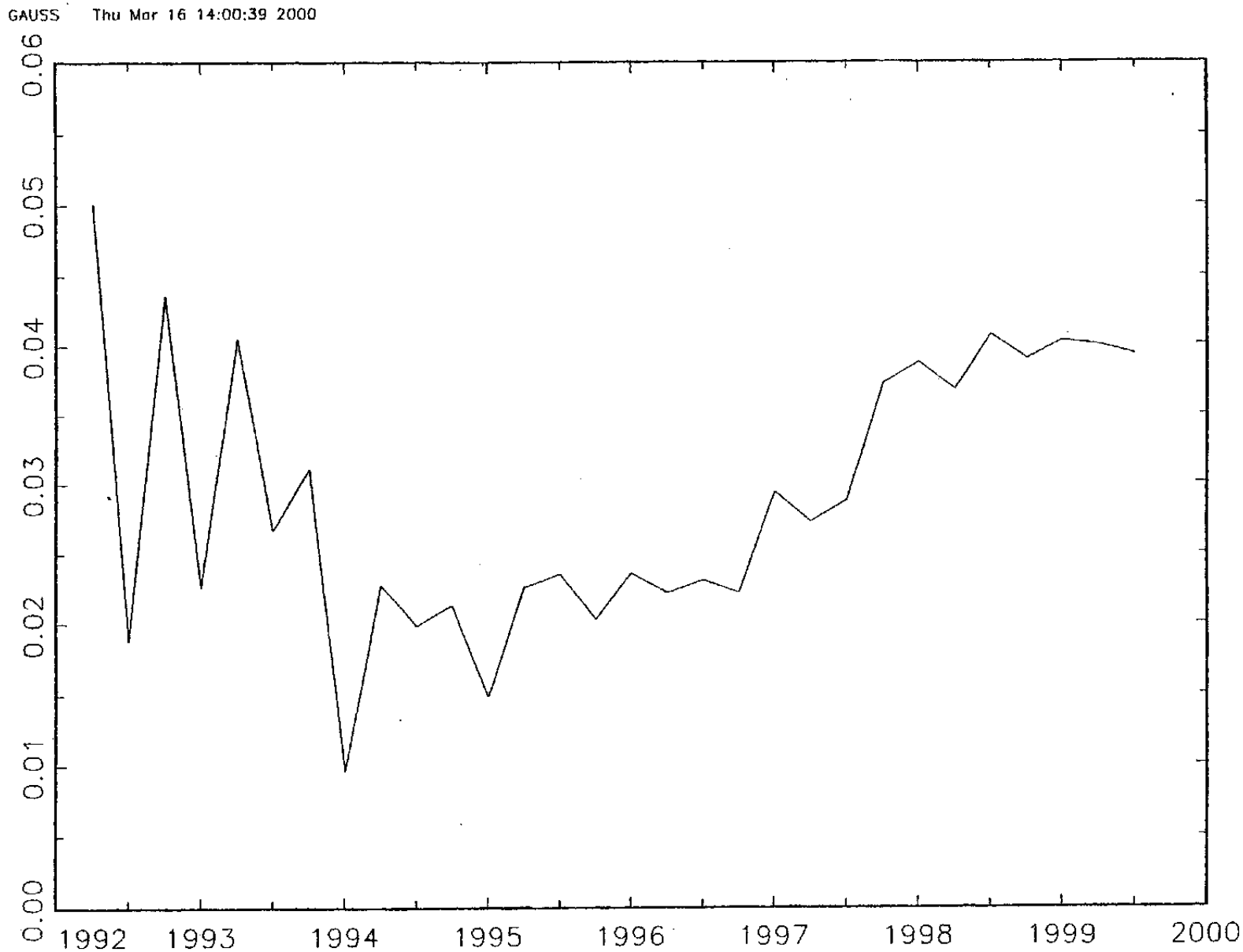


Figure 13. Chile: Smoothed Exchange Rate Coefficient

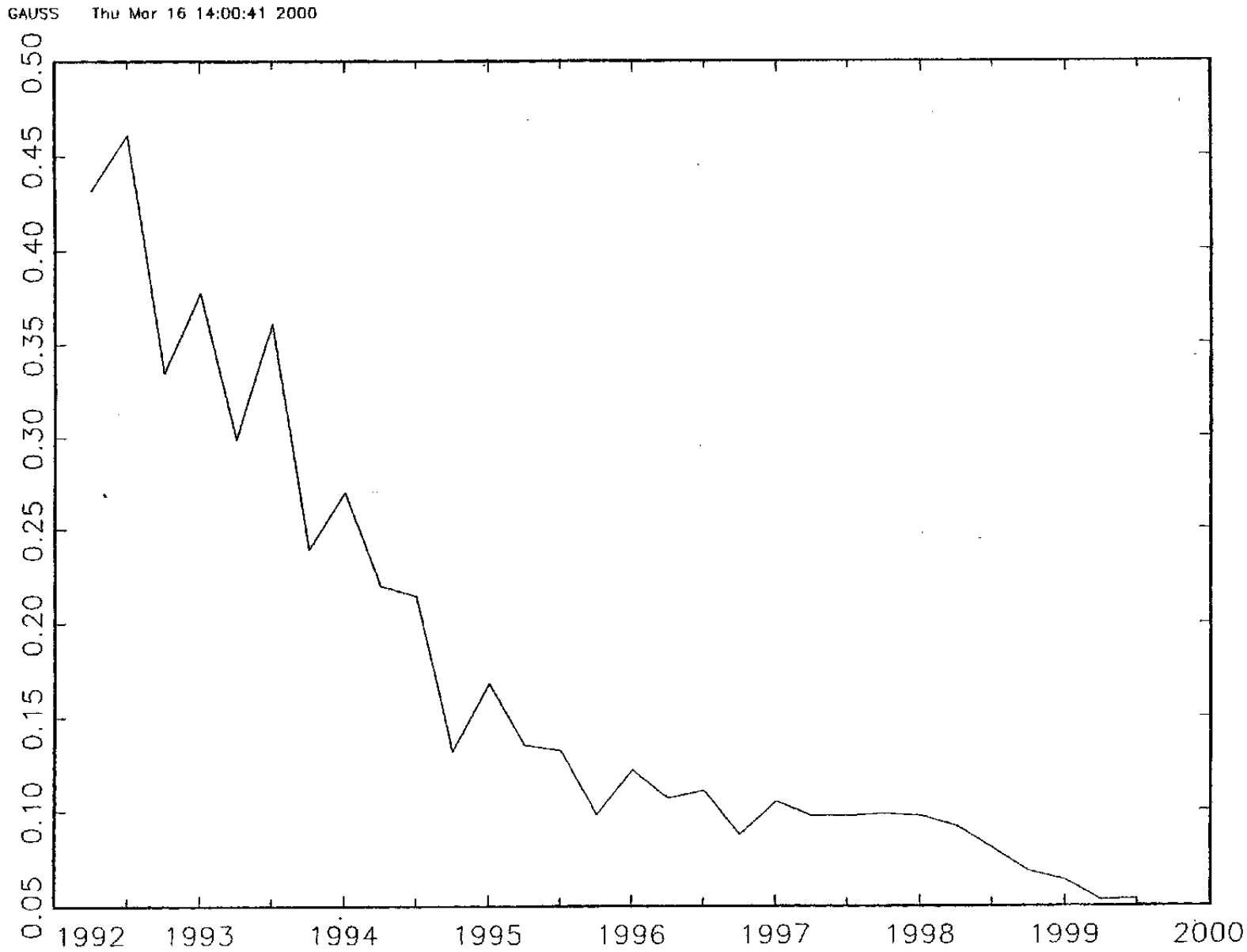
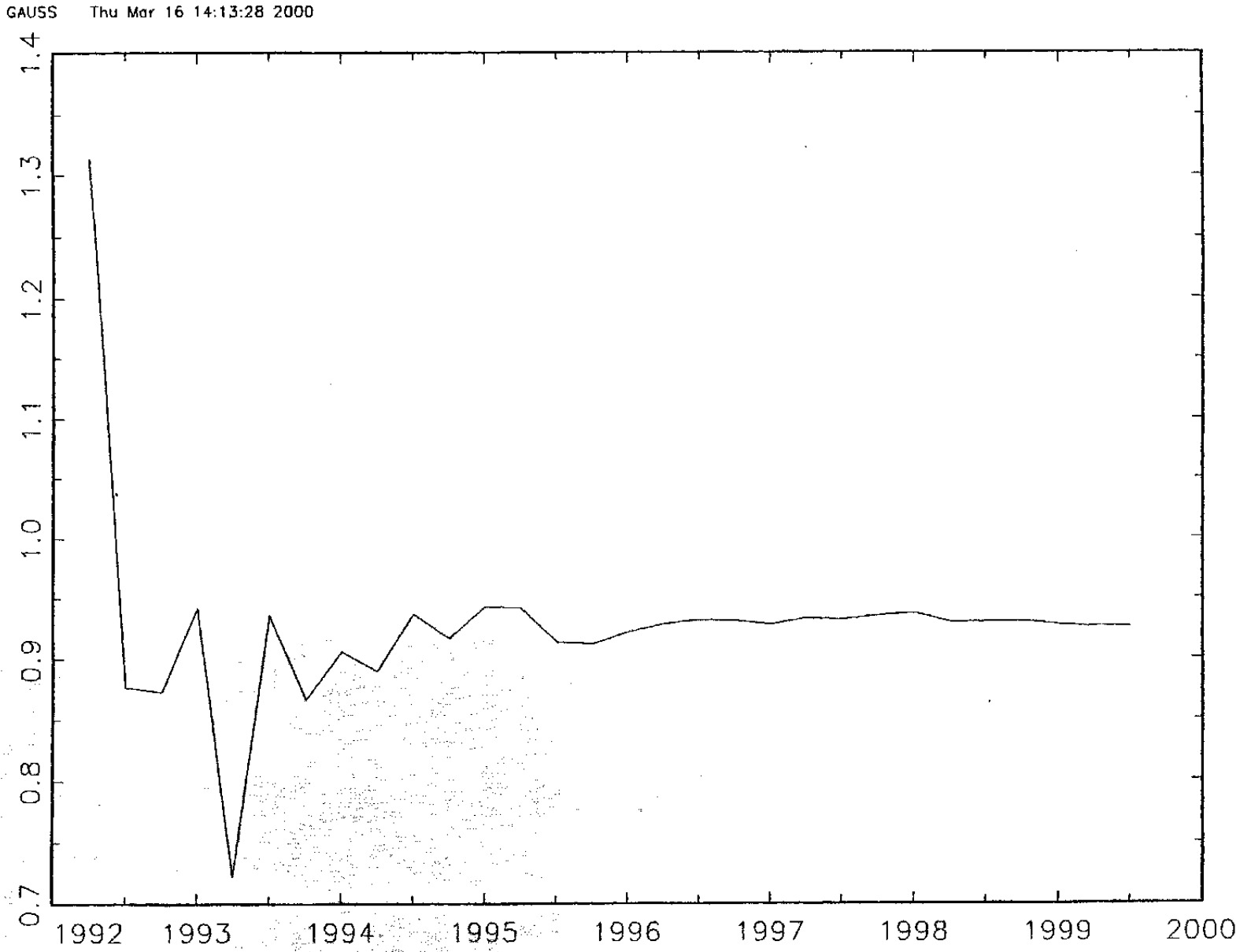


Figure 14. Chile: Smoothed Inflation Target Coefficient



into lower CPI inflation, other things equal. This is the asset-market channel of the monetary transmission mechanism. In an inflation targeting regime, in contrast, the cost of foreign financing is negatively correlated with domestic inflation. Briefly, under inflation targeting, because liquidity is endogenous, the asset-channel part of the transmission mechanism is weakened and thus, the negative correlation between changes in the cost of foreign financing and domestic inflation may prevail. There seems to be some indication that this happened in Chile.[21]

44. Second, the fiscal impulse coefficient is positive as expected. Interestingly, its weight in explaining inflation variance doubled between the end of 1996 and the mid-1998. It remained at that level thereafter.

45. Third, the pass-through of changes in the nominal exchange rate to CPI inflation varied over time significantly. As the inflation targeting regime acquired more credibility, the value of the pass-through coefficient fell. After mid-1995, and until the last year of the sample, the pass-through coefficient was stable at about 10 percent. It seems that when annual real GDP growth fell from 8 percent in the first quarter of 1998 to 5.9 percent in the second quarter of 1998, the pass-through coefficient also started to fall. It reached a value of less than 5 percent at the end of the sample period. Collins and Nadal-De Simone (1996) show that the "pass-through coefficient" depends at a minimum, on the structure of the economy, on the nature of the shocks affecting the economy, on the composition of the CPI regimen, and on the central bank's operating procedure. One implication they draw is that pass-through coefficients are likely to be econometrically unstable across policy regimes as well as across time within the same policy regime. This econometric study seems to validate that conclusion.

46. Finally, judging from Figure 14, the smoothed inflation target coefficient remained quite stable after 1994. Given the framework used in this study, this seems to be compelling evidence that the credibility of the Chilean inflation target framework was well established since the mid-1990s.

Estimation of selected time series models

47. A number of models based on Box-Jenkins techniques was also estimated. A reduced set of selected estimation results is reported in Table 5. The reported results refer to an AR(1), an AR(2), and an AR(1) transfer function model. The models are:

$$\pi_t = \phi_1 \pi_{t-1} + \varepsilon_t, \tag{10}$$

$$\pi_t = \phi_1 \pi_{t-1} + \phi_2 \pi_{t-2} + \varepsilon_t, \tag{11}$$

$$\pi_t = \phi_1 \pi_{t-1} + \theta_1 z_t + \varepsilon_t, \tag{12}$$

[21] Nadal-De Simone (1999) confirms this point using data for New Zealand.

Table 5. Chile: Time Series Models of Chilean Inflation
(1990:1–1999:3)

Model	Coefficients			Serial Correlation Tests			$\overline{R}^2$	Forecast	Theil's Inequidity
	ϕ_1	ϕ_2	θ_1	Q(8)	Q(16)	Q(24)			
AR (1) $y_t = \phi_1 y_{t-1} + \varepsilon_t$	0.1349 (0.0610)			18.13*	23.08	31.12	4.73	4.57 4.62 4.65 4.25	0.001 0.054 0.079 0.106
AR (2) $y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \varepsilon_t$	0.1179 (0.0872)	0.0183 (0.0661)		18.43*	23.03	30.97	2.07	4.56 4.59 4.62 4.21	0.001 0.052 0.076 0.103
AR (1) Intervention Model $y_t = \phi_1 y_{t-1} + \theta_1 z_t + \varepsilon_t$	0.1599 (0.0620)		0.9620 (0.0189)	18.88*	25.08*	32.62	96.07	4.35 4.32 4.18 3.69	0.024 0.036 0.046 0.063

where π_t is measured as the deviation of annual inflation with respect to the pre-announced official inflation target in equations (10) and (11), and it is measured as annual inflation in equation (12); z_t is the pre-announced official inflation target. Model (12) assumes that z_t is exogenous.

48. The AR(1) and AR(2) models show serial correlation in the first 8 lags while the AR(1) transfer function model also shows serial correlation in the first 16 lags. The AR(1) and AR(2) models have low R^2 while the AR(1) transfer function model has a reasonable R^2 (this is obviously biased upward by the presence of serial correlation in the residuals).

49. Based on the Theil's inequality coefficient for the first-step forecast, the AR(1) and AR(2) models do better than version two of the time-varying Phillips curve model and the open economy model (Table 6 has a summary of forecast results). However, the relative performance of models AR(1) and AR(2) deteriorates rapidly for subsequent forecast periods so that the time-varying Phillips curve model outperforms them. The time-series models still do better than the open economy model of inflation.

50. The AR(1) transfer function model does better than the time-varying Phillips curve model and the open economy model up to the third-period forecast. It does still better than the open economy model for the fourth-period forecast.

51. However, although the AR(1) transfer function model does better for short-run forecasts than the AR(1) and AR(2) models, it is likely that this ranking will change when the monetary policy regime enters its steady state during 2000 because the inflation target variance will become constant, i.e., its information content will fall. It will then be relatively important that the deterioration of the out-of-sample forecasts of the different models of inflation is not significant as subsequent periods are added to the forecast. On the basis of this criterion, i.e., for the medium term, it seems that the time-varying Phillips curve model and the open economy model do relatively better than the AR(1) transfer function model. The open economy model forecasts actually show quite a remarkable stability in terms of bias and variance. The second version of the time-varying parameter Phillips curve model, given that it is relatively parsimonious, also does a good forecasting job.[22] However, as with the AR(1) transfer model, it remains to be seen whether the time-varying Phillips curve model will still be the best specification of the inflation process in Chile after 2000. It is possible that a richer structure becomes then necessary.

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[22] For the United States, Stock and Watson (1999) have shown that a stand-alone *conventional Phillips curve* generally produces more accurate forecasts than other macroeconomic variables, including interest rates, money, and commodity prices. However, it is inferior to a generalized Phillips curve model based on measures of real activity other than unemployment such as an index based on a large number of real economic indicators.

Table 6. Chile: Summary of Inflation Forecasts 1/

	TVP-Phillips Curve, Version 1	TVP-Phillips Curve, Version 2	Open Economy	AR (1)	AR (2)	AR (1) Transfer Function
Forecasts	5.34	4.71	4.77	4.57	4.56	4.35
	4.79	4.57	5.52	4.62	4.59	4.32
	4.28	4.15	4.61	4.65	4.62	4.18
	3.97	3.44	3.91	4.25	4.21	3.69
Theil's Inequality Coefficient	0.078	0.015	0.022	0.001	0.001	0.024
	0.087	0.051	0.120	0.054	0.052	0.036
	0.084	0.054	0.120	0.079	0.076	0.046
	0.098	0.058	0.122	0.106	0.103	0.063
Root Mean-Square Forecast Percent Error	0.169	0.031	0.045	0.001	0.001	0.047
	0.193	0.115	0.285	0.122	0.117	0.076
	0.184	0.119	0.275	0.182	0.176	0.100
	0.238	0.134	0.291	0.274	0.266	0.156
Mean Forecast Percent Error	0.169	0.031	0.045	0.001	-0.001	-0.047
	0.192	0.095	0.223	0.087	0.082	0.025
	0.183	0.106	0.233	0.146	0.140	0.062
	0.226	0.123	0.258	0.222	0.214	0.111

1/ In the period 1998:4-1998:3, inflation was: 4.57, 3.94, 3.68, 2.93

E. Conclusions

52. The objective of this study is to estimate and forecast inflation in Chile using a state-space framework. Two models of inflation are estimated and used for out-of-sample forecasting of Chilean inflation. The first model is a time-varying Phillips curve model estimated in two versions; version one excludes the pre-announced official inflation target point and version two includes it. The second model is a reduced form model of a small open economy that does inflation targeting. The results of those estimations are compared with those of simple Box-Jenkins specifications of the inflation process in Chile. The sample period comprises 1990:1–1999:3, a period which is one year short of the steady state of the monetary policy regime, i.e., a regime in which the authorities target annual inflation between 2 percent and 4 percent on a permanent basis.

53. Models that include the pre-announced official inflation target are to be preferred to those that exclude this variable. Although including the pre-announced official inflation target introduces some serial correlation in the residuals, it also reduces forecasts errors significantly.

54. The out-of-sample performance of the time-varying Phillips curve model that includes the official pre-announced inflation target point is more favorable than the out-of-sample performance of small open economy model—which includes the pre-announced official inflation target point. In contrast, the statistics for the out-of-sample forecasts of the small open economy model are relatively more stable.

55. For the first step of the out-of-sample forecast, the Box-Jenkins models of inflation tend to do better than the time-varying Phillips curve model that includes the pre-announced official inflation target. However, their relative forecasting superiority deteriorates rapidly for forecasts further out in time.

56. An AR(1) transfer function model does better than both the time-varying parameter Phillips curve model and the open economy model, up to the third out-of-sample forecast. It still does better than the open economy model for the fourth out-of-sample forecast.

57. A note of caution is necessary, however. It is quite likely that the ranking of models performance will change when the monetary policy regime enters its steady state in 2001. The variance of inflation will probably depend on terms of trade shocks, productivity shocks, the fiscal position, the exchange rate, and the like; the variance of the inflation target will in contrast be constant, and will thus have, ceteris paribus, no power in explaining actual inflation. It will then become important to reassess the forecasting performance of the models paying particular attention that the quality of the forecasts in the medium term does not deteriorate rapidly. In that case, it is likely that models less parsimonious than the time series models of Box-Jenkins will become necessary.

State-Space Models

58. A state space model consists of two equations: a measurement (or output) equation and a state (or transition) equation. The measurement equation relates the set of observed variables to the set of unobserved state variables. The state equation describes the dynamics of the state variables.

59. The following five equations describe what can be called a representative state-space model:

$$y_t = H_t\beta_t + Az_t + e_t, \tag{A1.1}$$

$$\beta_t = \mu + F\beta_{t-1} + v_t, \tag{A1.2}$$

$$e_t \approx \mathrm{N}(0,R), \tag{A1.3}$$

$$v_t \approx \mathrm{N}(0,Q), \tag{A1.4}$$

$$\mathrm{E}(e_t, v_s') = 0, \tag{A1.5}$$

where y_t is a n x 1 vector of observed variables at time t; β_t is a k x 1 vector of unobserved state variables; H_t is an n x k matrix that links the observed y_t vector and the unobserved β_t; A is an n x r matrix of parameters; z_t is an r x 1 vector of exogenous or predetermined observed variables; μ and v_t are k x 1 vectors of constants and white noise processes, respectively; and F is an k x k matrix of parameters. Equations (A1.1) and (A1.2) are the measurement and the state equations, respectively. Equations (A1.3)–(A1.5) state that the sequences e_t and v_t follow normal processes with zero means and variances R and Q, respectively, and are uncorrelated. Note that elements of the matrix H_t can be either a set of constant parameters or data on exogenous variables. In the former case, equation (A1.1) is part of an unobserved-component model; in the latter case, equation (A1.1) is a time-varying parameter model.

60. State-space models have many applications. They have been used to estimate unobserved variables such as expected inflation (Burmeister *et al*, 1986), the ex ante real interest rate (García and Perron, 1996), and the common factor of major macroeconomic variables which we call business cycle (Stock and Watson, 1991). Alternatively, state-space models have been applied to the estimation of time-varying parameter models (Kim and Nelson, 1989) which give us insights as to how rational economic agents update their estimates of the coefficients of the model in a Bayesian manner when new information becomes available in a world of uncertainty, especially under changing policy regimes. Finally, state-space models have been combined with Markov-switching models of the business cycle to take into account not only that economic agents learn about the state of the economy and the coefficients of the model over time, but also to take into account that

economic processes may not be symmetric, for example, over the business cycle, or that there is also uncertainty due to the presence of heteroskedasticity in random shocks (Diebold and Rudebusch, 1996).[23] In this case, changes in the conditional variance of the forecast error are viewed, in part, as a result of endogenous regime changes in the variance structure.

61. Equation (A1.3) of the representative state-space model (A1.1)–(A1.5) can be modified to incorporate changing uncertainty due to changes in the variance of future random shocks. By considering Markov-switching heteroskedasticity in the disturbance term e_t, it is assumed that part of the changes in the conditional variance of the forecast error result from endogenous regime changes in the variance structure.[24] A state-space model with Markov switching can be represented by substituting equation (A1.3') in the model (A1.1)–(A1.5) by the following:

$$e_t \approx \mathrm{N}\left(0, \sigma^2_{e,S_t}\right), \tag{A1.3'}$$

such that

$$\sigma^2_{e,S_t} = \sigma^2_0 + \left(\sigma^2_1 - \sigma^2_0\right)S_t, \qquad \sigma^2_1 > \sigma^2_0, \tag{A1.6}$$

$$\Pr[S_t = 1 \mid S_{t-1} = 1] = p_{11}, \tag{A1.7a}$$

$$\Pr[S_t = 0 \mid S_{t-1} = 0] = p_{00}. \tag{A1.7b}$$

The variance of the error term e_t is a discrete variable S_t which evolution depends on S_{t-1} only, i.e., S_t follows an order 1 Markov process. The process is a two-state process with transition probabilities described by equations (A1.7a) and (A1.7b).

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[23] Until recently, it was not possible to address the state-space estimation problem at the same time than the regime-switching estimation problem. However, the algorithm for approximate maximum likelihood estimation developed by Kim (1993a, 1993b, 1994) has made operational a broad class of state-space models with regime switching.

[24] A major difference between ARCH and Markov-switching heteroskedasticity is that whereas the unconditional variance is constant for the former, the unconditional variance is subject to shifts (structural changes) for the latter.

The Output Gap Model

62. Following Clark (1987), the output gap is estimated by modeling output as the sum of two independent unobserved components, a local linear trend and an autoregressive process of order two. Assume

$$y_t = T_t + X_t, \tag{A2.1}$$

$$T_t = T_{t-1} + g_t + h_t, \tag{A2.2}$$

$$g_t = g_{t-1} + w_t, \tag{A2.3}$$

$$X_t = \theta_1 x_{t-1} + \theta_2 x_{t-2} + l_t, \tag{A2.4}$$

$$h_t \approx \mathrm{N}\left(0, \sigma_h^2\right), \tag{A2.5}$$

$$w_t \approx \mathrm{N}\left(0, \sigma_w^2\right), \tag{A2.6}$$

$$l_t \approx \mathrm{N}\left(0, \sigma_l^2\right), \tag{A2.7}$$

where y_t is real GDP, and T_t and X_t are its stochastic trend and its cyclical components, respectively. The stochastic trend is modeled as a local linear trend with a drift term g_t included to account for changes in Chilean "productivity growth" over the sample period.[25] The local linear trend model is interesting because not only the trend T_t is described as a random walk process but also *changes in the trend* are assumed to follow a random walk plus noise process. The cyclical component of output is modeled as a stationary autoregressive process of second order.[26] The variables h_t, w_t, and l_t are independent zero-mean, constant variance processes as described in equations (A2.5)–(A2.7).

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[25] This measure of "productivity growth" includes changes in factor endowments.

[26] Lucas' model has an AR(1) for the cyclical component of output. In contrast, in this study, the data generating process of the cyclical component of output is described as an AR(2). As in Lucas, the stationarity assumption is imposed.

A Model of a Small Open Economy with Inflation Targeting

63. This appendix briefly discusses a linear rational expectations model of a small open economy with nominal rigidity in the goods market. The main feature of the model is that it is able to replicate under *monetary targeting* the three basic empirical regularities of the post-1971 floating exchange rate period. Those regularities are: (1) exchange rates respond more promptly to shocks than do national price levels; (2) the pure random component of exchange rate fluctuations is greater than the pure random component of national price level fluctuations and; (3) relative prices of foreign goods exhibit a great deal of persistence. The model is adapted to an *inflation targeting regime* by modeling the policy rule of the monetary authority accordingly.

64. Assume a small open economy that produces two goods, some of which are exported. The economy also imports and consumes foreign goods. The price of domestic goods (p_t) is determined mostly by domestic forces while the price of foreign goods (p_t^*) is determined in world markets. With all variables except interest rates in logs, the model is

$$y_t^d = a_0 - a_1 r_t + a_2 q_t + a_3 y_t^* + a_4 d_t + u_t \quad \text{(A3.1)}$$
$$r_t = r_t^* + \alpha E_t (q_{t+1} - q_t) \quad \text{(A3.2)}$$
$$q_t = e_t + p_t^* - p_t \quad \text{(A3.3)}$$
$$y_t^s = T_t + \xi (p_t - E_{t-1} \bar{p}_t) + u_t \quad \text{(A3.4)}$$
$$P_t = \alpha p_t + (1 - \alpha)(f_t + p_t^*) \quad \text{(A3.5)}$$
$$m_t - P_t = b_0 + b_1 y_t - b_2 i_t + \chi_t \quad \text{(A3.6)}$$
$$i_t = i_t^* + E_t (f_{t+1} - f_t) + \rho_t \quad \text{(A3.7)}$$
$$i_t^* = r_t^* + E_t (p_{t+1}^* - p_t^*); \quad \text{(A3.8)}$$

where y_t^d is the demand for domestic output, r_t is the domestic real interest rate, q_t is the real exchange rate, y_t^* is foreign output, d_t is a measure of fiscal impulse, u_t is an output demand disturbance, r_t^* is the foreign real interest rate, f_t is the nominal exchange rate, p_t^* is the price of foreign output, p_t is the price of domestic goods, y_t^s is the supply of domestic output, T_t is potential output, u_t is an output supply shock, P_t is the general price level as measured by the consumer price index (CPI), α is the share of domestic goods in the CPI regimen, m_t is a broad measure of the money stock, i_t is the nominal interest rate, i_t^* is the foreign nominal interest rate, ρ_t is a measure of risk premium, and χ_t is a money demand disturbance.

65. Equation (A3.1) is a standard IS curve for a small open economy.[27] Equation (A3.2) posits real interest parity, consistent with the empirical evidence (Obstfeld and Rogoff,

[27] McCallum and Nelson (1997) show that the standard IS equation requires the addition of expected future income to be consistent with a fully optimizing model Given the econometric procedure used to estimate and forecast inflation in this paper, the use of the standard IS equation is innocuous.

1996).[28] The term α is needed in equation (A3.2) so that the rates of return on domestic and foreign assets are measured in the same units. The rate of return on domestic assets, or the domestic real interest rate r_t, is measured in terms of a basket of goods that includes both foreign and domestic goods. In contrast, the foreign interest rate r_t^* is measured using a basket of goods that comprises only foreign goods.[29] Equations (A3.1) and (A3.2) together imply that the current account—not explicitly modelled—is a function of q_t and y_t^*, making the current account balance consistent with equilibrium in **both** the domestic goods market and the asset market. Equation (A3.3) defines the real exchange rate. Aggregate supply behavior is represented by equation (A3.4), which embodies the "natural rate" hypothesis (see also equation A3.9 below). Equation (A3.5) defines the overall price level in terms of the prices of domestic and foreign goods. Equation (A3.6) describes the demand for money. Equation (A3.7) is uncovered interest parity and equation (A3.8) is the Fisher effect. Expectations are rational, and the information set dated at time (t) is common to market participants and to the central bank. Potential output (T_t) follows a random walk with a drift, or productivity growth term, as described in Appendix II. Similarly, foreign potential output follows a random walk with a drift, or productivity growth term. The stochastic processes assumed for domestic and foreign output allow the model to replicate the third regularity observed in the exchange rate data during the floating period.

66. Following McCallum (1989), "price stickiness" is introduced simply by assuming that domestic good prices are set at the value ($\bar{p}_t$) that is expected in period (t-1) to clear the market

$$p_t = E_{t-1}\,\bar{p}_t \qquad \text{(A3.9)}$$

Therefore, p_t is the price that would prevail in the goods market if there were no unexpected shocks. The idea of (A3.9) is that market participants find it optimal to preset prices at levels that are expected to clear the market next period.[30] However, unexpected demand and supply shocks will make output realizations to be different from expected values. As a result, current period output is demand-determined, given the price preset for the current period by producers based on their information at the end of previous period.[31] This formulation allows temporary

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[28] Frankel (1991) found that during the floating exchange rate period--after the liberalization of capital account transactions--real interest rate differentials have been highly correlated with changes in the real exchange rate, or "currency risk" in his terminology.

[29] Technically, this can be seen by taking expectations in equation (A3.5), and using the expression to replace the term $E_t(P_{t+1} - P_t)$ in a Fisher effect equation such as (A3.7), but for the home country.

[30] This assumption could presumably be justified by the existence of menu costs or, more generally, by the costs of gathering and processing information (Brunner *et al.*, 1983).

rigidity of domestic good prices while permitting full adjustment of prices in later periods. As a result, the model will reflect the first two regularities found in the data during the floating period.

67. Equations (A3.1)–(A3.9) form the *core model*. Nadal-De Simone (1999) discusses the steady state and the stochastic solution of the core model under two monetary regimes. The first regime is monetary targeting, and assumes a Friedman's rule for the stochastic process followed by the money stock m_t. The second regime is inflation targeting.[32] Importantly, under monetary targeting, simulations show that the model does replicate the regularities observed in the behavior of exchange rates during the post-1971 floating period.

68. When applied to an inflation targeting economy, the core model requires the specification of the feedback function of the monetary authority. The form of this policy reaction function chosen is a standard representation suggested by McCallum (1999), but adapted to reflect the fact that in Chile the operating instrument of the CBCH is a real interest rate

$$r_t = r_{t-1} - \lambda [E_t (P_{t+1} - P_t) - c_t]. \qquad \text{(A3.11)}$$

The second term of (A3.11) measures expected deviations of the inflation rate from the target (c_t).[33] In particular, the real interest rate is adjusted upward when expected inflation exceeds the inflation target (c_t), with the reaction coefficient λ measuring the strength of the adjustment. The second term of (A3.11) corresponds to the log of the inflation forecast targeting loss function of the central bank (equation (2.10) in Svensson, 1997). Inflation targeting implies inflation *forecast* targeting.

69. Finally, equation (A3.6) is superfluous to the extent that m_t is not part of the right-hand side of any equation in the system. Equation (A3.6) has been kept, however, because it determines the behavior of the money stock that is necessary to support the policy reaction function (A3.11).

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[31] This implies that the analytical solution of the model will depend on last period state variables. It is consistent with McCallum and Nelson (1999) who argue that the monetary authority and/or agents normally do not know the realizations of contemporaneous variables when they make their decisions. This is particularly significant in the case of potential output.

[32] The core model in Nadal-De Simone (1999) includes the fiscal impulse measure in the random shock υ_t, and makes the risk premium ρ_t constant.

[33] For analytical simplicity, only one period ahead forecast is considered. In fact, the monetary authority considers expected deviations from the inflation target over a number of periods, say for example, one to three years.

70. Drawing on Nadal-De Simone (1999), changes in domestic prices are a function of the following state variables

$$\pi_t = F(g_t, g_t^*, r_t^*, p_t^*, d_t, f_t, c_t) + \tau_t, \qquad \text{(A3.12)}$$

where the IS shock (υ_t), the output supply shock (u_t), and the money demand shock (χ_t) are included in the error term (τ_t); the risk premium ρ_t is measured as part of the overall cost of financing faced by the Chilean economy (r_t^*). The pre-announced official inflation target (c_t) is added to the core model; it is assumed to be an exogenous stationary process.

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III. The Impact of Monetary Policy on the Exchange Rate: International Evidence With Relevance For Chile [34]

A. Introduction

71. On September 2, 1999, the Central Bank of Chile discontinued its exchange rate band, which had been an integral part of its policy regime throughout the 1990s, and stated its intention to cease direct intervention in the foreign exchange market in all but exceptional circumstances. At the same time, it expressed its commitment to a continuous inflation target band of 2–4 percent, beginning in 2001, and for an indefinite period of time. In sum, the announcement marked a momentous change in the way monetary policy is conducted in Chile. Although Chile had used end-year point inflation targets to guide disinflationary expectations during earlier years, the exchange rate band continued to play an important role, both in slowing the appreciation of the currency during 1995–97, and in preventing its sharp depreciation in the face of bouts of speculative pressure during 1998. Thus, the September statement seals Chile's transition from a hybrid system to a classic inflation targeting regime, of the kind pioneered by New Zealand in the early years of the decade.

72. Perhaps ironically, abandoning the exchange rate band as a constraint in the conduct of monetary policy—and with it, foreign exchange market intervention as a way of meeting that constraint—implies that the question of how monetary policy affects the exchange rate will become *more* important than before. There are two ways in which this is true. First, in a small open economy with floating exchange rates, the exchange rate constitutes one of the main channels (along with market interest rates and perhaps credit) through which monetary policy affects nominal output and prices. Thus, the ability to predict the impact of monetary policy actions on the exchange rate is essential to gauge their effect on the ultimate targets. Second, in Chile, as elsewhere, the central bank retains an overall responsibility for the stability of the financial system.[35] In an economy as open and potentially vulnerable to external shocks, this may require stabilizing the exchange rate in times of turbulence. While the language of the central bank's September announcement suggests that the bank does not

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[35] This is explicitly recognized by the central bank law, which defines the objectives of the central bank as "safeguarding the stability of the currency and the normal functioning of internal and external payments". See *Banco Central de Chile* (2000), p. 3.

exclude resorting to direct intervention in such circumstances, the scope for intervention is limited by the availability of reserves. Interest rate policy remains the key potential instrument in fending off speculative pressures, and one would want to know about its effectiveness in doing so.

73. Thus far, there seems to be no satisfactory empirical answer to the questions posed in the previous paragraph, i.e. on the effect of monetary policy on the exchange rate in a small open economy such as Chile, either at normal times or at times of financial turbulence. While there is a consensus prediction on how monetary policy should normally affect the exchange rate—it should appreciate after contractions and depreciate after expansions, with some overshooting at the outset—backing this prediction empirically turns out to be remarkably hard for countries other than the United States. For example, studies based on simple vector autorregressions (VARs) in the early 1990s which looked at European countries tended to find either insignificant effects, of significant effects in the opposite direction of what standard models would predict.[36] As regards the impact of monetary policy on exchange rates in times of distress, there is little consensus even at the theoretical level, and among policy practitioners, particularly after the Asia crisis. At the most general level, Furman and Stiglitz (1998) have reminded us that the standard theoretical prediction does not necessarily follow from arbitrage arguments: even if uncovered interest rate parity holds, an increase in interest rates at home may lead to a depreciation of the domestic currency if there is an expectation that medium-term *future* exchange rates may be more depreciated (for example, because higher interest rates wreak havoc on domestic firms). As an empirical matter, the case against, or in favor, of a "conventional" effect of monetary policy on exchange rates in times of turbulence is not settled, in part because of the difficulty of disentangling cause and effect in the relationship between monetary policy and exchange rate movements. For example, does a significant correlation between exchange rate depreciation and high interest rates indicated counterproductive effects of tight money, or merely the fact that central banks tend to tighten policy when the currency comes under pressure? The same interpretational difficulty may arise in a vector autoregression (VAR) which assumes that the central bank's policy variable does not contemporaneously depend on the exchange rate (see Zettelmeyer, 2000, for details).

74. This paper takes a step in the direction of providing an answer to these questions. The strategy is as follows. First, as the difficulty of disentangling cause and effect of monetary policy appears to be *the* methodological problem that drives the ambiguities of the empirical literature, we do not perform a VAR-based analysis (which in economies where monetary policy is generally contemporaneously endogenous to the exchange rate is bound to be sensitive to the identifying restrictions chosen), but instead choose a non-VAR methodology which focuses on the *impact* effect of monetary policy actions on the exchange rate on the day of policy announcements. The cost of this choice is that we loose the ability to track the *dynamic* response of policy through impulse response functions computed based on VAR.

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[36] See Grilli and Roubini (1995, 1996) and, for further references, Zettelmeyer (2000).

However, this may be a price worth paying if it enables one to clearly identify the effects of monetary policy shocks on the exchange rate on impact. Second, given Chile's short experience with floating exchange rates so far (even counting the relatively brief period prior to September 1999 during which the Chilean peso was freely floating within the exchange rate band) the empirical evidence brought to bear in this paper will inevitably need to draw on the experience of other countries. Three countries—Australia, Canada, and New Zealand—were chosen on the basis of common characteristics suggesting that their experience is useful in predicting how the exchange rate might be expected to react to monetary policy in Chile in the coming years. Chile, Australia, Canada and New Zealand are all (1) commodity exporters with a high degree of openness both to trade and capital flows; (2) inflation targeters with floating exchange rate regimes, in the sense that direct foreign exchange market intervention occurs rarely (Australia, Canada, and now Chile) or never (New Zealand);[37] (3) small- to medium-size economies relative to the United States, which is the largest trading partner for Canada and Chile and the second largest for Australia and New Zealand. The main difference between Chile and the other three are obviously the level of industrialization and per capita income, and the potential vulnerability to sudden capital flow reversals, which remains higher for Chile as an advanced emerging market economy. The latter, in particular, implies that caution needs to be exercised when applying the results from Canada, Australia and New Zealand to Chile, at least in the short term (see concluding section).

75. The main results are as follows. First, we find a significant response of the exchange rate to policy shocks in the direction conventionally assumed (a contraction leads to an appreciation). Moreover, the magnitude of this direction is very similar across the three countries. Second, monetary policy shocks appear to work in the conventional direction even in times of turbulence. On no occasion do we find a depreciation of the currency in response to a tightening. However, we observe several cases in which monetary policy is tightened in reaction to pressure on the currency, and the initial depreciation to which the authorities were reacting is *not offset* by a recovery by the end of the trading day (although press reports generally note that some recovery was observed following the central bank action). On this basis, it is easy to see how correlations between daily exchange and interest rate changes, even when restricted to days on which policy announcements occurred, can give the mistaken impression that interest rate hikes lead to exchange rate depreciation. At the same time, these cases also raise questions about the overall effectiveness of interest rate hikes in resisting an attack, which we briefly take up in the conclusion.

76. In the first section that follows, the methodology is presented in some detail. We then turn to the data and results for Canada, Australia and New Zealand. The available data for Chile is reviewed next. While much too short to draw strong conclusions, it appears broadly consistent with the findings for the other countries. A concluding section summarizes the results and puts them in perspective.

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[37] See Zettelmeyer (2000) for details.

B. Method

77. The approach taken in this paper is to study the instantaneous—i.e. same day—response of exchange rates to specific monetary policy actions, such as changes in official interest rates or the overnight rate target, where the reaction of the three-month T-bill or a similar market determined rate is used as a measure of the unanticipated content of the action. In other words, the proposal is to run:

$$\Delta e_t = \alpha + \beta \Delta i_{3m,t} + \varepsilon_t \qquad (1)$$

where $\Delta i_{3m,t}$ is the change in the three month interest rate on the day of a policy announcement and Δe_t is the change in the exchange rate on the same day (defined such that an increase denotes an appreciation). Thus, the regression proposed does *not* use the full time series of daily changes in the exchange and interest rates, but only changes on the days of policy events. The constant α is included to capture any trend depreciation (as we shall see, it will generally be insignificant). In what follows, we justify (1) the focus on a narrow time window around the policy announcement, between market closing on the market day of the announcement and market closing on the previous day, and (2) the use of the change in the three month treasury bill interest rate (or similar rate of maturity between, say, one and twelve months) during this time interval as a measure of the unanticipated content of a policy action.

78. Using daily data—i.e. the highest frequency data that is readily obtained for the countries and time periods in which we are interested—is justified by the fact that both the left and right hand side variables in regression (1) are asset prices in liquid markets, and should jump instantaneously in response to new information such as a monetary policy announcement. Thus, for the purposes of studying the impact effect of monetary policy on the exchange rate, no information should be lost by restricting the focus to the day of the policy announcement. Moreover, the use of a short time interval around the policy announcement is key to the claim that the proposed methodology avoids the endogeneity problem that plagues much of the existing empirical literature on the subject. Depending on the institutional setup of the central bank, one may be able to argue that the actions of the central bank are very unlikely to be based on economic information that becomes available *on the same day* of the policy action, or at least that this is sufficiently rare so that exceptions can be identified based on press reports (see below). In contrast, if we used lower frequency data (say, the month or quarter in which the overnight target was changed), it would be impossible to argue that the policy event itself was not, in general, a reaction to contemporaneous (i.e., within-period) economic news.[38]

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[38] The identification approach used in this paper could be integrated into a VAR by simply using the sum of the shocks on the dates of policy actions in each month as an exogenous input (see Skinner and Zettelmeyer 1995b). However, this assumes that the dates at which we

(continued...)

79. The reaction of the three month interest rate in response to a policy announcement is a plausible measure of the surprise content of the announcement for two reasons. First, given the widely documented and accepted fact that central banks can control very short interest rates, most economists would agree that the three-month T-bill rate is *sufficiently short* that it will react to unanticipated monetary policy actions such as surprise changes in the overnight rate target. On the other hand, the three-month T-bill rate is *sufficiently long* that it will, to a first approximation, react to monetary actions *only to the extent that they are unanticipated.* Any anticipation would have been "discounted", in the sense that it would have been reflected in the closing rate on the day preceding the policy action. Of course, the same arguments apply to money market rates of somewhat shorter or longer maturity, and the results will be checked for robustness using several alternative interest rates as right hand side measures of the policy surprise. [39]

80. This said, two potential problems need to be dealt with:

- One drawback of using a market interest rate as a measure of the policy shock is that changes in this variable may obviously reflect other shocks—say, news about domestic activity, or external finance premia—that coincidentally occur on the day of a policy announcement. In other words, the change in the three month rate on the day of a policy announcement may contain some "noise", in addition to carrying a "signal" about the policy decision. In general, this will bias the estimate of the direct effect of the policy shock on exchange rates. Fortunately, there is a straightforward remedy, which is to use the underlying change in the policy target as an instrument in regression (1). This instrument is correlated with the change in the three month rate on the day of the policy announcement. However—provided the policy action was not endogenous to same-day economic news, see below—it is uncorrelated, by definition, with any non-policy noise that might affect the three month rate on the day of the announcement. Note that this method will work regardless of whether

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measure policy shocks are the only instances on which such shocks occur during a given month. Thus, when policy events are anticipated either because of the publication of relevant economic news prior to the action or because of statements by officials, this may not be a good measure, as it misses surprises that occur as relevant information becomes public *prior* to the actual policy event.

[39] A conceptually attractive alternative that cannot be used in this paper for lack of data, but gives very similar results for the U.S. as the approach proposed, is to measure the policy surprise associated with a new target announcement as the difference between the new target and the one-month ahead overnight futures rate at *t-1*, along the lines of the monthly measure proposed by Rudebusch (1998). Alternatively, one could also *estimate* a daily measure of interest rate expectations using market data (Hardy (1998) and Bagliano and Favero (1998, 1999)); see Zettelmeyer (2000) for arguments on why we prefer not to use this approach.

additional shocks that might be present on the day of policy announcement affect only interest rates or both interest rates and the exchange rate (in the event that they *only* affect the exchange rate, there was no problem to begin with since this is captured by the error term in equation (1)).

- A more severe problem is the potential endogeneity of policy actions to news that occur on the same day. This is a strong possibility in cases in which policy decisions are made public outside a predetermined schedule, as occurred frequently in the United States prior to 1994 and in our sample is often true for both Canada and New Zealand (but not for Australia). It becomes even more likely in situations in which the currency is under pressure, when central banks may well decide to take a policy action based on their observation of exchange rate developments in the early hours of trading, or overnight trading. To deal with this possibility, it is essential to not just compile the data set mechanically, by matching all days of policy events with reactions of the three-month rate and the exchange rate, but to understand the background of each policy event—based on both central bank press releases and financial press commentary—and to rule out (for the purpose of the main regressions) days on which policy may have reacted to news becoming public on the same day.

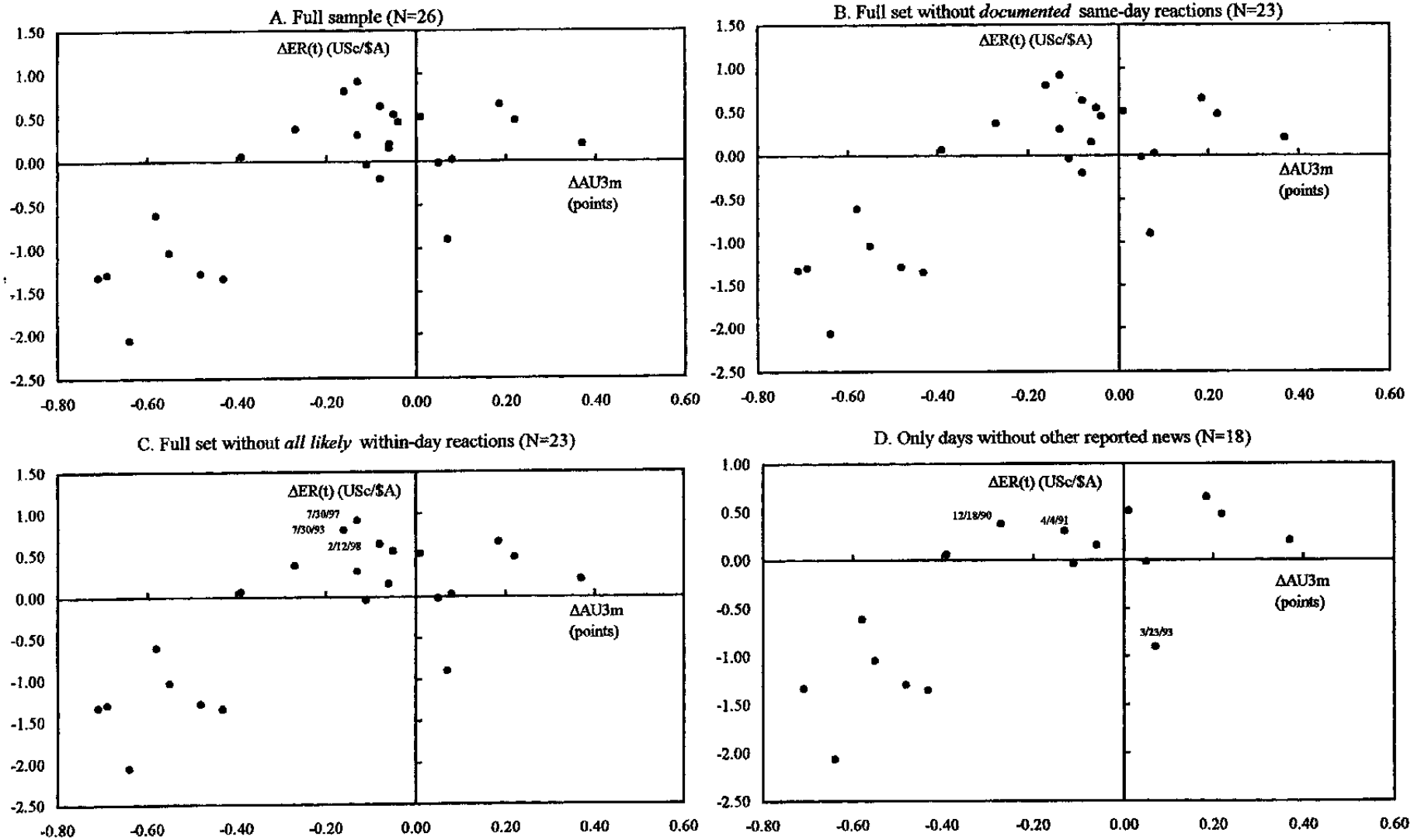
81. In practice, these considerations led to a three-step approach in analyzing the data for Australia, Canada, and New Zealand. First, a list of all major monetary policy actions for the three countries during the 1990s was compiled (see Appendix, and Zettelmeyer (2000) for details). Next, using market reports in the financial press, policy actions were classified according to (1) whether they coincided with other news that affected financial markets or not (2) whether or not they may have been endogenous reactions to such news. Within the last category, a distinction was made between events where an endogenous reaction of policy can be documented from the way the motivation of the event is described in either the financial press or by the monetary authority itself, and those where the endogeneity of the action is not documented, but cannot be excluded using hard criteria (say, timing). Finally, after excluding policy actions that were possible or likely endogenous reactions to same-day news, regression (1) was run both uninstrumented and using instrumental variables—where the instrument used was either the change in the underlying policy target or—in the case of New Zealand—a dummy variable describing the direction of the policy change (see Bonato, St. Clair and Winkelmann (1999), and Zettelmeyer 2000 for details). We also ran regressions on the full sample, but merely for descriptive purposes.

C. Results for Australia, Canada, and New Zealand

Scatterplots and basic regressions

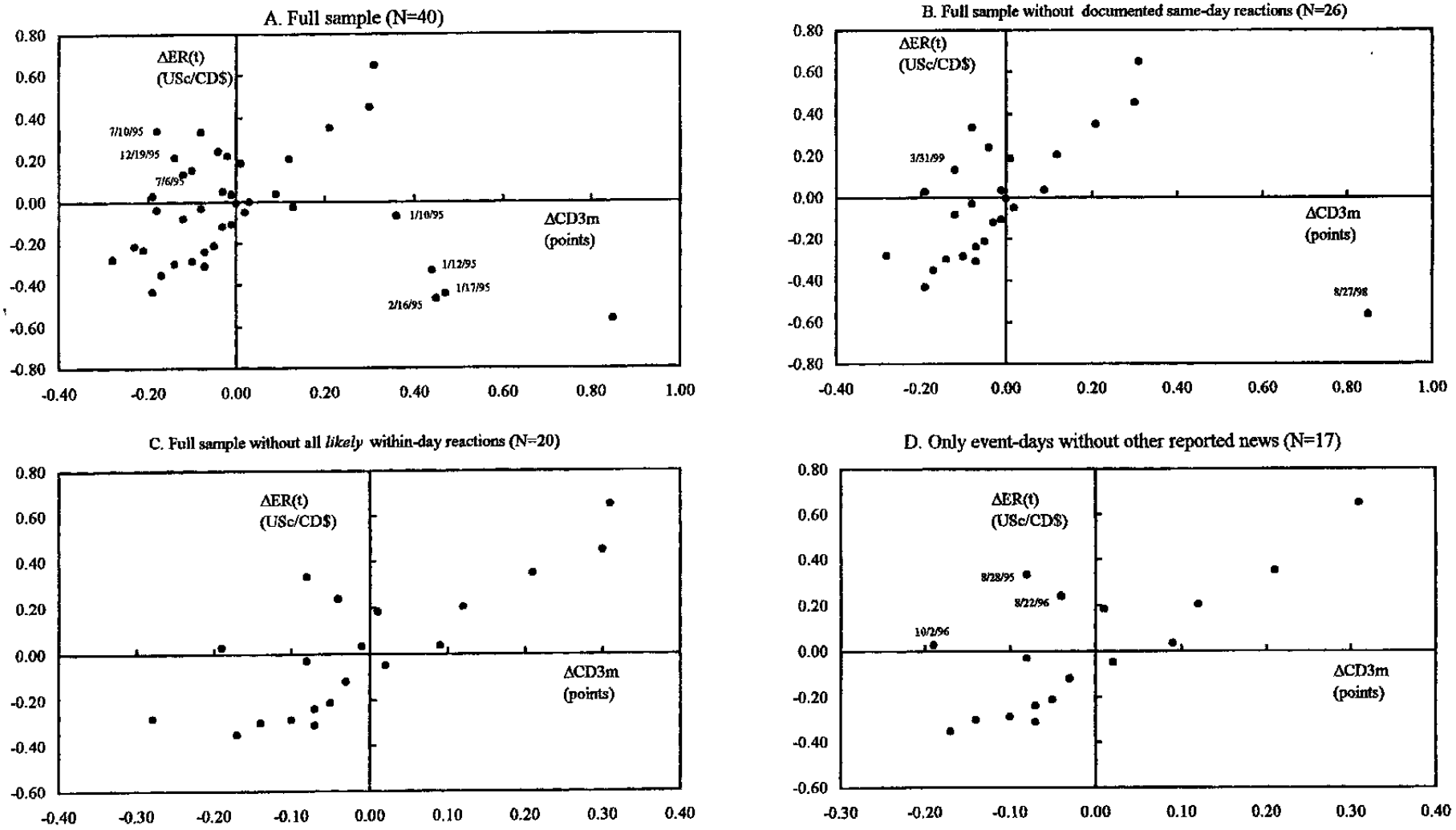
82. Figures 1 through 3 plot changes in three-month interest rates against changes in the bilateral exchange rate with the U.S. dollar on the days of domestic monetary policy announcements for Australia, Canada, and New Zealand, using the data contained in Appendix Tables 1–3. Each of the figures comprises four panels, labeled A through D, which reflect the classification by the presumed degree of "exogeneity" of monetary policy made in

Figure 1. Australia: Changes in USc/$A Versus Changes in 90-day Bank Bill Rate on Policy Days



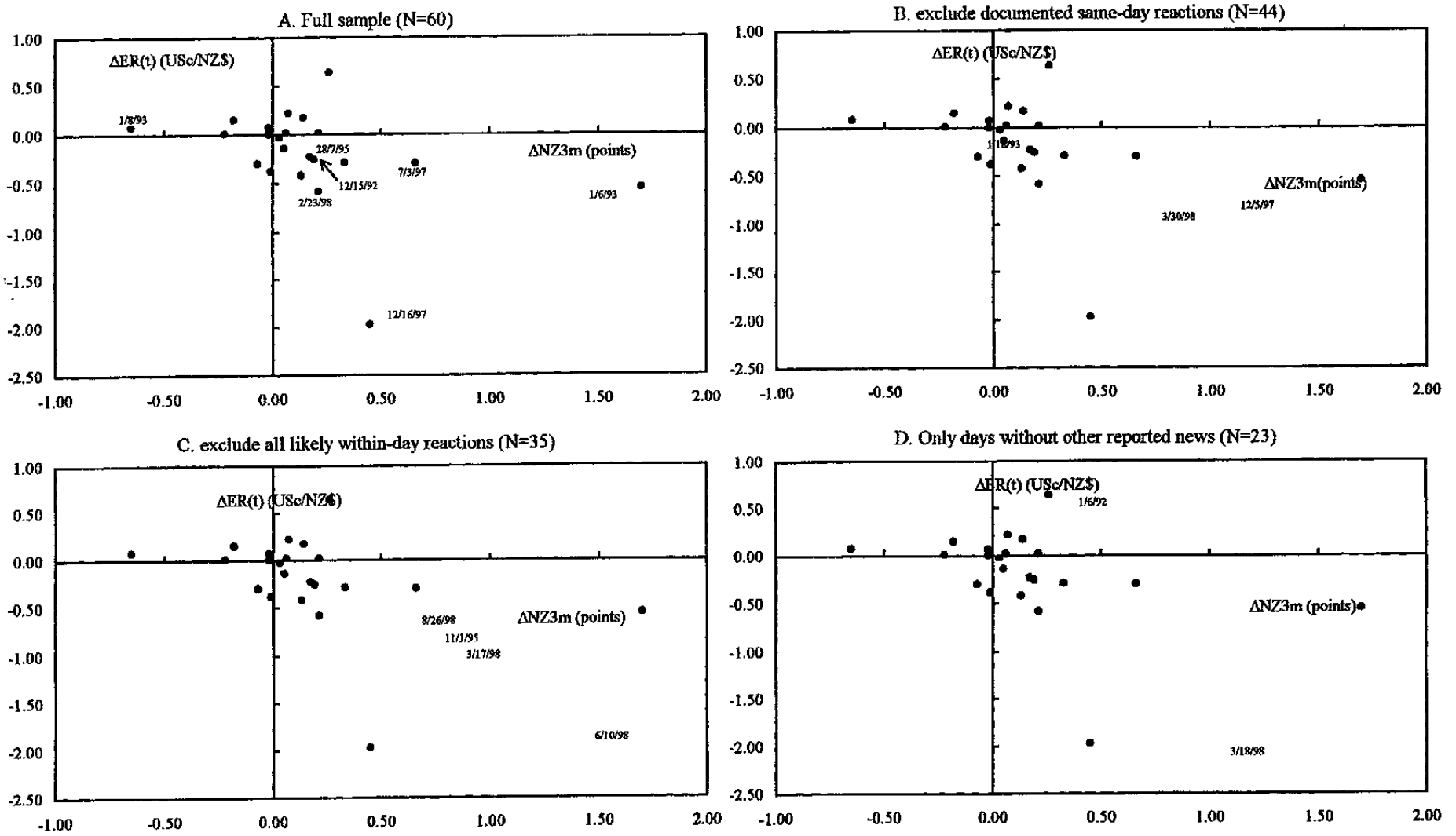
Sources: *Australian Financial Review;* and author's calculations.

Figure 2. Canada: Changes in USc/Can$ Versus Changes 3 Month T-bill Rate on Policy Days



Sources: Toronto *Financial Post;* and author's calculations

Figure 3. New Zealand: Changes in USc/$NZ Versus Changes in 90-day Bank Bill Rate on Policy Days



Sources: *New Zealand Herald;* and author's calculations.

the tables. The points shown reflect (A) the full event set, (B) the set of policy events excluding *documented* within-day responses of policy to economic news (C) the event set excluding *both documented and suspected* within-day responses policy events, and (D) the event set excluding days where *any other kind* of news were mentioned in financial market reports. Thus, C is the set of all policy actions that are presumed exogenous with respect to same-day information, while D is the set of policy actions that not only are presumed exogenous, but in addition do not coincide with major other news.[40] Thus, moving from top left to bottom right, we have an increasing degree of confidence that the points shown reflect the reaction of market interest rates and exchange rates *to* monetary policy announcements, as opposed to the mere co-movement between exchange rates and interest rates on the day of policy announcements, which might capture either reverse causality, or the influence of shocks unrelated to policy, or both.

83. The three figures have two main features in common. First, in all plots showing the full sample of exchange rate and interest rate changes to monetary policy events, a substantial subset of points is located in the upper left and bottom right quadrant of each graph. That is, there are a number of observations that seem to lend prima-facie support to the idea that exchange rates (sometimes) react "perversely" to monetary policy shocks (relative to the conventional prediction). The more prominent examples have been labeled by their dates; in the next section, we will take a look at what was "going on" on some of those dates. Second, by the time we get to the bottom right quadrant, the number of points in the top right and bottom left quadrant is much reduced, and a clear positive correlation emerges in all three figures. Thus, the scatterplots suggest that a large part of the observed "perverse" correlations observed in the full samples may have been attributable to either reverse causality or the coincidence of monetary policy with other economic news, and that by and large exchange rates did in fact respond to monetary easing or tightening in the direction that conventional wisdom would suggest.

84. There are also some noteworthy differences across the three figures. Most strikingly, whether or not we exclude policy actions that were either endogenous to or coincided with other reported news does not matter much for Australia, where the scatterplot shows a clear positive correlation even on the full sample, but it makes a large difference for New Zealand, where this correlation only emerges in the bottom right quadrant. Canada comes out in-between. This reflects the fact that much fewer Australian policy actions were endogenous to within-day news than for Canada and New Zealand, and that many more policy actions in New Zealand coincided with other news acknowledged in financial market reports than in both Australia and Canada. There are several reasons for these differences. First, the desire to lean against an exchange rate depreciation or appreciation played a much more prominent

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[40] In the terminology of Appendix Tables 1–3, A is the union of sets 1a, 1b, 2 and 3 (the full set); B is the union of sets 1a, 1b and 2; C is the union of sets 1a and 1b, and D is just set 1b.

role in monetary policy in Canada and New Zealand than in Australia (see Appendix Tables); as we shall see below, this constitutes one of the main sources of within-day policy endogeneity. Second, unlike in Canada and New Zealand, decisions in Australia were generally taken on pre-set dates (the first Tuesday of each month), which makes them less likely to be driven by economic information becoming public on the same day. Finally, in both Australia and Canada policy decisions were taken relatively rarely, so that they were less likely to share the limelight with other news than in the case of New Zealand.

85. The information embodied in the scatterplots can be summarized by running some simple regressions (Table 1). The results reported in the upper panel of the Table are the OLS regression counterparts of each of the panels of Figures 1 through 3. Regressions A and B should be interpreted only as a summary of the corresponding data, i.e. fitting a line through the corresponding scatterplot. As an estimate of the reaction of exchange rates to monetary policy they *cannot* be taken seriously since they suffer from an actual or potential endogeneity problem and are thus econometrically misspecified. Regressions on sets C and D, on the other hand, are valid except for the possible presence of "noise" in the interest rate variable, as described in the previous section, which can in principle be addressed by estimating the equation using instruments, as described at the end of the previous section. The trade-off between equations on set C and D is that the former is based on more data, but is also likely to contain more noise as it includes some datapoints which we know were influenced by news unrelated to monetary policy.

86. The main results from Table 1 are as follows:

- Once potentially endogenous observations are eliminated—i.e. based on sets C and D—a strong significant relationship between monetary policy shocks and exchange rate movements emerges for all three countries, in the direction conventionally assumed. In the OLS regressions using New Zealand data, this is true only for regression D, but not C (as one would expect from the corresponding scatterplot, see Figure 3). However, the instrumental variables regressions on set C shows that this is just an artefact of the high noise embodied in changes in the New Zealand three month rate, which biases the coefficient toward zero. For the other countries, the IV results are not significantly different from the OLS results (see line "Hausman *p*", which gives the threshold significance levels at which a Hausman specification test would reject the null hypothesis of no misspecification).

- The magnitude of the coefficients in regressions C and D for Australia and Canada, and C for New Zealand (once measurement error is corrected) are remarkably similar, namely between about 2.1 and 2.7.[41] Only the coefficient for New Zealand in the IV

[41] This statement is based on the notion that, for reasons of precision, one should use the OLS estimates as long as the null hypothesis of no misspecification cannot be rejected based on the comparison of the IV and OLS results (i.e. using a Hausman test). In the above, the Hausman test rejected only in the regressions for New Zealand (at the 5 percent level).

Table 1. Coefficient Estimates in Basic Regressions

(Dependent variable: percentage changes in the U.S. domestic exchange rate, t-values in italics)

Variable	Australia, 1990-2000				Canada, 1994-99				New Zealand, 1990-2000			
	Set A	Set B	Set C	Set D	Set A	Set B	Set C	Set D	Set A	Set B	Set C	Set D
OLS regressions												
Constant	0.30	0.29	0.28	0.05	-0.05	-0.05	0.05	0.04	-0.22	-0.19	-0.18	0.05
	1.70	*1.60*	*1.42*	*0.24*	*-0.88*	*-0.55*	*0.80*	*0.57*	*-1.81*	*-1.39*	*-1.10*	*0.32*
Δi 3m	2.58	2.57	2.55	2.38	-0.23	0.23	2.09	2.25	-0.19	0.83	0.89	2.07
	4.95	*4.82*	*4.60*	*4.25*	*-0.88*	*0.62*	*5.45*	*4.32*	*-0.53*	*1.50*	*1.41*	*3.48*
R^2	0.51	0.50	0.50	0.55	0.02	0.02	0.62	0.55	0.01	0.05	0.06	0.34
N	26	25	23	17	40	26	20	17	57	44	35	26
IV regressions 1/												
Constant			0.15	-0.12			0.04	0.03			-0.18	0.16
			0.58	*-0.42*			*0.74*	*0.47*			*-1.02*	*0.79*
Δi 3m			1.85	1.56			1.86	1.85			2.72	4.27
			1.92	*1.60*			*3.83*	*2.68*			*2.16*	*2.94*
Hausman p			0.36	0.26			0.45	0.37			0.05	0.02
N			23	17			20	17			35	26

Definitions: Set A: Full event set
Set B: Full event set excluding documented policy reactions to same-day economic news
Set C: Full event set excluding documented and possible policy reactions to same-day economic news
Set D: Only events in which no other economic news were mentioned in market reports as possible causes

1/ Instrument: either change in cash rate target (AU, CN) or dummy variable for direction of policy change (NZ).

version of regression D stands out above this range. The regression results thus imply that, on average, a contraction monetary shock that increases the three month interest rate by 100 basis points leads to an appreciation of the currency by about 2–3 percent.

87. Finally, its worth noting that these findings are robust to (1) the inclusion of additional explanatory variables, such as changes in the U.S. three-month T-bill rate and changes in commodity prices, and (2) alternative interest rate measures of the policy shock, including six month and one year money market rates. See Zettelmeyer (2000) for details.

A closer look at some outliers

88. The results so far support the "conventional" view on how monetary policy impacts the exchange rate; however, it is clear from the scatterplots and Table 1 that this would not necessarily be true if suspected endogenous reactions had been allowed to remain in the dataset. While these observations were excluded for good reason—one cannot draw conclusions from a regression that includes endogenous reactions because of the reverse causality problem—this does raise the possibility of sample selection bias. Specifically, if the reaction of exchange rates to interest rate hikes turns out to be weaker, or even negative, during speculative attacks against the currency, then the results of regressions C and D would overstate the impact of monetary policy on exchange rates, as days of speculative attacks are more likely to precipitate same-day policy reactions than normal days and thus more likely to be excluded from the data. It is thus important to take a closer look at the observations which were both excluded on the grounds of within-day endogeneity and exhibit movements between exchange rates and interest rates in the opposite direction of that predicted by regressions C and D, to see whether we can obtain any additional information—using contemporaneous financial press reports—on how the exchange rate reacted *following* the policy announcement. In addition, to the extent that observations which sharply contradict regressions C and D remain in the sample even after excluding actions which constituted within-day reactions or coincided with other economic news, one might be curious to know what was "going on" during those days, and in particular whether these observations support the notion that tight money might be counterproductive from the point of view of stabilizing the exchange rate in some circumstances.

89. Table 2 classifies the main outliers in Figures 1, 2, and 3—i.e. all datapoints identified with a date-label—according to whether (1) they were excluded due to suspected endogeneity; (2) they coincided with other major news or (3) neither. At this level, the table merely summarizes information that is already displayed in the figures. It then adds some additional information about the first of these three categories, along two dimensions. First, what proportion of the outliers that were excluded on the grounds of endogeneity constituted same-day reactions to exchange rate movements? Second, of those that were, what can one say about the exchange rate movement that followed the policy announcement?

Table 2. Classification of Outliers Associated with Within-Day Policy Reactions to News

	Total	Australia	Canada	New Zealand	
Major outliers associated with tightening ("bottom-right" quadrants)	19	1	5	13	
Within-day reactions (labeled by dates in b-r of panels A and B)	13	--	5	8	
Reaction to depreciation on same day	11	--	4	7	
Policy action prompted appreciation (documented)	8	--	3	5	
Policy action prompted depreciation (documented)	1	--	--	1	1/
Exchange rate reaction to action not documented	4	--	2	2	
Reaction to other same-day news	2	--	1	1	
Coinincident with other news (labeled by dates in b-r of panels C)	4	--	--	4	
Remaining outliers (labeled by dates in b-r of panels D)	2	1	--	1	
Major outliers associated with easings ("top-left" quadrants)	15	5	7	3	
Within-day reactions (labeled by dates in t-1 of panels A and B)	6	--	4	2	
Reaction to appreciation or Fed easing on same day	4	--	3	1	
Policy action prompted appreciation (documented)	3	--	2	1	2/
Policy action prompted depreciation (documented)	2	--	2	--	
Exchange rate reaction to action not documented	1	--	--	1	
Reaction to other same-day news	2	--	1	1	
Coinincident with other news (labeled by dates in t-1 of panels C)	3	3	--	--	
Remaining outliers (labeled by dates in t-1 of panels D)	6	2	3	1	

1/ Depreciation was reaction to current account projections that were announced together with MPS.
2/ Action was attempt to tighten (see Zettelmeyer (2000)).

90. The answers given in the table are as follows. First, most of the outliers that were excluded due to endogeneity do indeed correspond to within-day reactions to either the exchange rate itself or (on two occasions in the Canadian sample) to Federal Reserve easings. Second, in the large majority of cases in which the central banks tightened after a speculative attack on the same day, we do indeed find that an appreciation of the currency is reported following the policy action (although this appreciation was not enough, in the cases documented in Table 2, to reverse the initial plunge to which the central bank was reacting). Indeed, there is *only one* case in which one can document a *depreciation* of the exchange rate following the policy announcement. This turns out to be a very unusual case in which the exchange rate was in fact reacting to an unexpectedly pessimistic current account projection by the Reserve Bank of New Zealand that was announced in connection with the monetary policy statement, rather than the statement itself (see Zettelmeyer (2000)).

91. Things are not quite as clear-cut for the instances where exchange rate appreciations were associated with interest rate declines in the daily data ("top-left" outliers, lower panel of Table 2). This time, an appreciation *following* the policy announcement, rather than just prior to it, can be documented in 3 out of the 6 major outliers shown in the figures. As it turns out, however (see Zettelmeyer 2000) one of those three cases actually involves an attempt to tighten, so here the puzzle is why the *interest rate* registered a (small) decline, rather than an increase. The other two instances (3/31/99 and 12/19/95, both for Canada) truly describe appreciations following attempted easings; we will return to these shortly.

92. Next, consider the 8 outliers that remain after excluding endogenous policy reactions and event-days that coincide with major news other than monetary policy, of which two are bottom-right quadrant points and six in the top-left. Taking the latter first, it turns out that both of these points, which suggest an exchange rate depreciation following a contractionary monetary policy shock, actually correspond to *attempted easings*; see Zettelmeyer (2000) for details on why interest rates might not have declined after these actions. Finally, of the six instances of exchange rate appreciations associated with a decline in the three-month interest rate, one (New Zealand, 1/6/92) corresponds to an attempted tightening to which the NZ$ reacted as one would expect, and the puzzle, which market reports do not discuss, is why the 90 day bill did not (as it turns out, the one-year bond rate did rise slightly). In another case (Australia, December 18, 1990), market reports state that the $A actually fell after the RBA announcement, but then recovered and continued to rise for unspecified reasons during the rest of the day. The remaining four cases are more interesting in that they constituted attempts to ease *and* an appreciation of the currency is clearly attributed to this attempted easing, as was the case for the two instances described at the end of the previous paragraph. In one of these instances (Canada, 3/31/99), the market report does not attempt any explanation, simply stating that the dollar rose after the rate cut. For the remaining cases, however, two quite clear and distinct interpretations are suggested in the financial press reports:

- In case of the 4/4/91 (Australia) and 8/22/96 (Canada) event-days, the appreciation in the dollar is attributed to the fact that market participants believe that the central banks' easing signals *higher* interest rates in the future, either because the reduction

was smaller than expected, or because "the bank has now finished cutting interest rates" (Toronto *Financial Post* report on 8/22/96 easing by Bank of Canada). This immediately raises the question why this signal did not lead to a corresponding movement in the three month rate (i.e. up rather than down). One possibility is that the three month rate may not be sufficiently long to capture what may have a been perceived as a signal about the level of interest rates beyond the weeks immediately ahead. As it turns out, this idea is supported by the data: on both occasions, one-year interest rates *rose* after the announcement, so the puzzle vanishes when the policy shock is measured by the reaction of this longer rate.[42]

- In contrast, the story suggested in explaining the 8/28/95, 10/02/96 and 12/19/95 exchange rate appreciations (all for Canada) is that lower interest rates will lead to a stronger economy (see Zettelmeyer (2000) for details). Thus, these three event-days do indeed suggest the presence of a channel through which interest rate declines might induce an appreciation of the currency during a recession. However, note that all of these reactions occurred in an exceptionally favorable external environment: in the first two cases, on the heels of a major C$ appreciation, and in the latter, on the same day as a Fed easing.

Effect modifications by type of policy action

93. The last two sections have shown that (1) on average, there is a significant response of exchange rates to monetary policy shocks in the direction conventionally predicted by economists; (2) on closer inspection, this is true even for most observations which show negative co-movements between interest rates and exchange rates in the daily data (because of inverse causality, or other unrelated news on the same day). However, there remains a question whether this finding holds to the same degree for events in which the central bank was trying to influence exchange rates—i.e. leaning against depreciations or appreciations—or whether the strength of our average results is driven mainly by events in which the exchange rate was not a policy concern. To put it more plainly: did the exchange rate typically move in response to policy in the way predicted by the basic regressions on occasions when the monetary authorities *wanted* it to move? Furthermore, were there significant differences between the reaction of the exchange rate depending on whether the authorities wanted an appreciation or a depreciation? In this context, it is also worth asking whether there were significant differences in the way the exchange rate responded to contractionary and expansionary actions more generally.

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[42] In fact, for Australia both the six month and the one year interbank rates rise, as does the three-month interbank rate which is an alternative three month rate to the 90-day bank bill rate used in the Figures and regressions. Thus, the minus 0.13 movement in the bank bill rate reported for 4/4/91 appears to be an aberration.

94. Tentative answers to these questions are given in Table 3, which shows regressions on a basic sample of 69 observations from the pooling of Sets C for Australia and Canada and Set D for New Zealand.[43] The justification for working with pooled data is that it is impossible to slice the individual country datasets any further without getting into very small numbers of observations, and that pooling seems justified by the similar coefficients we get in Table 1 across countries. Two sets of regressions are shown, which differ only in whether the three outliers apparent in panel D of Figures 1 and 3 are included (left panel) or not (right panel).

95. There are two noteworthy results:

(i) Whether or not one runs the regression on the whole sample or the subsample that includes only policy actions that were responses to exchange rate depreciations ("Ed events") or appreciations ("Ea events") makes very little difference to the estimated coefficient on the change in the three-month interest rate. The *p* value corresponding to an F-Test for structural breaks (last line) indicates that there is no trace of such a break. Thus, the results from the basic regressions would seem to extend to instances in which the authorities were attempting to influence the exchange rate. One important caveat should be kept in mind, however. While the previous section made the point that excluding "Ed events" that were endogenous responses to depreciation on the same day did not bias our results in terms of the *direction* of the response of the exchange rate to monetary policy, it may still biase them in terms of the *size* of the response (for which we have no information for lack of historic intra-day data). For example, it is possible that the exchange rate appreciation in reaction to a contractionary policy shock is more feeble in the immediate aftermath of a heavy attack on the currency than in normal circumstances. Thus, excluding within-day responses could lead us to overestimate the impact of policy on exchange rates during Ed-type events.

(ii) Judged from the relative magnitudes of the coefficients, we do find a bit of an asymmetry in the response of exchange rates to policy on occasions when the trigger was an depreciation of the exchange rate (and the authorities attempted to tighten) and occasions when the trigger was an appreciation (and the authorities tried to loosen). In general, the former seem to generate less of an exchange rate response than the latter. In other words, it seems to be somewhat easier to "lean against the wind" when the wind is blowing from below (i.e. the triggering event is an appreciation of the currency) than when the wind is blowing from above. A similar finding holds for contractions and expansions more generally,

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[43] In principle, we would like to pool the largest data sets possible that exclude within-day endogenous reactions, i.e. sets C. For New Zealand, however, Set C contains a number of very noisy data points, and the relatively small sample sizes in the exercise that follows precludes the use of IV to deal with this noise. Comparing the OLS coefficients on the three-month interest rates across the three countries in Table 1 suggests that Sets C for Australia and Canada and Set D for New Zealand are good choices for the purposes of pooling.

Table 3. Coefficient Estimates on Subsamples

(Dependent variable: percentage change in U.S. cents per domestic currency; t values in italics)

	Basic sample 1/						Basic sample w/o 3 outliers 2/				
	All	Ed and Ea 3/	Ed events	Ea events	All Contr.	All Expans.	All	Ed and Ea events	Ed events	All Contr.	All Expans.
Constant	0.11	0.14	0.34	0.31	0.31	0.06	0.18	0.06	0.13	0.17	0.34
	1.27	*1.43*	*2.28*	*1.19*	*2.45*	*0.37*	*2.66*	*0.92*	*1.33*	*1.63*	*2.69*
Δi 3m	2.22	2.59	1.35	4.30	1.21	2.15	2.48	2.79	2.31	1.74	2.98
	7.16	*5.07*	*1.66*	*3.30*	*2.10*	*4.17*	*10.21*	*8.41*	*4.54*	*3.75*	*7.31*
R^2	0.43	0.59	0.19	0.73	0.20	0.30	0.62	0.81	0.65	0.45	0.58
N	69	20	14	6	20	42	60	19	13	19	40
Chow *p*		0.98	0.90	0.92	0.87			0.83	0.97	0.35	

1/ Union of sets C for Australia and Canada and set D for New Zealand (see Table 1).

2/ Namely, 3/23/93 (Australia), 3/18/98 (New Zealand) and 1/6/92 (New Zealand). See Figures 1 and 3, respectively.

3/ "Ea" refers to policy actions that attempt to lean against an appreciation, "Ed" refers to actions that attempt to lean against a depreciation.

with the coefficient on the three-month interest rate larger in the event of expansions. However, none of these differences are statistically significant, as shown by the Chow test p-values in the last line of the table.[44]

D. Some Tentative Evidence for Chile

96. The Chilean experience with floating exchange rates is much too brief for an analysis along the lines of the previous section. Only two policy actions occurred after the September 1999 regime change (in January and March of 2000). Even extending the sample back to the Fall of 1998, after the Central Bank of Chile began lowering the overnight target from its 14 percent peak and exchange rates were floating freely within the band (which was gradually widened beginning in December) yields only a dozen observations.[45] Moreover, there are reasons to suspect that many if not most of the policy actions over the last 18 months were endogenous—at least in terms of their precise timing—to news that became public at about the same time as the policy action itself. Policy actions often coincided with the release of data on economic activity, and in some cases, particularly in the first half of 1999, with events that tended to appreciate the exchange rate, such as large FDI inflows. Since a stated objective of the central bank during this period was to ease policy without reigniting pressures on the exchange rate (which had been the main reason for sharply tightening policy during 1998), it is conceivable that some of its measures were timed to coincide with days on which the risk of a sharp depreciation seemed particularly low.

97. Any attempt to exclude these instances and other instances of suspected endogeneity would leave us with very few datapoints. We consequently limit this section to showing the

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[44] The Chow test mostly refer to testing for a break between the particular subsample associated with each column an the whole sample (including outliers in the case of the left set of columns, and excluding them in the case of the right set of columns). The only exception is the value given for the "contractions" and "expansions" columns, which refers to a structural break test comparing these subsets and the sample comprised of the union of the two subsets. Testing for breaks vis-à-vis the whole sample would have made little difference to the results (it would have led to slightly higher *p*-values).

[45] Going back further in time is not useful for several reasons. First, the Central Bank of Chile changed operating procedures in May 1995, switching from a three-month interest rate target to its current practice of targeting the overnight rate. Thus, the methodology laid out in Section B cannot be applied prior to 1995. Moreover, most of the period 1995 to 1997 cannot be used, as the lower bound of the exchange rate band was binding during much of this time, and daily intervention data is not publicly available for this period. Finally, 1998 was a year of financial turbulence in which the central bank used a combination of instruments—tight liquidity, high overnight interest rates, a narrowing of the band, and direct intervention to stabilize the exchange rate. It is thus difficult to disentangle the effects of monetary policy and direct exchange rate policy during this period.

available evidence for illustrative purposes, and also to make the point that this evidence, given what we know about the circumstances in which policy actions were taken, certainly does *not contradict* the findings of the previous section. The starting point chosen is November 1998, a time at which external pressures had subsided and the focus of policy was returning to domestic activity and inflation. Since Chile lacks a liquid daily money market instrument (the central bank's 90-day PDBC and PRBC bills play a comparable role, but are only traded twice a week), and in order to see whether the findings are robust to the policy measure used, we measure monetary policy shocks using three alternative interest rates: an average 90–365 day deposit rate compiled by the central bank; an average 90-day deposit rate published daily by the business newspaper *Estrategia*, and a 90-day average interbank rate published by the Association of Banks ("TAB-90"). All rates are indexed to inflation, reflecting the widespread indexation of Chilean financial markets. However, given that we are considering daily changes, this makes virtually no difference in Chile's current low-inflation environment. Note that the exchange rate in Chile is defined in reverse of what it is defined in the countries studied in the last section, i.e. as domestic currency per U.S. dollar; thus, the earlier results would lead us to expect a *negative* relationship between exchange rates and monetary policy shocks (Figure 4).

98. The main impression to emerge from Figure 4 is that the correlation between exchange rate changes and interest rate changes on policy days is indeed negative, although substantially less tight than in panels C and D of Figures 1–3. This is confirmed by performing a simple regression, which we do both using the full sample and excluding the outlier labeled 6/22/99 as a rudimentary robustness check. The latter marks a highly unusual event, when a substantial monetary easing was announced together with a fiscal stimulus, after data showing the economy in "deep recession" (*El Mercurio*) had become public a few days earlier. The reaction to both announcements was a sharp *appreciation* of the exchange rate together with a small reduction in short interest rates. The interpretation given to this reaction in the financial press was twofold: first, it came of the heels of an even sharper depreciation in the two preceding days, driven partly by the anticipation of an imminent interest rate easing and in part by uncertainty about what other measures the authorities would take. Once this uncertainty was resolved by the announcement of a coordinated government package, the exchange rate bounced back. Second, the language in the central bank statement stated in unusually firm terms that this was the last easing of interest rates "in the foreseeable future", which may have been taken to imply that interest rates had reached their trough. Indeed, interest rate declines at the short end were minor, and *Estrategia* (June 23, 1999) reports that long rates in fact increased slightly after the action was announced.

99. In Table 4, the coefficient estimate on the interest rate is negative throughout, although not quite significant (with one exception). It is also smaller in absolute terms than the coefficients found in the previous section, consistent with the presence of noise in the interest rate measure, or the timing of easings in a way that coincided with shocks that tended to appreciate the exchange rate. The latter interpretation is also supported by the negative constant, which suggests that absent any policy shock the exchange rate would have tended to appreciate during the days that constitute the regression sample.

Figure 4. Chile: Percentage Changes in Ch$/US$ Versus Changes in Interest Rates on Policy Days

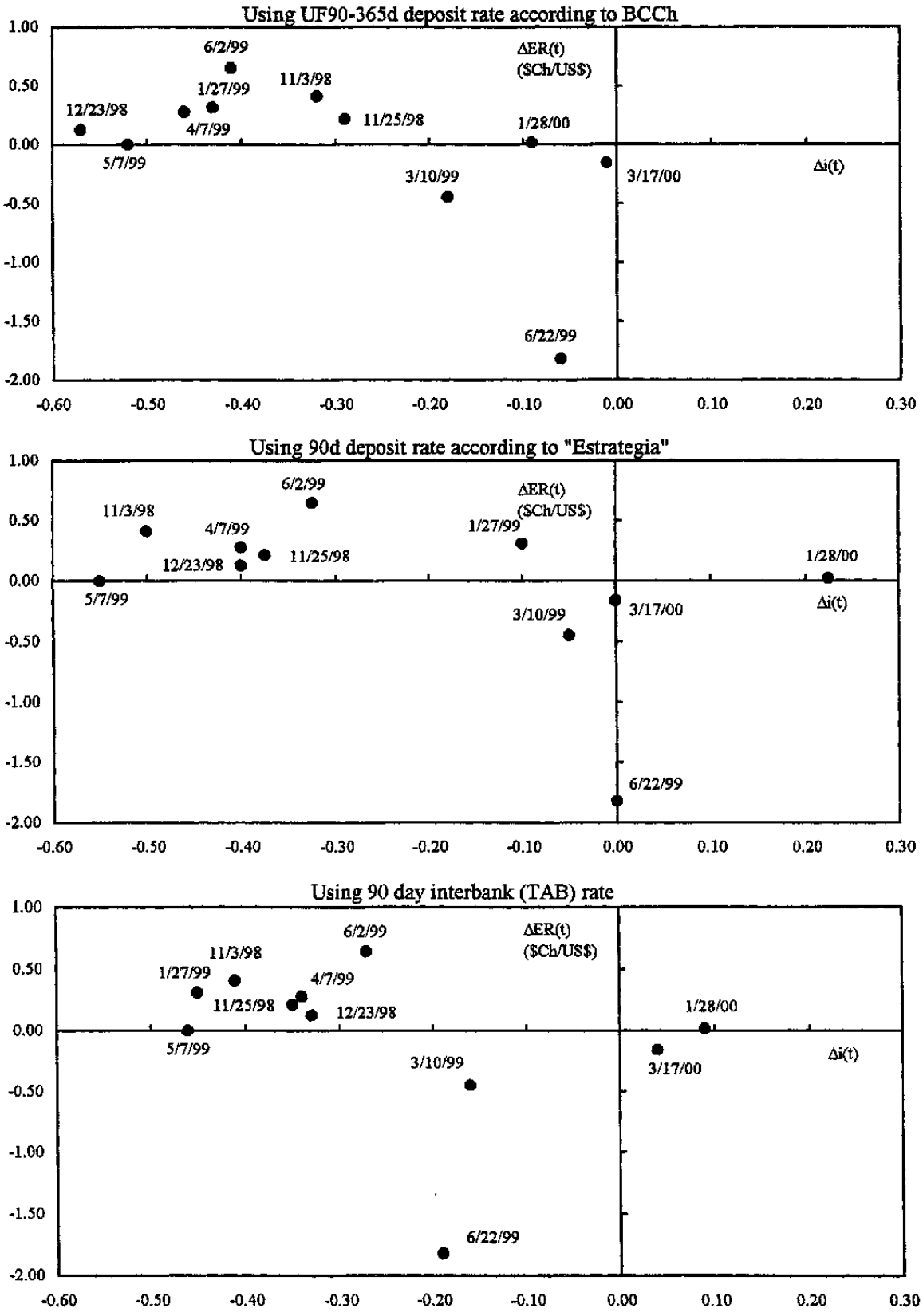

Table 4. Coefficient Estimates for Chile

(Dependent variable: percentage change in domestic currency per U.S. dollars
OLS estimates, column headings refer to interest rate data used)

	UF90-365		90-deposit		TAB 90	
Variable	full	excluding 6/22/99	full	excluding 6/22/99	full	excluding 6/22/99
Constant	-0.63	-0.13	-0.31	0.00	-0.33	-0.06
	-1.90	*-0.66*	*-1.21*	*0.03*	*-0.94*	*-0.37*
Δi	-1.94	-0.81	-1.21	-0.55	-1.13	-0.76
	-2.09	*-1.59*	*-1.55*	*-1.44*	*-1.01*	*-1.54*
R^2	0.33	0.24	0.21	0.20	0.10	0.23
N	11	10	11	10	11	10

E. Conclusions

100. This paper studied the impact response of exchange rates to monetary policy shocks in floating regimes, both during normal times and during times of pressure on the currency. Its main findings are as follows:

- Excluding events when monetary policy was an endogenous response to economic news (and in particular exchange rate pressure) on the same day, a regression of changes in the exchange rate on changes in the three-month interest rate on the day of policy actions shows a significant relationship between exchange rates and monetary policy in the direction commonly predicted. Coefficient estimates for Australia, Canada and New Zealand imply that a monetary policy shock leading to a 1 percentage point increase in the three-month interest rate will appreciate the exchange rate by 2–3 percent.

- Instances in which the exchange rate reacted "perversely" to a policy action were very rare. In only 5 instances (out of a total of 126) was this documentably the case. All are cases of appreciations after attempted easings. Three out of these five cases occurred in the context of a depressed economy as well as a favorable external environment, either on the heels of a major appreciation prior to the policy action, or on the same day as a U.S. Federal Reserve easing.

- Based on financial market reports, we could not find a single example in which raising interest rates to stabilize the exchange rate in times of turbulence backfired in the sense of leading to a further depreciation. However, on occasions when the policy action was prompted by pressure on the exchange rate on the same day, whatever stabilization or recovery of the exchange rate ensued as a result of the action was often insufficient to make up for ground lost earlier in the day. As a result, interest rate hikes prompted by exchange rate weakness often go together with exchange rate depreciations when both are measured over the entire day. Based on such events, it is easy to mistakenly conclude that higher interest rates led to more depreciated exchange rates.

101. In sum, the evidence presented in this papers supports conventional wisdom about the impact of interest rates on exchange rates in flexible regimes during normal times, and suggests that the direction of the relationship—i.e., a hike in interest rates prompting an appreciation—remains unchanged in times of financial turmoil. The evidence is more ambivalent on the harder question whether interest rate policy is an "effective tool" in stabilizing the exchange rate in such times. As shown in Table 3, we do find evidence that the average exchange rate reaction to policy shocks when the monetary authorities wanted to lean against a depreciation—which includes both "normal times" and times of turbulence—is no different from the average response on the whole sample. However, several caveats apply.

- The findings of Table 3 are based on regressions which exclude instances where policy was endogenously tightened in response to an attack on the same day. Since

these tend to coincide with days of particularly severe turbulence, we are not in a position to test whether the response of the exchange rate to monetary policy is different—and perhaps weaker than normal—during such severe turbulence.

- The constraints facing a central bank during severe turbulence may be quite different for advanced open economies such as Australia, Canada and New Zealand and emerging market economies. While Chile is in some ways closer to the advanced economies studied in this paper than to most of the emerging market crisis victims of the 1990s—in particular, vulnerability due to unhedged dollar liabilities is no longer a major concern—it remains subject to more severe capital flow reversals and larger swings in risk premia, which may imply that the degree of monetary policy tightening that must occur to stabilize the exchange rate in times of turbulence is correspondingly larger.

- A final caveat relates to the meaning of the word "effective". Even assuming that the results of Tables 1 and 3 apply in times of turbulence, the fact remains that in a large proportion of instances when the authorities tightened policy in reaction to an exchange rate depreciation (more than 40 percent, see Appendix Tables 2 and 3), the overall outcome on the day was a depreciation. While this is mostly attributable to the exchange rate depreciation *preceding* the policy announcement, the fact is that the tightening monetary policy in times of turbulence was quite often not fully "effective", in the sense of failing to fully reverse the preceding depreciation.

102. While it is thus conceivable that the estimated coefficients of Tables 1 and 3 are biased upward for the purposes of characterizing the exchange rate response to interest rate policy on days of intense exchange market pressure (both in general and particularly for Chile), it is also possible that the measured effect is right, but that the interest rate cost of a full defense on days of sufficiently high pressure is simply too high, prompting the central bank to offer only partial resistance. Suppose the market "requires" a sufficiently large depreciation (say, 15 percent). Assuming that the main empirical finding is correct—a 100 basis point monetary policy shock leads to an appreciation of 2–3 percent—resisting this depreciation would require a monetary policy shock of a magnitude which would have large costs in terms of real activity. The problem facing policy makers, on which this paper has nothing to say, is how to distinguish between market whim and market "requirement" in such circumstances, particularly since the strength of the attack may in turn depend on the perceived willingness of policy makers to defend the exchange rate.

Monetary Policy Actions in Australia, Canada, and New Zealand

103. Appendix Tables 1 through 3 show Australian, Canadian and New Zealand monetary policy actions for the 1990s, as well as changes in exchange rates and interest rates on the day of these changes. Generally, these are closing rates on the day on which the policy change was perceived by financial markets, minus closing rates on the previous day. In some cases in which there were major news after market closing on the previous day but prior to market opening on the day of the policy news, opening rates on the day of the policy news were used instead if available. Exchange rates are defined such that a positive change means an appreciation.

104. For Australia and Canada, the dataset comprises all changes in the overnight or ("cash") target during the 1990s. In Australia, the starting date is determined by the decision to publicly announce target changes, beginning in January 1990. The Canadian sample starts with the first publicly recognized change in the overnight rate target, based on Toronto *Financial Post* reports, after the Bank of Canada switched to the use of such targets in June of 1994.

105. The sample for New Zealand is based on a comprehensive set of New Zealand policy events compiled by Bonato, St. Clair and Winkelmann (1999) for the period 1990 to March 1998, and updated for the remainder of 1998 and 1999 using the record of RBNZ news releases contained on the RBNZ website. It begins with the first "open mouth operation" after the signing of the first policy target agreement between the RBNZ and the government in March 1990. For the period 1990–March 1998, this event-set is identical to the one described in Bonato, St. Clair and Winkelmann except that two "technical" RBNZ announcements (September 3 and 30, 1992), of which I found no mention in the press, were excluded. For the period March 1998–February 1999, I added all RBNZ announcements of the type compiled by Bonato, St. Clair and Winkelmann for the predecing period, i.e. comments on monetary conditions. For March 1999 until January 2000 I added all official cash rate (OCR) reviews that either changed the level of the OCR or went along with a comment on monetary conditions and the likelihood of future changes in the OCR

106. Along with the events themselves and financial market reactions, Appendix Tables 1–3 contain two sets of qualitative information:

107. First, policy events are classified in terms of their presumed exogeneity to same-day economic news. Classifications 1, 2, and 3 correspond to the distinctions made in the previous section: 1 means that no major other economic news to which the central bank might have reacted were reported in the money/currency market reports on the same day. Within this class, for reasons that will become clear in the next section, we make a distinction between events were *no* other news was reported as influencing market reactions, and events were—generally for reasons of timing—the monetary authorities could not possibly have reacted to them. Class 3 means that other news were reported *and* the fact that the monetary authorities were reacting to them is documented (either because the authorities themselves said so in accompanying or subsequent statements, or in the reporting of the event). 2 is

essentially a residual category: this refers to cases in which other economic news were reported on the same day, but it is not clear whether the bank reacted to them or not. For the case of Canada, categories 2 and 3 are subdivided into 2a, 2b, 3a, and 3b, respectively, according to whether the news to which the bank reacted, or might have been reacting, were news about U.S. policy actions or economic conditions, or not (for Australia and New Zealand, there were very few such cases). This distinction allows extending the Canadian dataset in the regressions by controlling for events that coincided with U.S. news (see Zettelmeyer (2000)).

108. Second, events are also classified in terms of whether they were motivated in terms of leaning against an appreciation ("Ea"), leaning against a depreciation ("Ed") or neither of the two ("O" for "other", e.g. a decision to loosen because of low inflation news or low growth numbers). These distinctions are taken to test whether the impact of monetary policy on exchange rates is any different in situations when stabilizing the exchange rate is the main objective of the central bank. Because the three central banks which we deal with in this paper go to great lengths to explain the rationale for their actions, making these classifications is typically straightforward. The setting in which an event was classified "Ed" (or "Ea") is generally one where the central banks argue for the need to offset a market driven loosening (or tightening) of monetary conditions, *and* it is clear either directly from the wording of the statement or from financial market behavior prior to the statement that this perceived loosening/tightening was attributable to exchange rate movements. On some occasions (mainly, January/February of 1995 and August of 1998) the Bank of Canada also argued that leaning against pressure on the C$ was necessary to prevent a disorderly depreciation, i.e. to reduce market volatility. Appendix Tables 1–3 show that the relevance of the exchange rate as a motive for monetary policy is very different across countries (very prevalent in New Zealand before February of 1999, not at all prevalent in Australia), in line with the differences in importance attached to the "monetary conditions index" in the three countries (see Zettelmeyer (2000) for details).

109. Finally, note that when comparing entries across tables it is important to keep the differences between time zones in mind. For example, there is no contradiction in the fact that the 11/17/99 entry for Canada states that market reports did not take note of any other news, while the entry for Australia for the same day mentions the tightening by the U.S. Federal Reserve. The Fed announcement reached financial markets in the early afternoon, Eastern Standard Time, on 11/16/99. Thus, it was reflected in Canadian financial markets before closing on the same day, but reached Australian markets on the 17th.

Table 1: Australian Monetary Policy Actions and Market Reactions, 1990-2000

Date perceived	Target midpoint	Motivation 1/	Other news referred to in money market reports on the same day?	"Exogeneity Class" 2/	ΔER(t) (USc/AU$)	ΔAU3m(t) (points)
01/23/90	17.00	O	no	1a	-1.33	-0.71
02/15/90	16.50	O	no	1a	-0.02	0.05
04/04/90	15.00	O	no	1a	0.51	0.01
08/02/90	14.00	O	Kuwait invasion (afternoon)	1b	-1.30	-0.69
10/15/90	13.00	O	no	1a	-2.06	-0.64
12/18/90	12.00	O	no	1a	0.37	-0.27
04/04/91	11.50	O	no	1a	0.30	-0.13
05/16/91	10.50	O	no	1a	0.06	-0.39
09/03/91	9.50	O	no	1a	-0.61	-0.58
11/06/91	8.50	O	no	1a	0.15	-0.06
01/08/92	7.50	O	Unexpectedly weak housing figures	2	-0.20	-0.08
05/06/92	6.50	O	no	1a	-0.04	-0.11
07/08/92	5.75	O	Comments on fiscal policy	1b	0.02	0.08
03/23/93	5.25	O	no	1a	-0.90	0.07
07/30/93	4.75	O	EMS crisis (safe haven buying)	1b	0.80	-0.16
08/17/94	5.50	O	Fed tightens	3	0.20	-0.06
10/24/94	6.50	O	no	1a	0.47	0.22
12/14/94	7.50	O	no	1a	0.20	0.37
07/31/96	7.00	O	no	1a	-1.35	-0.43
11/06/96	6.50	O	U.S. Republican party victory buoys bonds	1b	0.54	-0.05
12/11/96	6.00	O	no	1a	-1.04	-0.55
05/23/97	5.50	O	no	1a	-1.29	-0.48
07/30/97	5.00	O	Stronger commodity prices	1b	0.91	-0.13
12/02/98	4.75	O	Strong growth figures	1b	0.63	-0.08
11/03/99	5.00	O	Stronger than expected retail sales	2	0.45	-0.04
02/02/00	5.50	O	no (precedes Fed action)	1a	0.65	0.19

1/ "Ed": attempt to reverse, lean against, or offset impact of exchange rate depreciation.
"Ea": attempt to reverse, lean against, or offset impact of exchange rate appreciation
"O": any other motivation (generally to initiate policy easing or tightening, or "technical").
2/ "1a": no other news reported as relevant to money market developments on that day
"1b": other news reported as relevant to money markets, but could not have influenced policy action
"2": other relevant news reported, but unclear whether monetary policy reacted to them
"3": documented reaction to relevant news on same day

Table 2: Canadian Monetary Policy Actions and Market Reactions, 1994-99

Date perceived	Target midpoint	Motivation	Other news referred to in money market reports on the same day?	"Exogeneity Class" 1/	ΔER(t) (USc/CD$)	ΔCN3m (points)	ΔUS3m (points)
09/21/94	5.00	Ea	no	1a	-0.03	-0.08	0.18
11/16/94	5.25	Ed	no	1a	-0.05	0.02	-0.04
12/08/94	5.50	Ed	no	1a	0.04	0.09	0.00
01/10/95	6.00	Ed	Pressure on exchange rate	3a	-0.07	0.36	-0.05
01/12/95	6.50	Ed	Pressure on exchange rate	3a	-0.34	0.44	0.02
01/17/95	7.00	Ed	Pressure on exchange rate	3a	-0.44	0.47	0.18
02/01/95	7.50	Ed	Fed hike	3b	-0.03	0.13	0.07
02/16/95	8.00	Ed	Moody's warns of downgrade	3a	-0.47	0.45	-0.05
05/08/95	7.75	O	no	1a	-0.24	-0.07	0.03
06/02/95	7.50	O	Large decline in US earnings data	3b	-0.23	-0.21	-0.09
06/13/95	7.25	O	weaker than expected US retail sales	3b	-0.22	-0.23	-0.12
07/06/95	7.00	O	Fed easing	3b	0.15	-0.10	-0.15
07/10/95	6.75	O	C$ surge in European markets	3a	0.34	-0.18	-0.02
08/09/95	6.50	O	no	2a	-0.08	-0.12	0.00
08/28/95	6.25	O	no	1a	0.33	-0.08	-0.02
10/31/95	6.00	O	Fiscal consequences of Quebec referendum	1b	-0.28	-0.28	0.07
12/19/95	5.75	O	Fed easing	3b	0.21	-0.14	-0.10
01/25/96	5.50	O	U.S. budget standoff	2b	-0.43	-0.19	0.00
01/31/96	5.25	O	Fed easing	3b	0.22	-0.02	0.00
03/21/96	5.00	O	no	1a	-0.12	-0.03	-0.09
04/18/96	4.75	O	no	1a	-0.35	-0.17	0.02
07/19/96	4.50	O	CPI news	3a	-0.04	-0.18	0.03
08/09/96	4.25	O	Weak jobs data, low U.S. CPI	3a	0.05	-0.03	0.00
08/22/96	4.00	O	no	1a	0.24	-0.04	-0.01
10/02/96	3.75	Ea	no	1a	0.03	-0.19	-0.07
10/16/96	3.50	Ea	Weak manufact. data, low U.S. CPI	2a	-0.01	0.00	-0.04
10/28/96	3.25	Ea	U.S. inflation concerns	1b	0.03	-0.01	0.04
11/08/96	3.00	Ea	Bad unemployment & housing news	2a	-0.11	-0.01	0.03
06/26/97	3.25	Ed	no	1a	0.65	0.31	0.01
10/01/97	3.50	O	no	1a	0.18	0.01	0.01
11/25/97	3.75	Ed	no	1a	0.20	0.12	0.00
12/12/97	4.25	Ed	no	1a	0.35	0.21	-0.01
01/30/98	4.75	Ed	Slowing economy	1b	0.45	0.30	0.00
08/27/98	5.75	Ed	C$ under pressure after Russia crisis	2a	-0.57	0.85	-0.07
09/29/98	5.50	O	Fed easing	3b	0.00	0.03	-0.05
10/16/98	5.25	O	no	1a	-0.29	-0.10	-0.48
11/18/98	5.00	O	no	1a	-0.21	-0.05	0.00
03/31/99	4.75	O	Disappointing January output growth	2a	0.13	-0.12	0.02
05/04/99	4.50	O	no	1a	-0.30	-0.14	0.02
11/17/99	4.75	O	no	1a	-0.31	-0.07	-0.04

1/"1a" and "1b": defined as in Table 1

"2a": other major non-U.S. news reported, but unclear whether monetary policy reacted to them

"2b": major U.S. news reported, but unclear whether monetary policy reacted to them

"3a": documented reaction to other major non-U.S. news on same day

"3b": documented reaction to major U.S. news on same day

Table 3: New Zealand Monetary Policy Actions and Market Reactions, 1990-2000

Date perceived	BSW classification 1/		Motivation 2/	Other news referred to in money market reports on the same day?	"Exogeneity Class" 2/	ΔER(t) (USc/NZ$)	ΔNZ3m (points)
	Direction	Type					
08/01/90	1	P	Ed	no	1a	0.35	0.10
08/03/90	1	P	Ed	Kuwait invasion	1b	0.05	0.25
10/17/90	1	W	Ed	no	1a	0.00	0.00
10/18/90	1	P	Ed	Pressure on exchange rate	1a	0.75	0.40
01/11/91	1	W	O	no	1a	0.45	0.50
02/22/91	0	T	O	Brash comments	1b	-0.07	0.02
05/15/91	1	W	O	Unexpectedly low Australian inflation	1b	0.17	0.01
08/13/91	-1	T	O	no	1a	0.15	0.14
08/21/91	0	T	O	no	1a	0.07	-0.05
08/22/91	0	T	O	Lower cash rate from preceding action	2	0.00	-0.02
09/25/91	-1	P	O	no	1a	-1.12	-0.64
12/18/91	0	T	O	no	1a	-0.43	-0.22
12/24/91	0	T	O	no	1a	0.25	-0.05
01/06/92	1	W	Ed	no	1a	0.71	-0.06
09/09/92	1	W	Ed	no	1a	0.36	0.00
12/15/92	1	P	Ed	Pressure on exchange rate	3	-0.26	0.19
12/24/92	1	P	Ed	no	1a	0.20	0.15
01/06/93	1	P	Ed	Pressure on exchange rate	3	-0.55	1.70
01/08/93	-1	P	Ea	Pressure on exchange rate subsides	3	0.08	-0.65
01/18/93	-1	P	Ea	Pressure on exchange rate	2	0.15	-0.18
02/03/93	-1	P	Ea	exchange rate appreciation	3	0.01	-0.22
07/10/95	-1	W	Ea	no	1a	-0.31	-0.18
07/12/95	0	W	Ed	no	1a	0.06	-0.02
07/28/95	1	W	Ed	Pressure on exchange rate	3	-0.23	0.17
08/11/95	1	P	Ed	Pressure on exchange rate	2	0.02	0.06
08/25/95	1	P	Ed	Pressure on exchange rate	3	0.22	0.07
10/17/95	-1	W	O	Rise in market interest rates	2	-0.30	-0.07
10/30/95	0	W	O	Decline in market interest rates	3	0.07	-0.02
11/01/95	1	W	O	Goldman reports NZ$ overvalued	1b	-0.34	0.13
10/16/96	1	W	O	Decline in market interest rates	3	-0.03	0.03
10/24/96	-1	W	Ea	no	1a	-0.97	-0.33
12/17/96	-1	W	O	no	1a	0.71	0.06
03/13/97	-1	W	Ea	no	1a	-0.50	-0.22
05/12/97	1	W	Ed	Pressure on exchange rate	2	0.64	0.26
06/27/97	-1	W	O	no	1a	-0.54	-0.10
07/03/97	1	W	Ed	Pressure on exchange rate	3	-0.30	0.66
07/11/97	-1	W	Ed	BoP news/pressure on NZ$	3	0.17	0.14
08/18/97	1	W	Ed	no	1a	0.23	0.07
09/18/97	0	W	O	no	1a	-0.35	-0.09
12/05/97	1	W	Ed	Pressure on exchange rate	2	-0.29	0.33
12/16/97	0	W	O	RBNZ current account projection	3	-1.97	0.45
02/23/98	1	W	Ed	Strengthening of US$	3	-0.58	0.21
03/18/98	-1	W	O	no	1a	-1.28	0.25
03/27/98	1	W	Ed	Unexpectedly large CA deficit	3	0.02	0.21
03/30/98	0	W	O	Release of GDP data	2	-0.42	0.13
05/26/98	-1	W	O	no	1a	0.07	-0.22
06/10/98	1	W	Ed	Weakening of $A	1b	-1.22	0.63
08/20/98	-1	W	O	no	1a	-0.37	-0.54
08/26/98	1	W	Ed	Weakening of $A	1b	-0.15	0.09
10/07/98	1	W	O	Strengthening of $A and Yen	1b	0.48	0.15
11/18/98	0	W	O	no	1a	-0.42	-0.43
02/08/99	0	T	O	no	1a	0.66	0.15
03/17/99	0	P	O	Weakening of $A	1b	-0.47	0.18
05/19/99	0	P	O	Fed indicates tightening bias	1b	-1.00	-0.04
08/18/99	1	P	O	no	1a	0.17	0.02
11/17/99	1	P	O	Fed tightens less than expected	2	-0.38	-0.01
01/19/00	1	P	O	Unexpectedly low inflation	2	-0.14	0.05

1/ Follows Bonato, St. Clair and Winkelmann (1999). "P" stands for policy change (announcement accompanied by change in liquidity of money market); "W" stands for "Conditional Warning" (i.e. announcement that is not immediately backed up by an action that affects market liquidity); "T" for "Technical Change. "Direction" refers to whether announcement was intended to induce a tightening in monetary conditions (1), a loosening in monetary conditions (-1) or to be neutral. Note the actual impact of the announcement may have been different.

2/ See notes to Table 1.

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IV. Assessing External Vulnerability: The Case of Chile[46]

A. Introduction

110. This study considers the Chilean economy's degree of external vulnerability, focussing on evidence from the 1997–99 period. Adding to interest in this subject are several related developments of the last few years. First, the occurrence of severe, largely unanticipated crises in countries in East Asia—which like Chile have been considered star performers—suggests a need for frequent re-evaluation of perceptions and methods of assessment as well. Second, there indeed has lately been considerable research and data standards development aiming to improve the assessment of vulnerability. Third, recent shocks, such as the one emanating from Russia in 1998, provide an opportunity to learn about Chile's relative vulnerability by comparative observation.

111. The approach used here is eclectic and informal, surveying a broad range of indicators. The assessment of Chile is distinguished by these characteristics:

- Examination of vulnerability using modern approaches, in particular the emphasis on liquidity, and greater attention to data issues.

- Emphasis on cross-country comparison, including to advanced economies. The paper does not presume that a country such as Chile is most usefully compared to other emerging market economies. Instead, comparison is made to a group in which Chile would be centrally placed: the higher-rated emerging market countries, and a select group of advanced economies.

- Consideration of the crisis that emanated from Russia in 1998, contrasting Chile's experience in this period with that of other countries.

- Considering information from a range of sources: not only countries' official data, but also credit ratings, bond spreads, surveys of forecasts, and creditor-supplied debt data.

112. Several secondary goals of the paper can be noted. One is to identify any areas for improvement in the *set of information* now available for assessing Chile's external position. Another objective is to shed light on the usefulness of modern approaches to assessing

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external vulnerability, by highlighting Chile-specific issues that arise in applying such approaches, and that may raise questions about the applicability of one-size-fits-all approaches. In addition, there is the question of whether the indicators normally used in assessing emerging markets and developing countries are also usefully applied to advanced economies.

113. The organization of this paper is as follows. Section B outlines the kinds of indicators to be examined and discusses the selection of comparator countries. Section C examines four *summary indicators* that reflect assessments made by private sector agents, emphasizing how these were influenced by the 1998 Russia shock. Section D looks at *solvency indicators*, and Section E addresses *liquidity indicators*. Section F is a Chile-specific discussion that briefly addresses factors that are qualitative or less amenable to cross-country comparison. Here also, several areas are noted where further information would deepen analysis of Chile's external vulnerability. Section G summarizes and concludes.

B. Choice of Indicators and Sample

Quantitative indicators to be examined

114. Indicators of Chile's external vulnerability can be grouped into three categories.

115. The first category includes *summary indicators* of market and other private assessments, the values of which may synthesize a great deal of underlying characteristics. Regardless of whether such assessments are always valid, they are for some purposes "what counts." Such indicators used in this study are interest rate spreads on sovereign bonds; *expected* exchange rates, measured using surveys of forecasts; indices of exchange market pressure; and credit ratings. These indicators leave to others—market participants and ratings agencies—the task of weighing a vast set of potentially relevant information for each country. On the other hand, their summary nature limits their usefulness for policy purposes, since they may not directly indicate specific policy actions.

116. The other two categories include specific quantitative indicators, each of which may measure one of the underlying determinants of an economy's vulnerability.[47] The category of *solvency* or "fundamentals" indicators in Section IV include debt stock ratios, real exchange rate measures, export volume growth, and the current account. The category of *liquidity* indicators and simple "stress tests" of Section V, which have received most attention recently, are variations on the theme of the relationship of liquid assets to potential short-term liabilities.

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[47] An extensive literature has investigated the importance of many variables in either causing, or helping to predict, external crises. See, for example, Berg and Patillo (1998); Bussiere and Mulder (1999);and Kaminsky, Lizondo, and Reinhart (1998).

Selection of a comparator country sample

117. A comparison of Chile with other developing countries or emerging markets might only confirm the conventional wisdom of Chile as a star within this group. It may be more useful to draw lessons from comparisons with a group of countries in which Chile is more likely to be centrally placed—in particular if this group includes some advanced economies. Chile remains outside this club in terms of per capita income, but the question is whether it otherwise has already reached a similar position in terms of external soundness, or how it could do so in the future.

118. A group of 26 comparator countries was selected using the following criteria: (i) including a group of advanced economies—but only those which like Chile reasonably fit the "small open economy" label; (ii) also including emerging markets, but emphasizing the apparently stronger ones (based on credit ratings), (iii) excluding countries operating inside monetary unions or using currency board arrangements; and (iv) excluding countries whose currency is widely held as a form of international reserves.

119. The sample of 27 countries, including Chile, is listed below, grouped according to Standard & Poor's long-term, foreign currency credit ratings just before the Asian crisis broke, in relation to Chile's rating; the figures in parentheses represent each country's ranking in terms of per capita income.[48]

Rating Superior to Chile's, mid-1997			Rated with Chile, mid-1997			Rating Inferior to Chile's, mid-1997		
Australia	AA	(6)	Chile	A-	(15)	Brazil	BB-	(24)
Canada	AAA	(4)	Israel	A-	(9)	Colombia	BBB-	(22)
Cyprus	AA-	(10)				Greece	BBB-	(12)
Czech Republic	A	(14)				Hungary	BBB-	(16)
Denmark	AA+	(3)				Mexico	BB	(21)
Iceland	A+	(5)				Peru[49]	BB	(26)
Korea	AA-	(13)				Philippines	BB+	(27)
New Zealand	AA+	(8)				Poland	BBB-	(19)
Norway	AAA	(2)				Slovak Republic	BBB-	(17)
Singapore	AAA	(1)				South Africa	BB+	(20)
Slovenia	A	(11)				Turkey	B	(25)
Sweden	AA+	(7)				Uruguay	BBB-	(18)
Thailand	A	(23)						

[48] Per capita income on a PPP-adjusted basis, averaged during 1995–99.

[49] Peru was given this rating only in December 1997; previously, Peru was unrated.

120. Chile is indeed centrally placed in this sample, with respect to both credit rating and per capita income (note the strong correspondence between ratings and income). In the analysis below, it will be useful to split the comparator countries into "higher-income" (14 countries) and "lower-income" (12 countries) subsamples, defined with respect to Chile. Reference is also made to "advanced economy" and "emerging market" countries, a distinction that corresponds fairly closely to the income-based classification.

121. As regards the exchange rate regime, other than excluding currency board and monetary union cases, it was not possible to confidently select a sample based on strict similarity to Chile's regime. (Such regimes are in some cases ambiguous, and the management of exchange rates is often a question of degrees.) It should be kept in mind that the sample includes some variation in regimes, not only across countries but also over time. Indeed, a number of these countries, like Chile, began the 1997–99 study period with highly managed exchange rates but have since moved to greater flexibility.

Data

122. Nearly all the data used are from publicly-available datasets, primarily *International Financial Statistics*, *World Development Indicators*, and the Joint BIS-IMF-OECD-World Bank statistics on external debt. For any given country, these data may have important shortcomings; certainly they are not necessarily superior to country-specific data that may be available from other sources. In a sample of this size, however, country-specific discussion and judgmental selection of data is not feasible; impartiality also argues for systematic use of such cross-country datasets. However, certain limitations of these data will be discussed along the way, and for the case of Chile only, reference will also be made to alternative data in a few areas.

123. Other data sources include Bloomberg, for bond yield data, and the web site of Standard & Poor's for a detailed history of their credit ratings. Reference is also made to the survey of exchange rate forecasts appearing in *FT Currency Forecaster*. [50]

C. Market and Other Private Assessments

124. The indicators examined in this section are based on the following: credit ratings; sovereign bond spreads; an index of exchange market pressure; and revisions in exchange rate forecasts. All four indicators are first used to compare responses to a period of global stress; the first two are later used to compare Chile to other countries at a point in time.

[50] The actual levels of these forecasts are not presented.

Comparisons of responses to the 1998 crisis

125. The question here is whether Chile was affected more or less than other countries during the crisis that emanated from Russia in 1998. This episode is considered as a natural, albeit imperfect, experiment, which may reveal weaknesses not apparent during more normal times.

Credit rating changes

126. Table 1 presents *revisions* in the long-term, foreign currency ratings reported by Standard & Poor's during 1997–99. Changes in rating, or in rating "outlook," are shown according to the six-month window in which they occurred.[51] The window of primary interest is the second semester of 1998 (1998H2), corresponding to the Russia crisis. Note that the 1997H2 window corresponds to the East Asian crisis, while the other four periods give an idea of the frequency of ratings revisions during more normal times.

127. Almost half the sample countries experienced a downgrade during 1997–99; Chile was one of six with no rating change, in either direction. As expected, most downgrades occurred in 1997H2 or 1998H2.[52] During the other four sub-periods, downgrades were much less frequent, no more than two per semester. (Similarly, upgrades were less frequent in 1997H2 and 1998H2 than at other times.)

128. Of the many downgrades that occurred in1997H2, nearly all involved Korea or Thailand—there is no sign of a general negative effect outside East Asia in this period. On the other hand, the apparent effect of the Russia crisis, in 1998H2, was more general, with negative changes for six of the 27 countries. This group includes not only Brazil and Mexico (see Bussiere and Mulder, 1999), but also Cyprus, the Czech Republic, the Slovak Republic, and New Zealand. From this outcome (and in contrast to that for the indicators considered next) there is no suggestion that higher-income countries were less vulnerable than the lower-income economies.

Changes in bond spreads during the Russia crisis

129. Here we examine how far spreads on foreign-currency denominated bonds moved in response to the global crisis that occurred following the August 1998 events in Russia. The

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[51] The choice of a window as long as six months is motivated by the fact that such ratings are revised/confirmed not continuously but rather only occasionally.

[52] On whether ratings agencies "see through the cycle," see Monfort and Mulder, 2000.

Table 1. Changes in Credit Ratings, 1997-99

(Standard & Poor's Long-Term, Foreign Currency Ratings 1/)

	1997:H1	Asian Crisis 1997:H2	1998:H1	Russian Crisis 1998:H2	1999:H1	1999:H2
Downgrades 1/						
Total in period	0	11	3	6	2	2
		Colombia *	Philippines*	Brazil*	Brazil	Colombia
		Korea*	Slovak Republic*	Cyprus	Turkey*	Cyprus
		Korea	South Africa*	Czech Republic		
		Korea		Mexico*		
		Korea		New Zealand*		
		Philippines*		Slovak Republic		
		Thailand*				
		Thailand				
		Thailand				
		Thailand 2/				
Upgrades 1/						
Total in period	7	1	5	3	6	6
	Brazil	Mexico*	Denmark*	Greece	Australia	Brazil*
	Canada*		Hungary*	Hungary	Korea*	Greece
	Greece*		Iceland*	Turkey*	Korea	Korea
	Philippines		Korea*		Philippines*	Mexico*
	Poland*		Korea		Poland	Slovak Republic
	Sweden*				Thailand*	Turkey*
	Uruguay					
No change in period						
Chile						
Israel						
Norway						
Peru (no rating before December 1997)						
Singapore						
Slovenia						

Source: Standard & Poor's.

1/ Cases marked with an asterisk (*) reflect a change in rating "outlook" only.

2/ Downgrade of Thailand on January 8, 1999 is here shown as if it occurred during 1997H2.

most dramatic events of this crisis unfolded in mid-August, but its full magnitude took time to develop, so it is useful to consider a horizon of a few months.[53]

130. Table 2 reports average spreads on sovereign bonds during July and October of 1998. Since no Chilean sovereign bond was traded during this period, the state-owned Banco del Estado is used.[54] In not one case did a bond spread decline from July to October 1998, though the range of responses was wide. For some, the increase in spread was negligible. The advanced economies—which also started off with the lowest spreads—show increases of no more than 35 basis points. Chile started with a spread ranked 9th of 26; this was the lowest among the emerging markets and similar to that of such higher-income countries as Australia, Denmark, and New Zealand. From July to October, Chile's spread rose by about 65 basis points; while not severe, this was about twice the increase experienced by Australia and New Zealand. In terms of changes, Chile's position was 12th, as Israel and Czech Republic, for example, showed slightly smaller increases. In terms of both levels and changes, there is a wide gap between Chile's spread and that of most emerging markets, many of which experienced severe increases in spreads.

131. Although bond spreads suggest that Chile's riskiness (more precisely, risk premium) was somewhat affected during the Russia crisis, qualitatively Chile appears closer to the advanced economies than to most of the emerging market countries considered here. This is not to say that the negative effect of this crisis on Chile was economically insignificant—note the large jumps in the spreads on the bonds of Chilean private enterprises.

Exchange market pressure

132. The degree of external vulnerability may be reflected in the price of foreign exchange—that is, in various signs of "pressure" on the domestic currency during times of stress. We gauge such stress in two ways. The first, conventional, approach is to construct an index of exchange market pressure (EMP), taking a weighted average of actual currency depreciation and (a proxy for) foreign exchange market intervention during a given period. Such indices have been used for various purposes; Bussiere and Mulder (1999) have recently used one to measure the impact of crisis episodes.[55]

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[53] A problem with very short horizons is that daily data for spreads are sometimes missing in the periods of greatest stress.

[54] The remaining maturity of the Banco del Estado bond was shorter than that on most other bonds analyzed in Table 2.

[55] The Bussiere and Mulder sample, in contrast to the one used here, excludes advanced economies and includes lower-rated emerging markets. The purpose of their analysis is not merely to observe EMP but to analyze its determinants.

Table 2. Sovereign Bond Spreads, July-October 1998 1/

(In basis points)

(By increasing per capita income)	July 1998	Rank	October 1998	Rank	Absolute Change	Rank
Philippines	405	20	817	21	412	22
Peru	537	25	798	20	261	19
Turkey	470	23	880	22	410	21
Brazil	614	26	1,266	26	652	26
Thailand	390	19	556	17	166	17
Colombia	370	18	882	23	512	24
Mexico	459	22	890	24	431	23
South Africa	351	17	647	18	296	20
Poland	198	15	345	15	147	15
Uruguay	222	16	381	16	159	16
Slovak Republic	430 ~	21	1,080 ~	25	650	25
Hungary	75 ~	10	175 ~	14	100	14
Chile (Banco del Estado)	**56**	**9**	**121**	**10**	**65**	**12**
Czech Republic	100 ~	14	150 ~	12	50	8
Korea	477	24	668	19	191	18
Greece	81	11	153	13	72	13
Slovenia	15	1	17	1	2	2
Cyprus	90 ~	13	100 ~	9	10	3
Israel	85	12	136	11	51	10
New Zealand	40 ~	4	70 ~	4	30	5
Sweden	21	2	71	5	50	8
Australia	50 ~	8	75 ~	6	25	4
Iceland	40 ~	4	75 ~	6	35	6
Canada	23	3	60	3	37	7
Denmark	40 ~	4	40 ~	2	0	1
Norway	43	7	97	8	54	11
Number of observations	26		26		26	
Mean	219		406		187	
Median	95		164		86	
Standard deviation	198		386		202	
Memorandum items:						
Chile, private sector bonds						
Compañía Telecom Chile	100 ~		530 ~		430	
Embotelladora Andina S.A.	175 ~		570 ~		395	
Celulosa Arauco	150 ~		650 ~		500	
Emerging Market Bond Index	622		1,268		646	
Merrill Lynch High Yield Bond Index	335		604		269	

Sources: Bloomberg; J.P. Morgan; and Merrill Lynch.

1/ Monthly averages, based on daily data. Sovereign bonds, where available; no data for Singapore.
~ indicates approximate value.

133. An EMP index was constructed as a monthly series for each country, taking a weighted average of the observed rate of currency depreciation and the reported decline in official reserves (the latter scaled by the stock of reserve money).[56] Thus a positive EMP value would in general indicate market pressure *against* the national currency, though the measure may not be a precise one. Note that the index will not capture policy intervention in the forward exchange market, nor the role of an interest rate policy response in deflecting currency pressures.[57]

134. Table 3 summarizes the behavior of EMP before and during the 1998 Russia crisis. During the last few years before this crisis, EMP measured on a monthly basis was on average close to zero in this sample, as one would expect of normal times. In August 1998, however, average EMP jumped sharply upward.[58] By this measure, the countries most affected were Canada, Mexico, New Zealand, and Turkey. At this one-month horizon, there is no sign that higher-income countries were less affected than others, in contrast to the evidence found for bond spreads. Chile does show positive EMP in August 1998, but less than most others, and only a fraction of the mean or median EMP of the sample. Chile's ranking, in terms of avoiding EMP during this crisis, is 7th of 26 countries.

135. In considering slightly longer horizons—August–September or August–October—the main change is that average EMP falls back, and even goes negative, for the higher-income countries. Chile's (small) EMP shows this pattern as well. In contrast, average EMP for the lower-income countries does not improve over these longer horizons.

Revisions in exchange rate forecasts

136. This second indicator related to the price of foreign exchange requires a measure of expected future exchange rates. For this purpose, we use the 12-month ahead "Combined Consensus Forecasts" published monthly in *FT Currency Forecaster*. The idea is that a negative shock may induce a revision in the expected future level of the exchange rate,

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[56] Scaling reserves losses by the previous period's reserve money stock gives meaningful units, and this allows the weighting of EMP index's components to be uniform across countries. The weighting of the index—2:1, with the greater weight on currency depreciation—was chosen to make the variance of its two components roughly similar for most countries during the period before the crisis. The basic results discussed here are not sensitive to changes in this weighting (e.g., alternative weights of 1:1 and 4:1).

[57] Another problem is the short-term noise in reserves data induced by lumpy new external borrowing and amortization of debt.

[58] Over horizons of a month or two, the role of trend depreciation against the U.S. dollar is minimal, and it can be safely disregarded. The exception is Turkey, where an adjustment is made.

Table 3. Exchange Market Pressure During Russia Crisis, August-October 1998

(By increasing per capita income)	August 1998		August-September 1998		August-October 1998	
	EMP Index	Rank	EMP Index	Rank	EMP Index	Rank
Philippines	17	20	4	14	-8	11
Peru	8	11	11	20	16	20
Turkey 1/	33	24	33	24	38	25
Brazil	6	8	42	26	50	26
Thailand	-4	2	-12	5	-35	3
Colombia	12	14	32	23	37	24
Mexico	36	25	42	25	34	23
South Africa	13	15	-6	8	-17	8
Poland	16	17	7	17	0	16
Uruguay	3	4	3	13	7	17
Slovak Republic	9	12	18	22	23	21
Hungary	...	...	...	...	...	...
Chile	**4**	**7**	**-1**	**12**	**-4**	**15**
Czech Republic	16	19	-12	6	-21	7
Korea	7	9	-1	11	-23	6
Greece	21	22	4	15	-5	13
Slovenia	3	3	-36	2	-41	2
Cyprus	3	5	-15	4	-12	9
Israel	7	10	9	18	28	22
New Zealand	37	26	10	19	-34	4
Sweden	-4	1	-33	3	-32	5
Australia	14	16	6	16	-5	14
Iceland	3	6	-4	9	-8	10
Canada	28	23	15	21	14	19
Denmark	16	18	-6	7	-6	12
Norway	11	13	-3	10	7	18
Singapore	19	21	-40	1	-88	1
Full sample						
Mean	13		3		-3	
Median	12		4		-5	
Standard deviation	11		21		30	
Lower-income						
Mean	14		16		13	
Median	12		11		16	
Higher-income						
Mean	13		-8		-16	
Median	12		-4		-10	

Memorandum item: EMP per month, 1995-1998:H1 (full sample)

	Mean	Median	Standard Deviation
1995	-2	-2	12
1996	-1	0	13
1997	4	2	17
1998:H1	-1	0	17

Source: Calculated from data in *International Financial Statistics.*

1/ For Turkey, EMP index is adjusted for trend depreciation.

regardless of whether the shock is immediately reflected in the spot rate or (traditional measures of) official reserves, and thus the EMP.

137. Table 4 shows percentage revisions in 12-month ahead expected spot rates, taking the forecasts surveyed in late July 1998 as the pre-crisis base, and considering how much the levels of these had been changed by the time new surveys taken one, two, and three months later.[59]

138. Most of the forecast revisions—including those for Chile—are indeed in the direction of more depreciation vis-à-vis the U.S. dollar. (This shift cannot be attributed to an improved outlook for the dollar, forecasts for which were weakening against other reserve currencies during this time.) Again, there is some sign that the higher-income countries were on average less affected than others.

139. Regarding the Chilean peso, the magnitude of the forecast revision does not stand out; in fact it is similar to the sample mean and median values. At all three horizons, Chile's rank is 13th of the 22 countries for which forecast data are available.

Chile's current position: credit ratings and bond spreads

140. Putting aside the question of differential reactions to common shocks, we close this section with brief reference to two summary indicators of Chile's current relative position.

141. The first is Standard & Poor's long-term, foreign currency ratings, as of mid-March 2000. From the sample of 26 comparator countries, 10 are still rated above Chile (this group no longer includes Czech Republic, Korea or Thailand); Israel and now also Greece and Czech Republic share Chile's A- rating; and the remaining 13 countries have lesser ratings. Second, as regards bond spreads, in March 2000 it remained true that Chile's spread was among the lowest in the group of emerging markets.

* * * * *

142. Chile began the 1997–99 period being evaluated by market participants as a bit behind the advanced economies—but near the top of the emerging markets—considered here, and this remains true in early 2000. As regards the impact of the 1998 Russian crisis, three of the four indicators examined (the exception being credit ratings) suggest that the lower-income countries were usually more negatively affected than the higher-income ones,

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[59] Each successive survey of 12-month ahead forecasts refers to the spot rate expected for a date that is one month further into the future, but this slight time-shift can be ignored for most currencies. Again, the exception is Turkey, the only country in the sample with high inflation, and accordingly with a steep depreciating trend to its exchange rate. As it happens, Turkey comes off well in Table 4, even without adjusting for expected trend depreciation.

Table 4. Revision in One-year Ahead Exchange Rate Forecasts, August-October, 1998

(Percentage changes, from forecasts surveyed end-July 1998) 1/

(By increasing per capita income)	Change, as of end-August	Rank	Change, as of end-September	Rank	Change, as of end-October	Rank
Philippines	4.5	14	9.6	21	-17.8	1
Peru	1.3	4	6.5	18	7.7	18
Turkey 2/	-3.7	1	-6.0	4	-3.5	8
Brazil	1.3	5	3.9	15	4.8	17
Thailand	2.5	11	-11.3	1	-14.5	2
Colombia	1.4	7	8.9	20	20.7	21
Mexico	16.9	21	26.3	22	23.1	22
South Africa	0.0	2	0.0	6	-7.5	6
Poland	21.8	22	3.4	14	9.3	19
Uruguay	...	...	...	...	...	...
Slovak Republic	...	...	...	...	...	...
Hungary	1.7	9	0.0	6	4.5	16
Chile	3.3	13	2.3	13	3.1	13
Czech Republic	1.4	6	-9.1	2	-9.4	4
Korea	6.8	19	6.8	19	-11.4	3
Greece	5.0	17	-1.4	5	-3.2	9
Slovenia	...	...	...	...	...	...
Cyprus	...	...	...	...	...	...
Israel	1.4	8	0.7	9	14.3	20
New Zealand	4.5	15	4.5	16	3.3	14
Sweden	5.1	18	0.3	8	-0.8	11
Australia	4.6	16	6.3	17	4.2	15
Iceland	...	...	...	...	...	...
Canada	2.0	10	1.8	11	2.9	12
Denmark	0.5	3	-6.5	3	-7.0	7
Norway	2.8	12	1.7	10	-1.6	10
Singapore	7.9	20	1.8	12	-7.9	5
Observations	22		22		22	
Mean	4.2		2.3		0.6	
Median	2.6		1.8		1.0	
Standard deviation	5.5		7.6		10.5	
Lower-income, mean	4.8		4.1		2.7	
Lower-income, median	1.5		3.7		4.7	
Higher-income, mean	3.8		0.6		-1.5	
Higher-income, median	4.5		1.7		-1.6	
Memorandum items:						
ECU	-0.7		-6.1		-7.8	
British pound	-1.6		-2.3		-2.6	
Japanese yen	2.9		3.0		0.4	

Source: Calculated from forecasts published in *FT Currency Forecaster*.

1/ Based on exchange rates expressed as domestic currency units per U.S. dollar.
2/ Figures not adjusted for trend depreciation of Turkish currency.

though the latter were not always immune. It was revealed that Chile also was not immune to the effects of a crisis such as this one, though the other emerging markets in the comparator group tended to be more strongly affected. In terms of both bond spread and EMP responses to this shock, Chile looks more like an advanced economy.

143. In closing this section, several interpretative limitations deserve note. First, the four indicators analyzed—all of which are related to the value of a country's financial assets—cannot capture all aspects of vulnerability, such as the effects of external shocks on output and employment. Second, on the apparently lesser impact of the Russian crisis on Chile, these indicators do not distinguish how much may have been due to a policy response that impressed market participants, as opposed to a stronger position already in place when the crisis began. Thus in August 1998, the operational policy of interest rate targeting was temporarily abandoned by Chile, and the overnight (real) interest rate was essentially allowed to float to a level determined in the credit market, from about 8 percent in early August to over 30 percent by early September. This policy response, not captured by any of the indicators examined above, may have been more effective in stemming currency pressures. Third, the indicators examined in this section reflect the "what" rather than the "why." The rest of this paper looks at the latter question, examining specific factors that may underlie Chile's external position.

D. Indicators of Solvency

144. Although recent work has focussed on liquidity, solvency issues are still considered the "fundamentals." But solvency remains inherently difficult to assess: since it is a long-run concept, judgments about solvency rest only partially on an observable past and present, depending also on conjectures about future behavior.

145. This section is organized around two groups of solvency indicators, all of which rely only on currently-available data: (i) stock data, focussing on the level of external debt; and (ii) price and flow variables, including such indicators of "competitiveness" as real exchange rate measures, performance of export volumes, and current account behavior.[60]

Debt stock indicators

146. Solvency of the public sector is probably a necessary, though not sufficient, condition for avoiding external crises. In Chile, the total debt of the nonfinancial public sector—both external and domestic—is clearly manageable, about 10 percent of GDP in 1999.

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[60] For an earlier, more comprehensive treatment of solvency issues in Chile, see Milesi-Ferretti (1998).

147. Total external debt is much higher, on the order of 50 percent of GDP or 200 percent of merchandise exports in recent years, but manageable for a country with strong growth of output and exports, moderate spreads on external debt, and sizable foreign asset holdings.

148. Comparison of Chile's total debt stock to that of other countries in the sample is problematic. The debt data used here, from *World Development Indicators* (WDI) may differ in coverage or accuracy. Moreover, this dataset does not include any of the countries ranked 1st–12th in per capita income. Considering the 15 countries with data available, Chile's debt was close to the median in 1997,[61] scaled by either GDP or exports (Figure 1a). (In all charts such as these, countries are presented in order of increasing income per capita; data for Chile appear near the center.) WDI debt data for 1998 and 1999 are not yet available, but it is likely that Chile's ranking deteriorated in those years. (Figure 1b presents these same ratios, but calculated using an external debt concept published by the BIS. While this series is available for the full sample, it tends to understate the debt of the lower-income countries, since it does not include official credits; comparisons between higher- and lower-income countries should probably be avoided here.)

149. While Chile's external debt ratios cannot be called low, its stock of foreign assets is believed to be considerable, although comprehensive International Investment Position data have not been published. Merely considering official reserves, and ignoring all privately-held external assets, changes the picture greatly: e.g., subtracting official reserve assets from the stock of external debt would reduce Chile's debt ratios by about one-third.

150. Still, Chile's gross external debt has accelerated: in just the three years through end-1999, external debt rose by close to 50 percent in U.S. dollar terms. The increases in 1997 and 1998 were roughly in line with the uncustomarily high current account deficits of those years (Figure 2). However, strong debt growth continued into 1999, despite the near-disappearance of the current account deficit. This development did not reflect any shift away from equity inflows (which increased) but rather on an accelerated accumulation of external assets by the private sector. Such portfolio adjustment is presumably mainly of a one-time nature and so would not be expected to result in rapid debt growth on an ongoing basis.

151. To the extent that it finances asset accumulation, growth of external debt does not raise solvency questions. In principle, it could be a concern as regards liquidity, but to gauge liquidity risk, extensive "micro" information would be needed, to learn whether firms doing the borrowing are the same ones increasing their external assets; how liquid are such assets; and whether firms doing the borrowing have earnings mainly in foreign exchange or have

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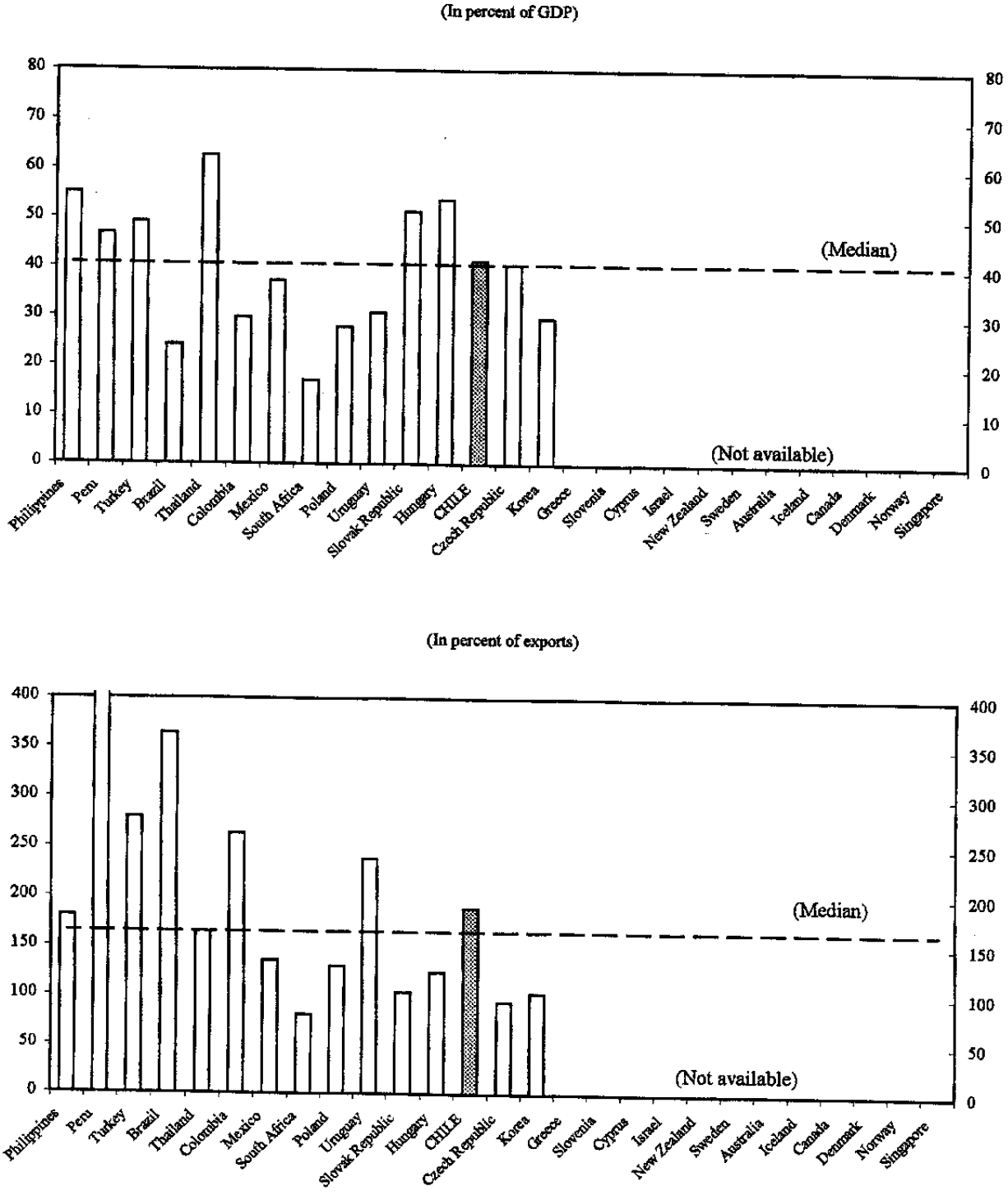
[61] Data for 1997 are used here, and elsewhere in this chapter, because they are consistently available for all countries in the sample. Such data also may also be useful as a "pre-Russia crisis" base (though for many variables considered, data a year or two earlier or later would show largely similar cross-country patterns).

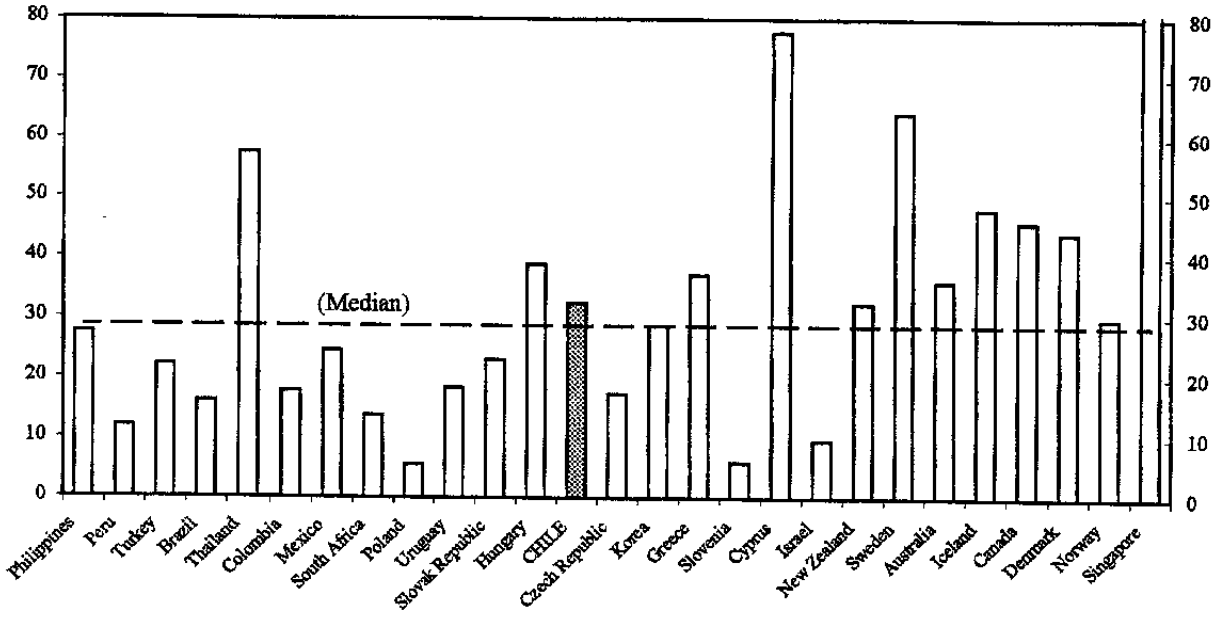
Figure 1a. Selected Countries: External Debt (World Development Indicators), 1997



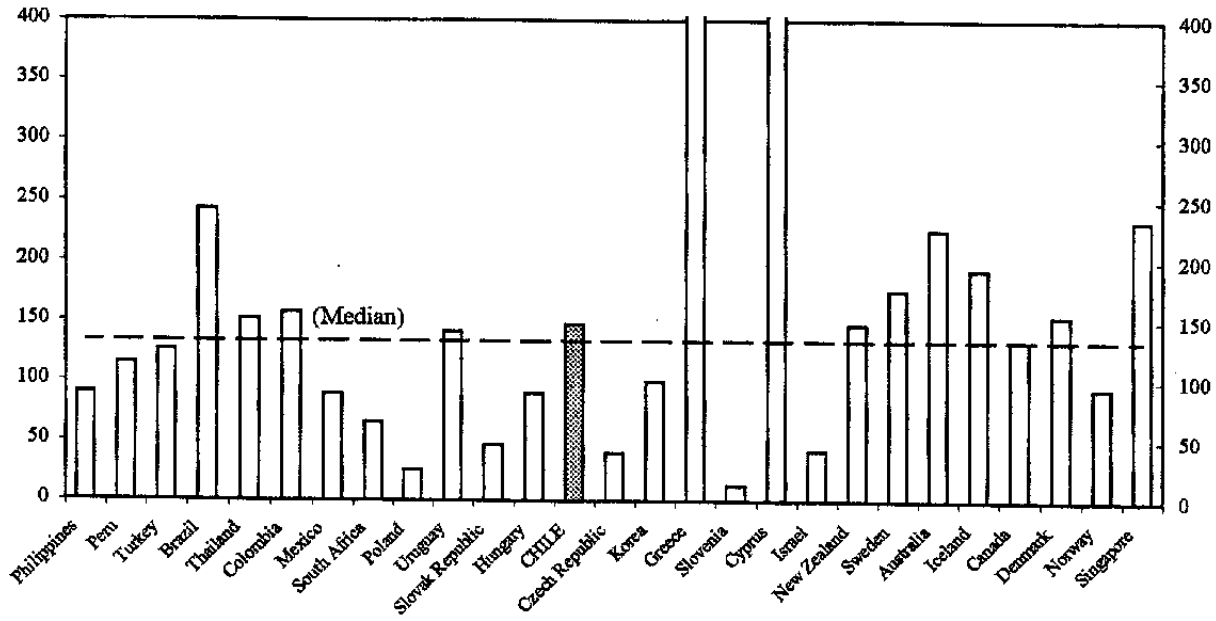
Sources: Joint BIS-IMF-OECD-World Bank debt data; and IMF, *International Financial Statistics.*

Figure 1b. Selected Countries: External Debt Reported in BIS Line I.C., 1997 1/

(In percent of GDP)



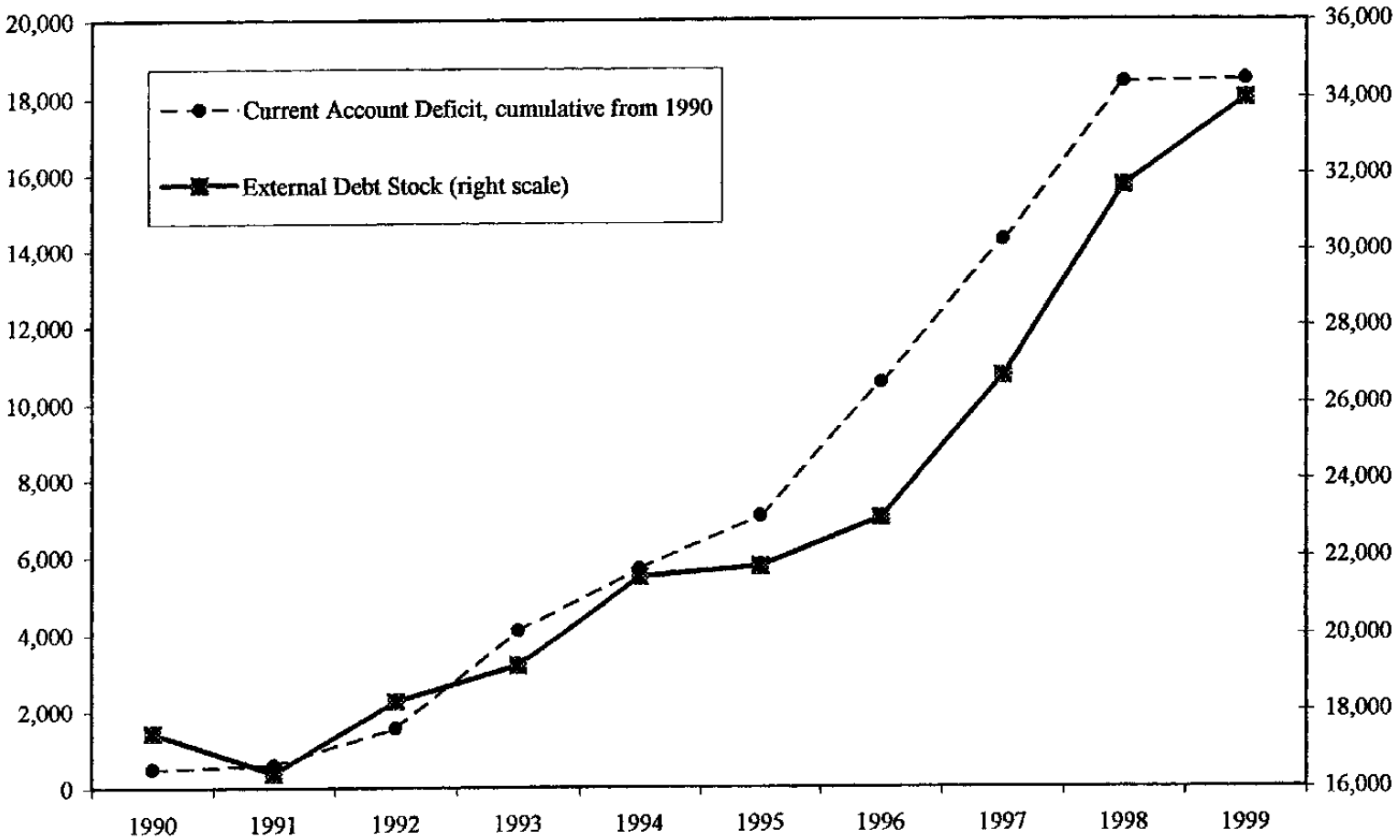
(In percent of exports)



Sources: Joint BIS-IMF-OECD-World Bank debt data; and IMF, *International Financial Statistics.*

1/ BIS line I.C. refers to loans from banks and debt securities issued abroad. Since credits from official sources are not included, these data tend to understate the indebtedness of developing countries especially.

Figure 2. Chile: External Debt Stock and Cumulative Current Account Deficit, 1990-99
(US$ millions)



Source: Central Bank of Chile.

otherwise hedged themselves. (An indirect, more qualitative way of assessing the risk would involve assessment of the financial regulatory regime; section F briefly remarks on this.)

Competitiveness: real exchange rate, export volume, and current account

152. Various indicators of Chile's competitiveness improved in 1999, particularly with an improvement in copper prices and a sharp fall in the current account deficit. However, during 1997 and 1998, Chile's competitiveness might have been an area of investor concern.

153. Chile experienced a sizable appreciation during the 1990s, with the appreciating trend in fact beginning in 1990. From 1990 through autumn 1997, real appreciation has been measured at some 40 to 50 percent (Figure 3).[62] It is likely that some, but unlikely that most, of this real appreciation could be attributed to relative productivity gains. Valdes and Delano (1998), for example, estimate that appreciation of roughly 1 percent per year might reflect this effect, only about one-fifth of the average rate of appreciation during the 1990s. Moreover, it is not clear that the real appreciation could be attributed to improving terms of trade; while copper export prices were above the depressed levels of the mid-1980s, their path through the 1990s was if anything a declining one (Figure 4).

154. In 1996–97, two sources of potential concern developed. One was a negative shock to the terms of trade. Copper prices crashed in mid-1996; a partial price recovery was followed by a deeper crash in the second semester of 1997.[63] Even if some part of this decline was perceived as temporary, it might still have concerned investors, particularly since no quick recovery was expected.[64] Another concern was an acceleration of real appreciation in 1997: roughly one-third of the total 1990–97 appreciation took place in just the first nine months of 1997.

155. Thus, by the time of the height of the Asia crisis in January 1998, several indicators might have led some investors to expect an exchange rate "correction." However, two

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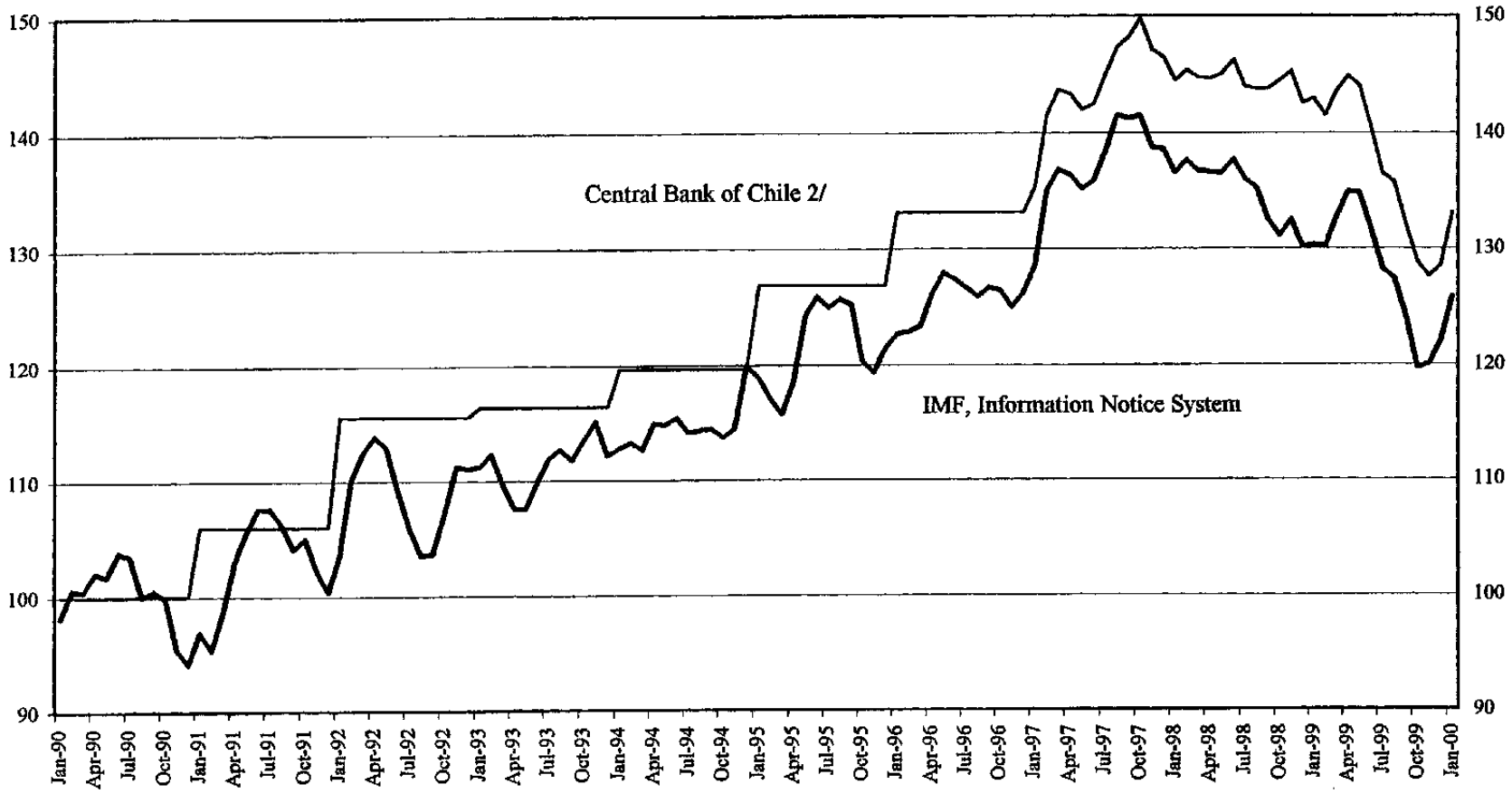
[62] That is, 41 percent according to the IMF's Information Notice System (INS), and about 50 percent according to the series from Chile's central bank.

[63] Prices then continued to fall, bottoming in Spring 1999 at about half the mid-1997 value.

[64] Since early 1998, forward market prices have pointed to some copper price recovery, but not to a fast one. For example, during the Russia crisis period of August–October 1998, when LME copper prices averaged about 72 U.S. cents per pound, prices for copper 2¼ years ahead averaged only 76 U.S. cents per pound. It can also be noted that real copper prices in 1998–99 were much below their averages of the previous 10, 25, or 40 years, hinting at room for mean-reversion. If such prices do have a mean-reverting component, however, it is slow enough to make it difficult to reject the hypothesis of a unit root (even using the more powerful tests that allow for breaks in the series) in the 1957–99 period.

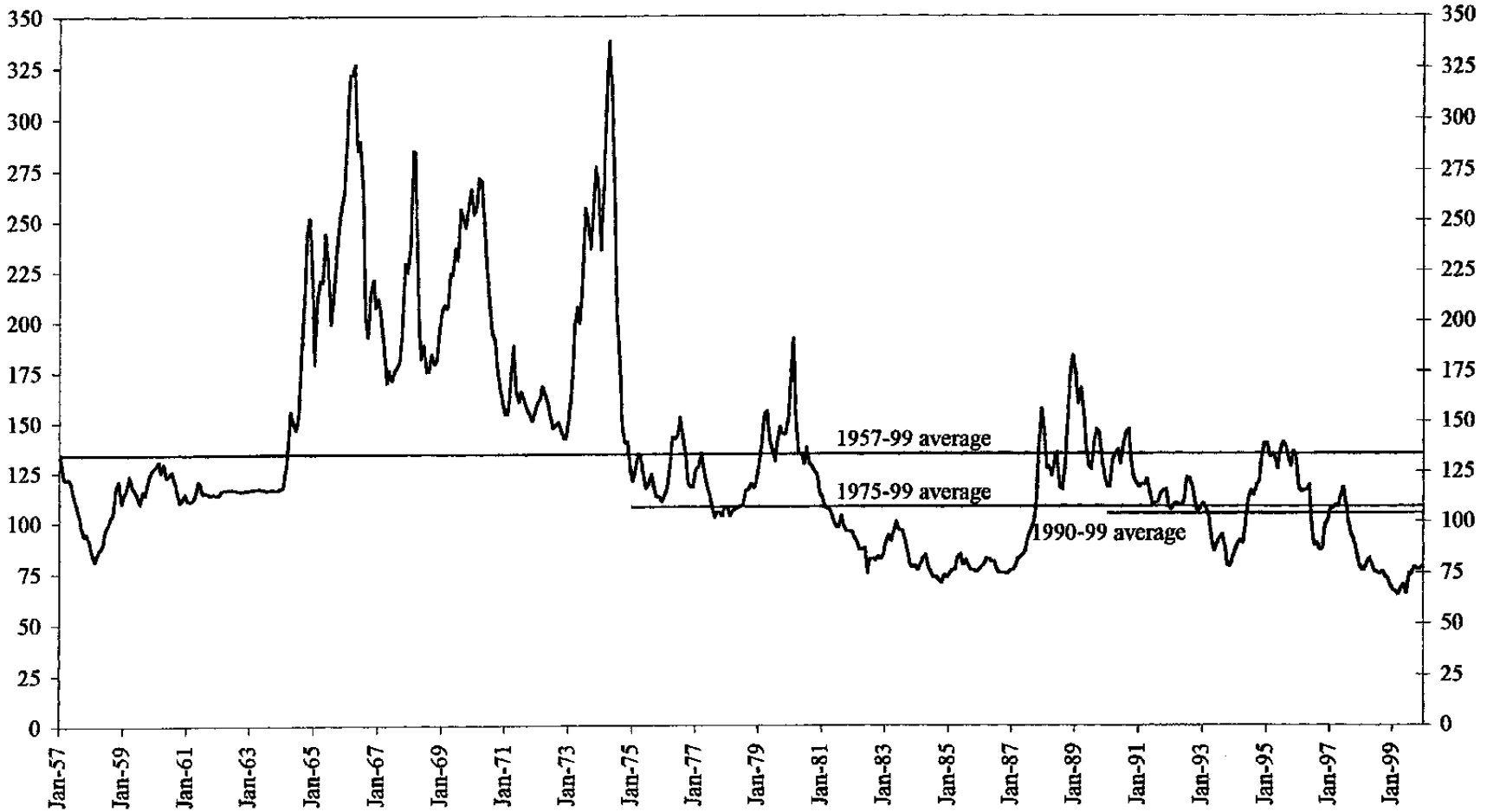
Figure 3. Chile: Real Exchange Rate Indices, January 1990-January 2000 1/
(1990=100)



Sources: Central Bank of Chile; and IMF Information Notice System.

1/ An increase denotes a real appreciation of the Chilean peso.
2/ Annual data for 1990-96, monthly thereafter.

Figure 4. Real Copper Price, January 1957-December 1999
(U.S. cents per pound, in constant prices of 1999) 1/



Source: IMF, *International Financial Statistics.*

1/ Copper price deflated by U.S. wholesale price index.

considerations make it unclear that Chile's substantial real appreciation was a serious problem, likely to require a large, or abrupt, nominal exchange rate correction in the near future. First, the level of the real exchange rate in 1990 was not necessarily an equilibrium, and appreciation from that point may have been largely a movement toward equilibrium. Estimates by Cespedes and De Gregorio (1999) of Chile's equilibrium real exchange rate imply a substantial undervaluation in 1990; not until 1996–97 do they find any overvaluation. Second, the real appreciation that occurred was evidently not governed by the exchange rate band's limit on nominal depreciation. There was usually room available for continuous depreciation within the band (as opposed to the discrete, band-busting depreciation that draws speculative attacks). For much of the 1990s, exchange market pressure was usually in the direction of appreciation.

156. With price-based indicators not providing a clear signal, we turn to two flow indicators. There was also no obvious case that *export volumes* were stalling. Certainly, copper export volumes were strong: even at the real exchange rate peak in 1997, they grew by almost 20 percent. On the other hand, non-copper export volumes did slow in 1996 and especially1997, though even in 1997 they grew by almost 5 percent (perhaps, important lagged effects of real appreciation had not yet materialized).

157. Ultimately, the solvency question comes down to the *current account*, and in fact the size of Chile's deficit was a widely-expressed concern for several years. The deficit showed a steep increase in the mid-1990s, mainly accounted for by a jump in import levels that began in 1995 and was sustained until August 1998. For 1996 and 1997, Chile's actual deficit[65] was about 5 percent of GDP; it then peaked at about 7½ percent of GDP during the 12 months ended September 1998, just as several East Asian countries underwent wrenching import contractions. Such deficits were considerably larger than typical among the sample; e.g., Chile's deficit in 1997 was more than twice the sample median (Figure 5, top panel).[66]

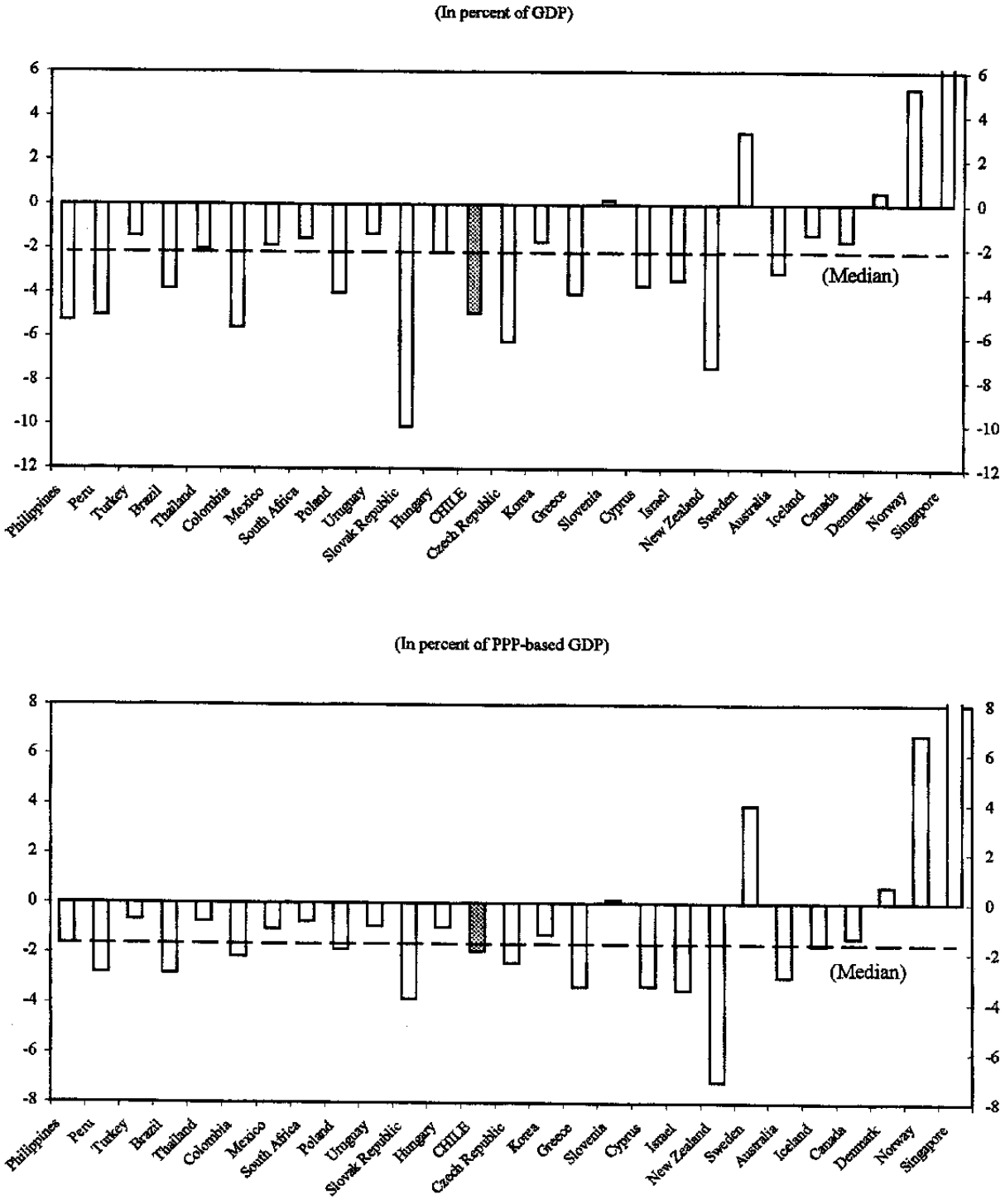
158. The immediate problem posed by Chile's current account deficit, perhaps, was not that it was adding rapidly to the debt stock—in principle, solvency was not at issue because there was time to gradually trim the deficit to a level that was more clearly sustainable. Rather, the problem for Chile may have been that a deficit of this size meant that the economy could be more vulnerable to a "sudden stop" of capital inflows.

* * * * *

[65] Guajardo and Le Fort (1999) construct an alternative indicator, the *trend current account*, abstracting from shocks to the terms of trade and the volumes of certain exports. From this perspective, the peak current account deficit occurred in 1997 rather than 1998.

[66] Note that on average the higher-income economies have smaller current account deficits than the lower-income ones, scaling by GDP converted to U.S. dollar terms at actual exchange rates. Using PPP-based GDP (Figure 5, bottom panel) considerably reduces the apparent size of the lower-income countries' deficits.

Figure 5. Selected Countries: Current Account Ratios, 1997



Sources: IMF, *International Financial Statistics;* and World Economic Outlook.

159. Where does Chile stand now, in early 2000? By nearly every indicator of solvency or competitiveness, Chile's position is now much improved from just a few years earlier. A substantial if moderate real depreciation, some terms of trade improvement, an acceleration of export volumes—albeit mainly in copper—and especially the steep reduction in the current account deficit, all combine to form a picture that looks safer. Looking ahead, a positive view of solvency is also supported by the expectation of further copper price increases and continued strong growth of output. The only solvency-related indicators not to have improved are the external debt stock ratios, but part of their recent rise reflects asset accumulation. With the current account deficit now much-reduced, growth of Chile's debt stock ratios is expected to halt.

E. The Question of Liquidity

160. The question of liquidity here centers on the level of official reserves, but there are many ways the adequacy of this can be assessed. A simple start is to seek only a relative answer, making cross-country comparisons, using a variety of scaling variables. We then turn to assessments of liquidity involving the relationship between reserves and potential short-term liabilities. Finally, we discuss various issues regarding the measurement of reserves and short-term debt, applying these questions to the case of Chile.

Scaled measures of reserves

161. Figures 6 and 7 present reserves ratios for Chile and the comparator countries, using four different scaling variables.[67]

- *Reserves to GDP (at actual exchange rate).* GDP is an obvious candidate for scaling reserves data across countries. By this indicator, advanced and developing countries' levels of reserves are broadly similar on average. Chile's second-ranked ratio is 22 percent, twice the sample median.

- *Reserves to GDP (using PPP exchange rate).* Switching to PPP-based valuation of GDP alters the picture, as many lower-income countries' ratios fall sharply.[68] The average ratio for the higher-income countries is about twice the average of the lower-income countries. Chile no longer stands out; in fact, its ratio drops fairly close to the sample median.

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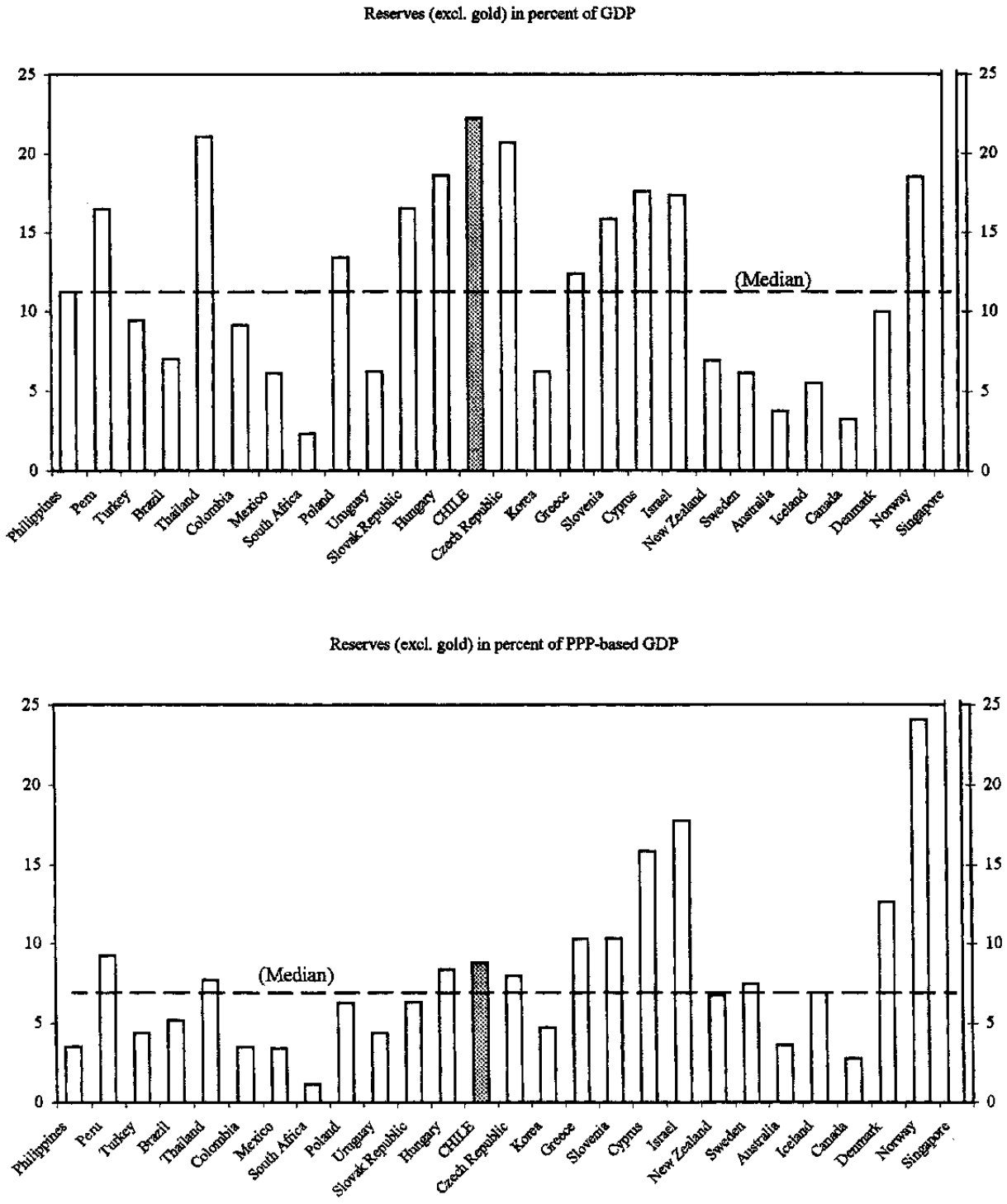
[67] Based on IFS reserves data excluding gold. For most countries in the sample, these ratios would be only slightly higher if gold were included. Reserves ratios for Philippines, South Africa, and Uruguay would be most affected, but their sample rank would change little.

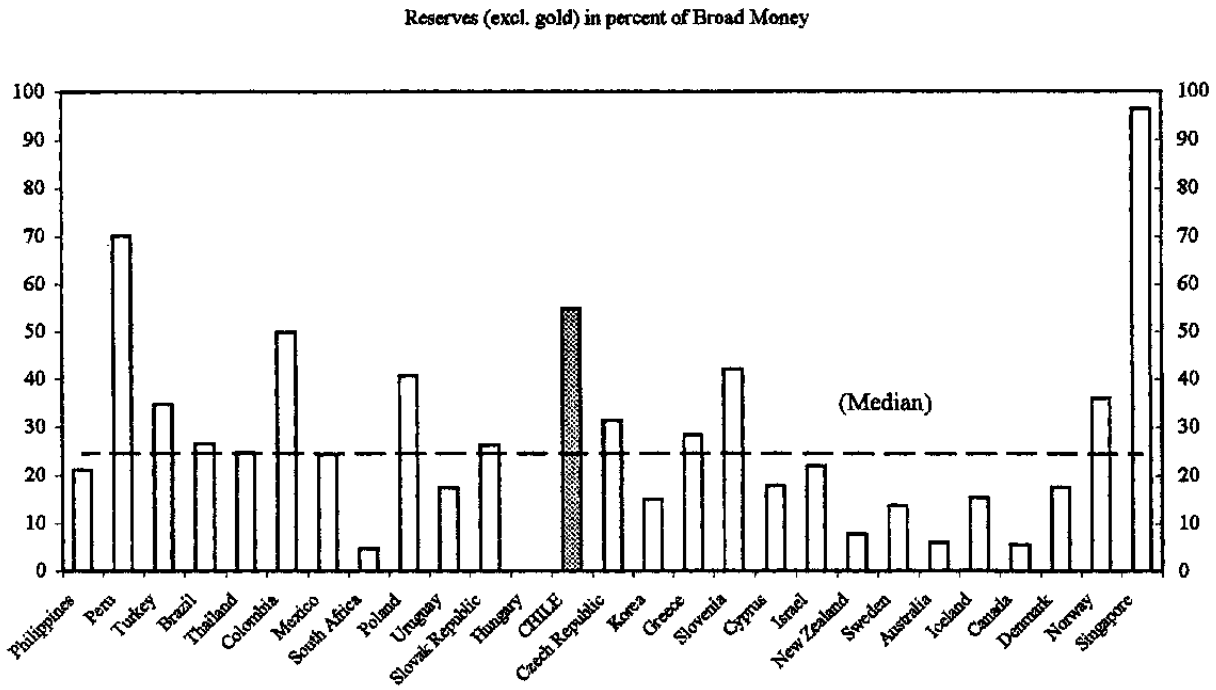
[68] This pattern is consistent with the usual pattern of exchange rate undervaluation (in the PPP-based sense) found in developing countries.

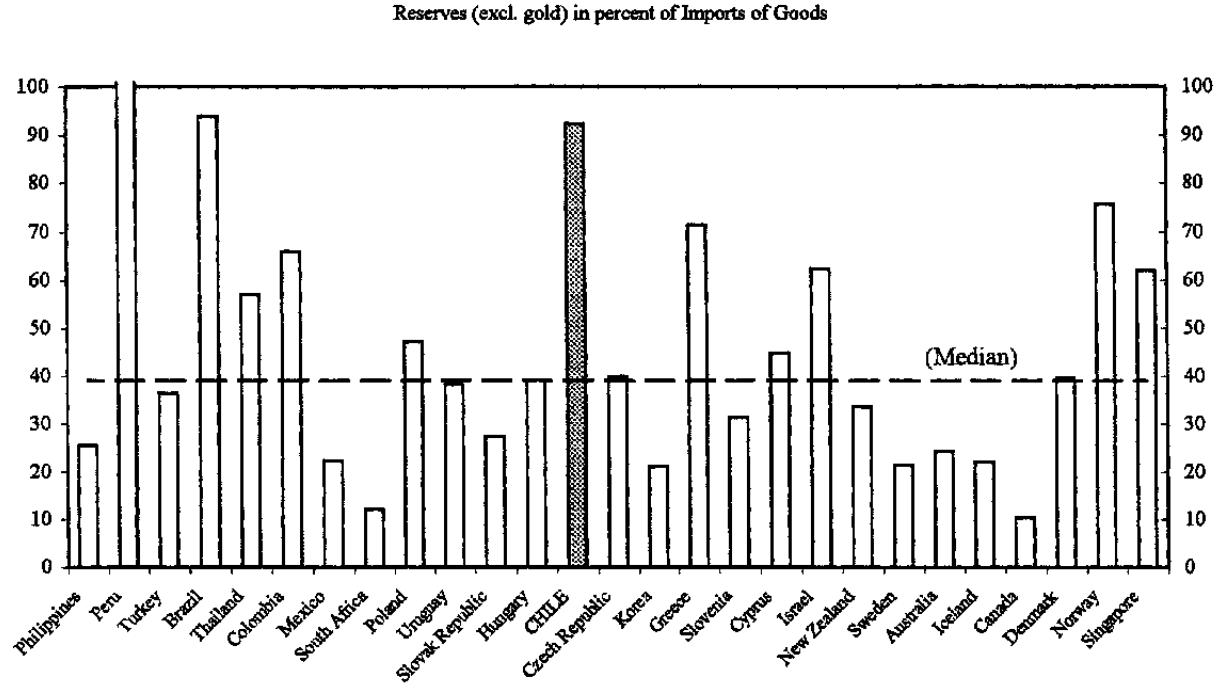
Figure 6. Selected Countries: Reserves in Comparison to GDP, 1997



Source: IMF, *International Financial Statistics.*

Figure 7. Selected Countries: Other Reserves Ratios, 1997





Source: IMF, *International Financial Statistics.*

- *Reserves to Broad Money*. This indicator is perhaps most relevant in a fixed exchange rate context—so it now may be less relevant for Chile than previously. With a ratio of 55 percent, Chile holds 3rd position, again at roughly twice the median value of this ratio. By this indicator, higher-income countries tend to have *smaller* reserves than the lower-income ones—indeed, Australia, Canada, and New Zealand have some of the lowest ratios in the sample. It is striking that this indicator of reserve adequacy is apparently irrelevant to these highly-perceived (e.g., in terms of credit ratings or bond spreads) economies. Clearly, a very low value of this ratio is not perceived as necessarily being a problem, at least for advanced economies with flexible exchange rate regimes.

- *Reserves to Imports*. This traditional indicator still receives attention, though its conceptual appeal has waned as capital accounts have been opened. (Another problem is that a high ratio might reflect mainly a low level of trade openness which might be associated with greater vulnerability.) On average, advanced economies' import cover is *lower* than in lower-income countries. Chile's 3rd place ratio of 90 percent is more than twice the sample median.

162. Although these indicators of reserves can give a quite different picture for any one country, for Chile the relative position looks very strong for three of the indicators, and for the other Chile is centrally placed.

Liquidity as the relation between reserves and potential short-term liabilities

163. This type of indicator is fast becoming a standard, based on its success in predicting currency crises. The most basic form is a comparison between official reserves and the stock of short-term debt, typically expressed as a ratio. Such an indicator can have both a relative and an absolute interpretation. In relative terms, it has been shown empirically that higher values are less frequently associated with crises (though such conclusions have been drawn from samples of emerging markets, and the relationship may not apply in the same way to higher-income countries). A conceptually-based, absolute interpretation is also possible, in which the ratio is considered to represent a simple "stress simulation" for a hypothetical shock involving the complete cutoff of external inflows for a period of one year. In this case, a ratio of 100 percent can become a benchmark, one with some intuitive appeal, but also some problems.[69]

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[69] One problem is that the choice of a one-year duration for the financing shock is arbitrary. A more fundamental question, where most short-term debt is owed by the private sector, is whether and how the reserves held by the public sector would come into play. (For example, short-term creditors may not be confident that the parties to which they have lent would have the domestic currency resources to purchase, at prevailing exchange rates, the foreign currency needed to amortize their debt.)

164. In considering such indicators, measurement problems become acute, since for many countries there is substantial uncertainty about the true level, or appropriate definition, of short-term debt. Given the size of the sample used here, the only practical option is to use the publicly-available Joint BIS-IMF-OECD-World Bank ("BIS") data for short-term debt. (Since such data are not available for many of the sample's higher-income countries, the sample size falls to 19.) Again, these debt data are not beyond question, and their use here is motivated by convenience and impartiality only. As regards reserves data, these are taken from the IFS. (Specific issues in the measurement of short-term debt and reserves are discussed below, emphasizing the Chilean case.)

165. *Ratio of reserves to short-term debt (Figure 8, top panel).* Poland and Israel are outliers at the high end, with ratios about three times that of Chile. Still, at about 150 percent, Chile's ratio exceeds the benchmark of 100 percent, and it is the 7th highest of the 19 countries with data available.[70] However, the absolute size of such ratios has no direct, intuitive interpretation, so it is useful to consider a variant with more familiar units.

166. *Reserves minus short-term debt, as a percent of GDP (Figure 8, bottom panel).* This formulation, which scales the gap between reserves and short-term debt by the size of the economy, changes the picture greatly for some countries: e.g., Poland and Israel no longer appear as strong outliers, while Singapore becomes one.[71] Chile's rank, however, is almost unchanged, at 6th out of 19 countries. The value for Chile is positive, by 7.3 percent of GDP.

Some Chile-specific modifications

167. Since Chile passes the simple benchmark of having reserves in excess of short-term debt, the next step is "raise the bar."

168. One possibility is to compare reserves to the *sum* of short-term debt and the current account deficit over the coming year. The problem with this suggestion is judging the appropriate level of the deficit to be included. In Chile's case, however, the question may be moot, since the excess of reserves over short-term debt is considerably larger than any deficit on current account Chile is likely to experience soon. Thus the latest-available BIS data, for-end 1999, indicate that reserves exceed short-term debt *by more than 10 percent of GDP*.

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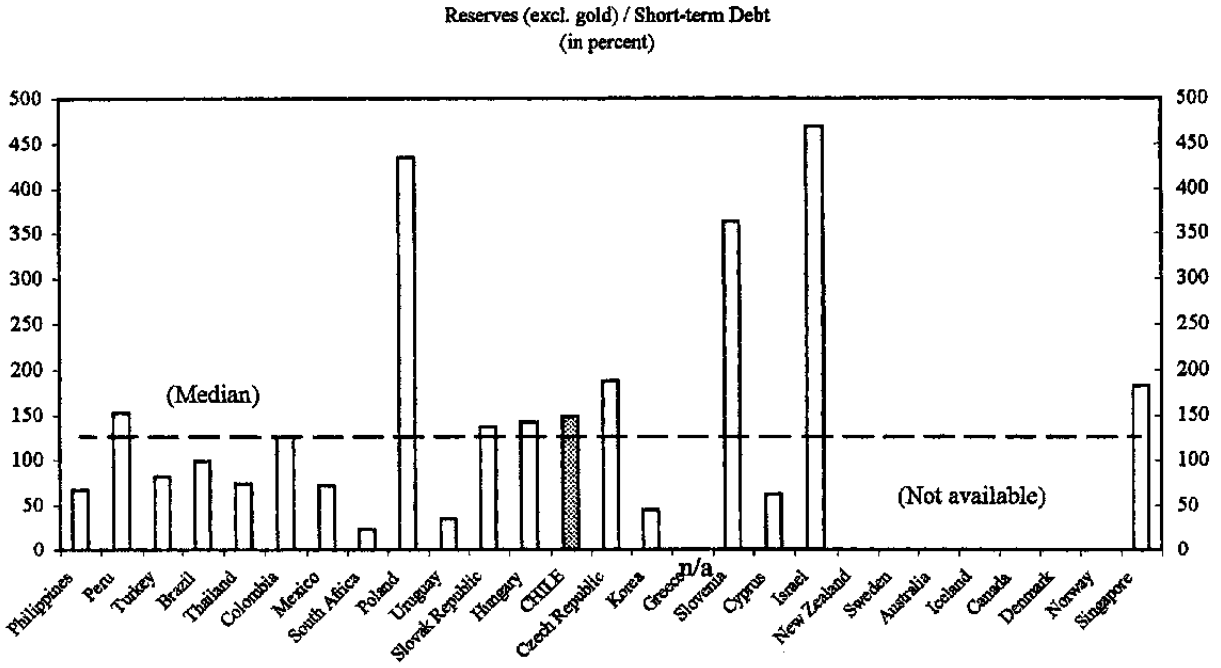
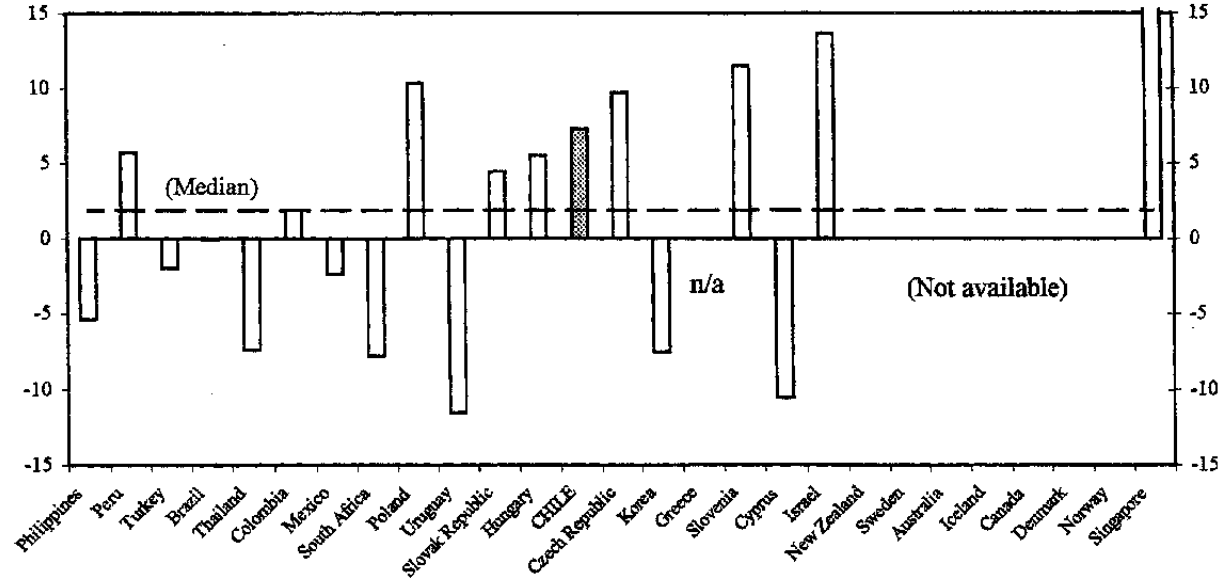
[70] Regarding the rule of thumb proposed by Bussiere and Mulder (1999), which adjusts the 100 percent benchmark according to the level of the current account deficit and the extent of recent appreciation of the real exchange rate, Chile would have been near the borderline of a comfortable situation in 1997, but would easily pass this benchmark today.

[71] The ratio of reserves to short-term debt can be quite sensitive to low values of its denominator. According to BIS data, both Poland and Israel have unusually low values of short-term debt (expressed in relation to GDP, for example, about 3 percent). Chile's ratio of short-term debt to GDP is close to the median, about 12 percent of GDP.

Figure 8. Selected Countries: Reserves in Comparison to Short-term Debt, 1997 1/





Sources: Joint BIS-IMF-OECD-World Bank debt data; and IMF, *International Financial Statistics.*

1/ For Czech Republic and Slovenia, BIS short-term debt data are incomplete, so the ratios shown here are biased upward, by an unknown amount.

169. For a more challenging stress simulation, one may consider not only a year-long cutoff of external finance, but also shocks that at the same time might abruptly increase the size of the current account deficit to be financed. Consider three events which might afflict Chile:

- *A decline in copper prices.* At around 40 percent of exports, and 10 percent of GDP, copper exports are clearly significant to the Chilean economy. Moreover, copper prices are highly volatile and it is not unusual for the real price of copper to change by a factor of two—in either direction—in a year or two. Currently, however, downside risk is limited by the already-weak state of copper prices, which touched a 40-year low in early 1999, and have subsequently recovered only slightly. Moreover, copper prices in 1999 seem to have been approaching a natural floor, in that prices were reportedly close to a level at which less efficient producers would be unable to cover variable costs (indeed the year was marked by many mine closures outside Chile). Nevertheless, to take an extreme scenario, consider a hypothetical decline in the LME copper price to 50 U.S. cents per pound, or about 30 percent below the 1999 average. The direct, static impact on the current account would be on the order of 2½ percent of GDP. Surely, this figure is an overestimate;[72] nevertheless, it represents only a fraction of the excess of reserves over short-term debt.

- *Higher oil import prices.* Another potential negative shock would be an increase in oil import prices, since Chile produces only a small share of its oil consumption. Imports of crude oil tend to be no more 1½ percent of GDP, while imports of other combustible fuels and lubricants are typically another 1 percent. As a rather extreme example, a rise in spot oil prices to US$35 per barrel would represent an approximate doubling of their 1999 level (which was broadly similar to the average level of the 1990s). If maintained for a year, the static (i.e., overestimated) impact on the current account would be roughly 2½ percent of GDP.

- *Increased foreign interest rates.* Consider, for example, an increase of 300 basis points in the U.S. dollar interest rates to which Chile's floating rate debt is tied. With total external debt on the order of 50 percent of GDP, and roughly two-thirds of that debt having a floating interest rate,[73] the direct impact effect on the current account of higher interest payments would be 1 percent of GDP. Again, such an outflow is small in relation to the excess of official reserves over short-term debt. (This calculation is conservative in that it does not take into account increased receipts on Chile's foreign assets.)

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[72] For example, because the large degree of foreign ownership of Chile's copper sector, implying that diminished profit outflows in the current account would somewhat offset the loss of export revenue. Also, such a decline in export prices would initiate a range of responses tending to trim import demand.

[73] At end-1998, for example, floating rate debt represented 64 percent of the total.

170. All these possibilities represent negative shocks large enough to be unlikely in any given year. Yet even when their effects on the current account are calculated in a clearly overstated manner, none are large enough to alter the perception of strength that comes from a simple comparison of Chile's reserves and short-term debt levels.

171. To further check the robustness of Chile's position, we next take a closer look at the data used above to represent reserves and short-term debt.

Taking account of reserves' usability

172. As has become better appreciated, the concept of reserves is not self-explanatory, and for many countries the nature of reserve holdings, and their degree of usefulness, traditionally has not been transparent. However, the development of the SDDS "reserves template" has begun to counter this problem.

173. Chile began publishing reserves data on this basis with figures for end-April 2000. Overall, this new information suggests that most of Chile's reported official reserves would in fact be available for policy purposes, even in a worst-case scenario. For example, the sum of net pre-determined and contingent short-term foreign exchange flows is negative, but it is less than 5 percent of the stock of gross reserves. Also of interest is the amount shown for liabilities denominated in foreign currency but settled by other means (such as the domestic currency): for Chile, this was reported to be a bit less than 10 percent of total reserves in April 2000.

174. For many countries, another point of interest in analyzing reserves data is the amount of foreign exchange deposited by resident financial institutions at the central bank, since some of these funds might be withdrawn quickly in a crisis. The level of such deposits at Chile's central bank is not separately identified in the published data, but it is understood that it recently has represented only 1 to 2 percent of gross reserves.

Measures of Chile's short-term external debt

175. As noted, the BIS data considered above are not the last word on short-term debt measurement, for Chile or any other country in the sample. A detailed study of alternative debt measures in each country would be impractical here, but a few remarks on Chile are worthwhile. Use of the officially-published short-term debt statistics would improve the view of Chile's liquidity position, since these data indicate stocks smaller than BIS data. The Chilean authorities have studied the differences between the numbers, identifying a number of methodological differences that could account for the gap. In 1999 the gap narrowed considerably when the authorities shifted to a residual maturity basis. Of the remaining difference between Chilean and BIS data, one difference is that the former do not yet include

trade credits.[74] Another is that the BIS figures include foreign currency loans extended by foreign-owned banks which are resident in Chile; the Chilean statistics do not consider this as *external* debt.[75] The BIS recently began identifying the amount of such loans in its published data; for end-1999, they constituted more than one-third of the BIS-reported short-term debt.

F. Other Factors Affecting External Vulnerability of Chile

176. This section briefly notes a range of factors, including policies, affecting Chile's degree of vulnerability. What these factors have in common is their qualitative or judgmental nature, which does not lend itself to direct cross-country comparison—thus the focus on Chile.

177. In general, Chilean policies would seem to score well in terms of limiting external vulnerability. Some policies are of course reflected in the quantitative indicators examined in the previous sections, but mention could also be made of the following:

- *Apparent avoidance of tax or other regulatory bias in favor of short-term external borrowing.* Such bias is a factor often cited to explain the origins of the 1997–98 crises in East Asia. On the contrary, Chilean policy until very recently involved an explicit bias against short-term capital inflows.

- *Strength of the banking system, including banking regulation.* It often happens that currency crises and banking crises occur together. A comprehensive examination of these issues cannot be included here, but Chile's banking system is widely considered to be strong, exceptionally so among emerging markets. For example, in early 2000 Moody's ranked the financial strength of Chile's banks 15th of 75 countries, similar to those of Australia, and exceeded only by Singapore among emerging markets. A further indicator of strength is the way Chilean banks have weathered the recent recession and the various shocks of 1997–99, including a substantial currency depreciation since late 1997. One factor in this performance is likely the relatively low external indebtedness of Chile's banks: although most of Chile's debt is private, financial institutions account for only about 15 percent of medium- and long-term external debt, for example. Banks' exposure to foreign currency risk is a focus of regulation. The short-term foreign assets of commercial banks have exceeded their short-term foreign liabilities since 1997, with the difference at end-1999 being more than 5 percent of GDP. Recent regulatory initiatives seek to facilitate banks' analysis of risk they incur in lending to Chilean companies.

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[74] In principle, BIS data for short-term debt captures some, but not all, trade credits.

[75] The Chilean treatment is consistent with the IMF Balance of Payments Manual.

- *Factors limiting the financial vulnerability arising from the corporate sector.* Chile's corporate sector has avoided the very high debt-equity ratios seen in East Asia and often cited as contributing to the severity of the 1997–98 crisis. Regulations also play a role, for example the requirement of a minimum credit rating for firms issuing foreign currency bonds.

- *Exchange rate flexibility, and transparency of the exchange rate regime.* Since September 1999, new detail in the reporting of changes in official reserves allows a clearer picture of central bank intervention (or its absence). This step was recently complemented with data following the SDDS reserves template. Arguably, the new exchange rate regime itself may help to prevent crises.

- *Policy focus on monitoring the current account deficit.* The outlook for solvency is supported by an apparent consensus among many policymakers in Chile that macro policy should closely monitor the current account deficit (i.e., aside from the real exchange rate), thinking in terms of some maximum safe, sustainable current account deficit, and taking action when this level is exceeded.

178. From the standpoint of limiting external vulnerability, it is difficult to find fault with Chile's policy regime. However, certain areas exist in which there is room for *deepening the set of information* that is available for assessing vulnerability. Such information, and the better private decision making it facilitates, can in principle reduce external vulnerability. The following areas can be mentioned:

- *Data on external assets of the private sector.* Since these are believed to be large, they are of interest, and could be especially useful in interpreting the significance of Chile's also sizable external debt. Not only the size but also the liquidity of these assets could be relevant for some questions. Publication of complete International Investment Position data would be a significant step.

- *Data on foreign currency exposure by sector, or average levels of exposure.* Outside the financial sector, the exposure of the rest of the private sector is unclear. It would be useful to know whether the same firms or sectors that have recently been accumulating external debt at a fast pace are also the ones which have been building up their external assets, and whether such debtors are foreign exchange earners.

- *A fully-developed medium-term fiscal framework* would make clearer to markets the role the public sector sees for itself in maintaining Chile's overall solvency, dealing with terms of trade shocks, and influencing the national saving rate. The recent initiative to consider the fiscal stance in terms of structural balance, and the suggestion to aim at a surplus on a sustained basis, could provide a useful signal.

- Expanded coverage of external debt statistics. Data for short-term debt that included trade credits could sharpen the analysis of liquidity (though the basic picture might

not be much affected, given the size of Chile's international reserves). As regards total external debt, more complete coverage of the debt (and assets) of the military sector would be useful in analyzing the solvency of the Chilean economy.

G. Conclusions

179. Assessment of external vulnerability remains an art. After examining numerous indicators, conclusions such as the following must contain an element of judgment as well as generalization:

- Chile aside, one finding of this study is the pattern of differences between higher- and lower-income countries, with the former tending to look stronger by most indicators. Certainly, the higher-income countries on average have higher credit ratings and lower bond spreads. Moreover, the higher-income countries also appeared less affected by the Russia shock in terms of the measured *responses* of bond spreads, exchange market pressure, and forecasts of their exchange rates. The higher-income countries also tend to have smaller current account deficits. However, it cannot be said that higher-income countries hold larger official reserves; for several reserves indicators, the opposite pattern holds. (Unfortunately, comparisons related to external debt stocks are frustrated by the lack of comparable data.)

- Relative to other emerging markets, the strength of Chile's external position is confirmed—even among the class of "better" emerging markets considered here.

- Relative to the advanced/higher-income economies considered here, Chile remains somewhat but not too far behind, according to such summary indicators as bond spreads and private credit ratings. In terms of the relative degree of vulnerability revealed by the 1998 Russian crisis, it can be said that the crisis did not show Chile to be completely out of this league. For several of the response indicators examined, Chile looks more like a higher-income country.

- As regards liquidity, Chile's relatively high level of official reserves, considered against its relatively moderate level of short-term debt (both measured as shares of GDP) suggest a position of strength. Chile's excess of reserves over (BIS-measured) short-term debt is on the order of 8 percent of GDP, which dwarfs the additional short-term financing needs that might arise from various shocks to the current account.

- Comparisons to other countries aside, Chile's external position in early 2000 looks stronger than in several years. The greatest weakness perceived in recent years was probably the size of the current account deficit, but this deficit nearly disappeared in 1999. The recent moderate improvement in the terms of trade is another positive factor, and some further recovery is likely. Also among Chile's greatest strengths are

the health of its banking system, the low level of public sector debt, and the coverage of short-term debt by reserves.

- Chile's least favorable indicator might be the total stock of external debt. Although the recent rise in external debt ratios is not likely to continue, such ratios have moved outside the low ranges, and the level of debt bears monitoring. Still, this debt should be considered against Chile's foreign assets, and the more relevant issue may not be solvency but the management of the foreign exchange exposure of the private sector.

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V. Fiscal Policy Through Time-Varying Tax Rates[76]

A. Introduction

180. Time-varying tax rates, defined as tax rates that hinge on the state of the business cycle, have been used sporadically in different countries and under different circumstances. In the late sixties, for example, the U.S. Government hiked temporarily income taxes to counter the effect of fast-growing economic activity on inflation.[77] On the other hand, countries such as Japan and Thailand have used in recent years temporary tax breaks to attempt to boost economic activity during times of recession. In Chile, the issue of variable tax rates for counter-cyclical purposes has been in the academic and policy arena for the last few years;[78] the discussion has been primarily motivated by some large surges in domestic demand during the 1990s. In contrast to the occasional use done by some countries in unusual circumstances, like a deep and protracted slump in economic activity, in Chile the use of variable taxes has been envisaged more as a fine-tuning policy scheme in which tax rates would be adjusted according to the state of the business cycle.

181. In this context, the aim of this paper is to investigate from an analytical viewpoint whether there are circumstances when fiscal policy through time-varying tax rates can improve welfare and whether this policy can be effectively implemented in practice. We select two cases that present at least the potential for time-varying taxes to improve welfare: one is the case of *under-consumption* resulting from negative transitory shocks to income and binding credit constraints; the other is the case of *over-consumption* resulting from time inconsistency in the allocation of consumption due to a change in preferences, i.e. time-decreasing discount rates.

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[76] Prepared by Martin Kaufman. This paper draws extensively from "Fiscal Policy Through Time-Varying Tax Rates: If and How" IMF Working Paper, 2000 (forthcoming). I have benefited greatly from discussions with Luis Cubeddu on a joint research project on fiscal policy. I am thankful to Guillermo Le Fort, Mario Marcel, Francisco Nadal-De Simone, Steve Phillips, Robert Rennhack, Klaus Schmidt-Hebbel, and participants in a seminar held at the Central Bank of Chile for helpful comments. Special thanks are due to Nigel Chalk, Saul Lizondo and Jeromin Zettelmeyer for their insightful suggestions. Any error or omission is the sole responsibility of the author.

[77] For a review of the U.S. experience in 1968 with the use of tax rates for counter-cyclical purposes see for example Okun (1971, 1975), Brandson (1973), and Springer (1977). For more recent empirical literature on the consumption effect of tax changes in the United States see Parker (1999).

[78] Budnevich and Le Fort (1997) have discussed the potential benefits and shortcoming of such policy for Chile.

182. This paper examines whether changes in tax rates could be used to boost or to restrain consumption in such a way to increase welfare. Under binding liquidity constraints, a reduction in consumption taxes is more prone than a reduction in income taxes to boost consumption and improve welfare. In presence of time consistency problems in the allocation of consumption induced by hyperbolic discounting,[79] a hike in consumption taxes can be used to restrain consumption and improve welfare. However, the use of variable tax rates has serious implementation problems.

183. While this paper shows that, in principle, variable taxes could improve welfare in some cases, it also highlights the very particular circumstances that need to prevail for such a result to follow. This places the burden of proof onto the proponents of variable taxes to demonstrate that these specific circumstances are actually present in the particular case considered.

184. More generally, the discussion of variable tax rates as a counter-cyclical policy invokes many questions related to counter-cyclical policies at large: Can the authorities act timely so as not to exacerbate cycles? Can the authorities correctly distinguish transitory from permanent shocks? These interrogations need to be reckoned carefully over and above the issues that this paper addresses in detail.

185. Moreover, many questions that we will not tackle here need to be dealt with before serious consideration is given to using tax rates for counter-cyclical policy. The first fork in the road to be encountered is the question of why fiscal instruments instead of monetary instruments to pursue counter-cyclical policies. Then there is the question of why use tax rates for fiscal policy and not public expenditures. In fact, the use of tax rates would contradict the well-established tax-smoothing proposition when taxes are distortionary (Barro (1979)).

186. Finally, there are several strands of related literature that this paper will not deal with but that are worth bearing in mind for balance and perspective. First there is the optimal taxation issue from the standpoint of income versus consumption taxation or uniform versus differential taxation across consumption goods and sources of income (on this see for example Harberger (1974), Chari and Kehoe (1999) and Judd (1998a, b));[80] the focus of this

[79] Hyperbolic discounting of consumers' utility, vis-à-vis the traditional exponential discounting, determines a time-decreasing discount rate as opposed to the traditional constant rate of discount. This implies that foregoing consumption for one period today is more costly in terms of utility than foregoing consumption for one period at any time in the future; thus the optimal plan will be changed period after period (a time inconsistency problem). This 'impatience' in consumption generates a front-loaded consumption path that is sub-optimal and the consumer would be better off if it could make an irrevocable commitment on its consumption path.

[80] Also see Lucas and Stockey (1983) for optimality and time-consistency.

paper will be instead on optimal taxation from the point of view of tax-smoothing versus time-varying tax rates for a given type of tax and in specific circumstances. Secondly, there is a literature that deals with the issue of investment and investment stimuli under irreversibility (on this see for example Pennings (2000)), which addresses the effect of taxation on the timing of investment; the analysis in this paper will center on consumer decisions. Lastly, there is also a vast literature on the relationship of private and public savings that highlights the extent of private offset of changes in public savings (on this see for example Loayza, Schmidt-Hebbel and Serven (2000) and Lopez, Schmidt-Hebbel and Serven (2000)).[81]

187. The paper is organized as follows: in the next two sections we identify in theory circumstances under which variable tax rates could potentially improve welfare. Thus, section II deals with the case of a temporary reduction in tax rates to boost private consumption in presence of a negative transitory shock and binding credit constraints, while section III considers the case where tax rates are transitorily increased to restrain private consumption under hyperbolic discounting (time-decreasing discount factor). Then, in section IV we address feasibility and implementation issues impinging on the use of variable tax rates. The last section concludes by summarizing the main findings.

B. The Use of Variable Taxes to Boost Consumption Under Credit Constraints: Can Time-Varying Taxes Increase Welfare?

188. To answer the question posed in the title of this section, we analyze separately the cases of income and consumption taxation.[82] The exercise performed is to compare the case of a constant tax rate (the optimal solution without credit constraints) with the case of tax rates that vary with the state of nature to investigate if, in presence of binding liquidity constraints, it is possible to improve welfare under the second alternative.

189. The results are derived from a theoretical framework comprising a representative agent that maximizes utility over its life-time horizon and a government that maximizes

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[81] For the case of Chile, Morandé (1998) found that, in the long run, private savings would fall by about 1/3 of a percentage point of GDP as a result of an increase of 1 percentage point in public savings. Thus, government savings do crowd out private savings but with an offsetting coefficient well below 1.

[82] It must be noted, at the start, that the use of fiscal policy to try to correct an imperfection in the financial market, such as the credit constraint, is not a first best solution. The first best response would be to tackle the problem at the source, i.e. to correct the informational or institutional problems that originate the imperfection in the financial sector. Only if the first best solution cannot immediately be applied does the search for second best remedies gain relevance. In this section we analyze one of those options, but no attempt is made to study it comparatively or produce a welfare-ranking vis-à-vis other alternatives.

welfare using distortionary taxes (see Kaufman (2000) for a detailed presentation of the model and a fully spelled-out presentation of results). In this two-period model, the states of nature (productivity shock) are reveled at the beginning of times, and determine in each period the representative agent's real return on labor. In presence of a maximum-debt constraint, the state of nature in period 1 will determine whether the credit constraint is binding or not. The government levies taxes to finance a given stream of public expenditures (which we assume do not enter into the representative agent's utility function) and faces no credit constraint (which is needed to be able to pursue counter-cyclical fiscal policies). The economy has a constant return to scale production function, scaled by a productivity factor, with labor as the sole input.[83] The economy is small and internationally open, thus facing given good prices and the international interest rate.

190. For the case of income taxes, when agents face binding liquidity constraints[84] and tax distortions are small, time-varying tax rates may improve welfare. In absence of credit constraints there is no role for government action to smooth private consumption and the welfare maximizing policy is to minimize distortions by fixing tax rates across time (Barro's (1979) tax smoothing hypotheses). With credit constraints, a policy of time-varying tax rates faces a welfare trade-off between labor distortions and private consumption smoothing.

191. For consumption taxation, the unconstrained optimal policy is again tax smoothing. But, with binding liquidity constraints, variable consumption taxes are in a better footing than income taxes to improve welfare since they do no distort labor decisions. The intuition of this result is as follows: with tax smoothing a binding liquidity constraint prompts agents, at some margin, to work harder in that period to close the gap between desired and constrained consumption. Lowering income tax rates in the period when the constraint is binding increases the disposable income and thus would tend to relieve the need to work harder but at the same time lower income tax rates create the incentive to work more, thus distorting the allocation that would have resulted from lump-sum tax breaks. Lower consumption taxes, in turn, will increase real income without distorting the inter-temporal allocation of labor, but will otherwise induce a consumption path tilted toward the current period. Inter-temporal lump-sum transfer would be the only non-distortive policy to relive cash-strapped agents, which we assume here nonfeasible.

192. To show these results we will use the framework described above where the representative agent's problem can be stated as follow:

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[83] The lack of capital and income taxation on dividends in the model may bias some of the results obtained in the following section. Specifically, the preferred use of consumption taxation vis-à-vis income taxation may be less robust once taxes on dividends are introduced.

[84] Note that liquidity constraints rule out Ricardian equivalence.

$$\underset{c,\,l}{\text{Max}} \qquad \mathbf{U} = U(c_1, l_1) + \beta U(c_2, l_2);\ 0 < \beta < 1$$

with $U_c > 0,\ U_{cc} < 0,\ U_l < 0,\ U_{ll} > 0$

Subject to:

$$(\lambda)\ W \equiv \omega_1 l_1(1-\tau_1) + \delta\omega_2 l_2(1-\tau_2) = c_1 + \delta c_2;\ \ \delta = \frac{1}{1+r} \qquad \text{Income tax case (IT)}$$

$$W \equiv \omega_1 l_1 + \delta\omega_2 l_2 = c_1(1+\tau_1) + \delta c_2(1+\tau_2) \qquad \text{Consumption tax case (CT)}$$

$$(\mu)\ D_1 \le \overline{D};\ D_1 = c_1 - \omega_1 l_1(1-\tau_1) \quad \text{IT}$$

$$D_1 \le \overline{D};\ D_1 = c_1(1+\tau_1) - \omega_1 l_1 \quad \text{CT}$$

Where c stands for consumption, l for labor, ω for labor income, W for wealth, τ for tax rate on income/consumption, r for interest rate, D for debt, $\overline{D}$ for maximum debt constraint, λ is the intertemporal budget constraint multiplier, and μ is the liquidity constraint multiplier.

193. The first order conditions for this problem, which are sufficient conditions given the strict concavity of the utility function with respect to consumption and leisure, are:[85]

IT: c) $U_{c_1} = \lambda + \mu$

$\beta U_{c_2} = \lambda\delta$

$$\Big\} \quad \frac{U_{c_1}}{U_{c_2}} = \frac{(\lambda+\mu)}{\lambda}\frac{\beta}{\delta} \quad \text{(I)}$$

l) $U_{l_1} = -\lambda\omega_1(1-\tau_1) - \mu\omega_1(1-\tau_1)$

$\beta U_{l_2} = -\lambda\delta\omega_2(1-\tau_2)$

$$\Big\} \quad \frac{U_{l_1}}{U_{l_2}} = \frac{(\lambda+\mu)\omega_1(1-\tau_1)\beta}{\lambda\omega_2(1-\tau_2)\delta} \quad \text{(II)}$$

μ) $\overline{D} - D_1 \ge 0 \vee \mu \ge 0 \wedge \mu(\overline{D} - D_1) = 0$ (III) Kuhn-Tucker Condition

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[85] We assume throughout the paper that the constraint $l_i \le l^{max}\ \forall i$ is non-binding, i.e. we consider only interior solutions.

CT: c) $U_{c_1} = (\lambda+\mu)(1+\tau_1)$

$\beta U_{c_2} = \lambda\delta(1+\tau_2)$

$$\left.\begin{array}{l} U_{c_1} = (\lambda+\mu)(1+\tau_1) \\ \beta U_{c_2} = \lambda\delta(1+\tau_2) \end{array}\right\} \quad \frac{U_{c_1}}{U_{c_2}} = \frac{(\lambda+\mu)}{\lambda}\frac{(1+\tau_1)}{(1+\tau_2)}\frac{\beta}{\delta} \quad (\text{I'})$$

l) $U_{l_1} = -\lambda\omega_1 - \mu\omega_1$

$\beta U_{l_2} = -\lambda\delta\omega_2$

$$\left.\begin{array}{l} U_{l_1} = -\lambda\omega_1 - \mu\omega_1 \\ \beta U_{l_2} = -\lambda\delta\omega_2 \end{array}\right\} \quad \frac{U_{l_1}}{U_{l_2}} = \frac{(\lambda+\mu)\omega_1\beta}{\lambda\omega_2\delta} \quad (\text{II'})$$

μ) $\bar{D}-D_1 \geq 0 \vee \mu \geq 0 \wedge \mu(\bar{D}-D_1)=0$ (III') Kuhn-Tucker Condition

Income tax case

194. This section analyzes the case where the government levies income taxes to finance a given stream of government expenditures.[86] If credit constraints are nonbinding, there is simply no role for government action to smooth private consumption and the welfare maximizing policy boils down to minimizing tax distortions (Barro's (1979) tax smoothing hypotheses), which is achieved by fixing tax rates across time.

195. If credit constraints are binding time-varying income tax rates can improve welfare[87] under certain conditions. These conditions are associated with the degree of distortion caused by taxes on the consumers' decisions. The starting point is to recognize that under a negative transitory shock to income (and constant tax rates) individual would like to borrow to smooth their consumption. However, under binding liquidity constraints, they would not be able to do so. Thus, they would only be able to achieve some smoothing of consumption by working more in that period. As the smoothing would not be complete, there would be an intertemporal allocation of consumption tilted toward the future and an allocation of labor tilted toward the present relative to the unconstrained allocations.

196. However, a policy that reduces tax rates in presence of negative transitory shocks can increase welfare when tax distortions are small and the liquidity constraint is strongly binding , i.e. the constrain multiplier is large. To show this result it suffices to note that lower

[86] The analysis presented in this section can readily be applied to transitory and fully-compensated changes in any income-related tax, such as mandatory pension contributions.

[87] Note that in this case time-varying taxes are also state-contingent taxes.

tax rates, when the credit constraint is binding, can achieve an allocation of consumption and labor closer to the unconstrained optimal one, and that such allocation can, under some conditions, improves welfare.

197. A lower first-period tax rate will induce higher consumption in period 1 compared to the constant tax rate case when (adjusting for any wealth effect) it reduces the credit constraint multiplier (the shadow price of an additional unit of spending capacity in period 1). This will occur if the reduction in the tax rate does not reduce excessively labor supply in the first period, i.e. if tax distortion is limited. Moreover, lower tax rates in period 1 will induce lower consumption in the second period if again the effect of income taxes on labor supply is limited, i.e. if labor supply in period 2 does not increases excessively as a result of labor reduction in period 1 (see below).

198. Turning now to labor supply, lower period 1 tax rates will determine a lower labor supply in period 1 when again the credit constraint multiplier (adjusting for any wealth effect) is effectively reduced; this is the result of a reduced need to over-work (compared to the unconstrained optimum) to compensate for the lack of financing to achieve the optimal consumption plans. But now the reduction needed of such multiplier is larger than the one required for higher consumption in period 1. This is because there is now at play both income and substitution effects while in the higher period 1 consumption condition there was only an income effect. Period 1 labor supply will be lower if the income effect (reduction in the credit constraint multiplier adjusted by any wealth effect) exceeds the substitution effect. The income effect (the higher disposable income brought about by a reduction in the tax rate) supports lower first period labor; the substitution effect (the higher return to labor in period 1) induces higher labor in the first period. The presence of a substitution effect curbs the reduction in period 1 labor. Lastly, period 2 labor supply will be higher (toward the unconstrained optimal labor allocation) but still leading to a negative wealth effect, so that the effect of variable taxes on the overall labor-supply does not imply a net increase in labor income and wealth.

199. Having shown the condition that will lead to an intertemporal allocation of consumption and labor closer to the optimal unrestricted allocation, we turn now to the condition for higher welfare of the tax-varying allocation vis-à-vis the tax-smoothing allocation. Welfare will generally be higher with lower tax rates in period 1 (under a strictly positive liquidity constraint multiplier) when the welfare gains of moving consumption and labor in period 1 closer to the unconstrained optimal allocation outweighs the discounted welfare loss of moving consumption and labor in period 2 closer to the unconstrained optimum. This condition will be more likely to hold the farther apart the tax-smoothing allocation is from the optimal unrestricted one, i.e. how binding the liquidity constraint is. The more binding the credit constraint is the more likely that variable tax rates will lead to an allocation of consumption and labor with higher welfare than the tax-smoothing allocation.

Consumption tax case

200. Drawing from the framework use above, in this section we analyze the effect of variable consumption tax rates on welfare under binding liquidity constraints. In the case of consumption taxation, even with nonbinding credit constraints time varying tax-rates affect the allocation of consumption. This is because time-varying taxes affect the relative price of consumption today vis-à-vis tomorrow. As mentioned before, the optimal policy to maximize welfare without credit constraints is achieved again under constant tax rates. This result follows from the fact that fixed tax rates across time lead to the intertemporal allocation of consumption that would prevail in the case of lump-sum taxation.

201. With binding liquidity constraints, a policy of variable consumption tax rates can be welfare improving vis-à-vis a policy of constant tax rates under some conditions. These conditions are less stringent than those discussed above for the income tax case.

202. As we did in the case of income taxation, we proceed by showing the conditions under which a reduction in period 1 taxes can achieve an allocation of consumption and labor closer to the unrestricted optimal allocation, to then show the conditions needed for such allocation to improve welfare.

203. A lower first-period tax rate will induce higher consumption in period 1 compared to the tax-smoothing case when (adjusting for any wealth effect) the credit constraint multiplier (the shadow price of an additional unit of spending capacity in period 1) is effectively reduced. The condition for that to happen, compared to that of income taxation, supports now a broader set of wealth effects, i.e. larger negative wealth effects, and thus it is more likely to hold. This is so because the reduction in the period 1 tax rate induces, ceteris paribus, higher consumption in that period (distortionary effect on consumption). As a result, consumption in period 1 will be higher even under a larger negative wealth effect relative to the income tax case. As before, the reduction in tax rate will lessen the credit constraint when the effect on labor supply in period I is limited, i.e. the reduction in tax rates does not reduce 'excessively' labor supply; similarly, a lower tax rate in period 1 will lead to lower consumption in the second period when the effect on labor supply in the second period is limited, i.e. when labor supply in period 2 does not increases excessively.

204. Turning now to labor supply, a lower period 1 tax rate will determine a lower labor supply in that period again when the credit constraint multiplier (adjusting for any wealth effect) is effectively reduced. But, compared to the income tax case, this condition is again less restrictive, and hence more likely to hold, because the tax break now only has the income effect but not the substitution effect on labor decisions as it was the case with income taxation. Once more, the period 2 labor supply will be higher if the wealth effect is negative, but again this condition is looser relative to the income taxation case because of the lack of a substitution effect on labor, i.e. there are now no disincentives to work harder in period two, as in the income tax case, and hence a lesser negative wealth effect will prompt agents to increase labor in that period toward the unconstrained optimal labor allocation.

205. Given the conditions that would let variable taxes shift the consumption and labor allocations toward the optimal one, we can proceed to focus on the condition for higher welfare under the variable-tax allocation vis-à-vis that of constant tax rates. As before, welfare will generally increase with variable taxes (lower tax rates in period 1) when the liquidity constraint is binding enough. But since now the set of allocations that would meet this condition is broader, then it would be more likely that time-varying consumption tax rates, relative to variable income taxes, will lead to an allocation of consumption and labor with higher welfare than the tax-smoothing allocation.

C. The Use of Variable Taxes to Restrain Consumption Under Hyperbolic Discounting

206. In this section we analyze the case where tax rates are used to restrain private consumption. But, are there situations when such policy could be optimal? Although, several potential reasons could be identified in the literature, such as moral hazard problems,[88] here we will deal only with the case of hyperbolic discounting (for a comprehensive discussion on the latter see for example Laibson (1996, 1997)). This is because we want to focus on phenomena of a temporary nature, like a shock to preferences that can induce a burst of impatience and a path of consumption that is suboptimal due to time consistency problems.[89]

207. Since income taxation without binding credit constraints has no effect on the intertemporal allocation of consumption, in this section we will consider the case of consumption taxation only. We draw closely from the framework developed in the previous section, and assume that all present and future information is revealed at the beginning of times. The exercise performed here is to compare the welfare effects of variable taxation relative to tax-smoothing in an economy subject to the change in preferences implied by hyperbolic discounting and without access to a commitment technology.[90] The spirit of the exercise is to investigate if variable taxes can prevent time-consistency problems arising from a shock to discount rates.

208. The representative agent's problem at t=0 can be described as follows:

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[88] To deal with moral hazard problems that induce excessive consumption, forced pension schemes are used in practice. These schemes, in fact, serve to transfer early consumption to later years through forced savings. The effectiveness of such schemes rely on the presence of some degree of credit constrains so that agents cannot borrow against this source of future income and consumption is effectively restricted.

[89] I thank Jeromin Zettelmeyer for suggesting the issue at an early stage.

[90] A commitment technology is any type of arrangement that will permit an agent to make a commitment at a certain point in time and not allow him/her to renege on it later on.

Max $\mathbf{U} = \beta[\rho U(c_1, l_1) + \rho^2 U(c_2, l_2)]$; $0 < \beta < 1$; $0 < \rho < 1$
c, l

with $U_c > 0$, $U_{cc} < 0$, $U_l < 0$, $U_{ll} > 0$

Subject to: (λ) $W \equiv \delta\omega_1 l_1 + \delta^2\omega_2 l_2 = \delta c_1(1+\tau_1) + \delta^2 c_2(1+\tau_2)$; $\delta = \frac{1}{1+r}$

Where c stands for consumption, l for labor, ω for income, W for wealth, τ denotes the consumption tax rate, r the interest rate, and λ is the intertemporal budget constraint multiplier.

209. In this case the first order conditions, which are sufficient given the strict concavity of the utility function with respect to consumption and leisure, are:

c) $\beta\rho U_{c_1} = \lambda\delta(1+\tau_1)$

$\beta\rho^2 U_{c_2} = \lambda\delta^2(1+\tau_2)$

$\Big\}$ $\frac{U_{c_1}}{U_{c_2}} = \frac{(1+\tau_1)}{(1+\tau_2)}\frac{\rho}{\delta}$ (I'')

l) $\beta\rho U_{l_1} = -\lambda\delta\omega_1$

$\beta\rho^2 U_{l_2} = -\lambda\delta^2\omega_2$

$\Big\}$ $\frac{U_{l_1}}{U_{l_2}} = \frac{\omega_1\rho}{\omega_2\delta}$ (II'')

Conditions (I'') and (II'') determine the allocation of consumption and labor under commitment.

210. In absence of a commitment technology, hyperbolic discounting implies that consumers will re-optimize their plans in each period. This is because hyperbolic discounting entails a time-decreasing discount rate, as opposed to the traditional constant rate of discount, which determines that foregoing consumption for one period today is more costly in terms of utility than foregoing consumption for one period at any time in the future. Thus the optimal plan will be changed period after period (a time consistency problem). This generates a front-loaded consumption path that is sub-optimal and the consumer would be better off if it could make an irrevocable commitment on its consumption path. Then, if consumers could commit at the beginning to a consumption path, then it would be tilted to the future relative to the one that would result under no-commitment. Similarly, the allocation of labor in absence of

commitment will be tilted toward the future. Under commitment, the optimal policy will be tax smoothing; this is because, since the consumption path is the optimal, fixed tax rates across time will achieve the undistorted allocation as with lump-sum taxation.

211. Without a commitment technology, the representative consumer will re-optimize in t=1 facing the following problem:

$$\text{Max}_{c,l} \quad \mathbf{U} = U(c_1,l_1) + \beta\rho U(c_2,l_2) \;;\; 0<\beta<1 \;;\; 0<\rho<1$$

with $U_c>0,\ U_{cc}<0,\ U_l<0,\ U_{ll}>0$

Subject to: $(\lambda) \quad W \equiv \omega_1 l_1 + \delta\omega_2 l_2 = c_1(1+\tau_1) + \delta c_2(1+\tau_2)$

The first order conditions now become:

$$\left.\begin{aligned} &c)\ U_{c_1} = \lambda(1+\tau_1) \\ &\beta\rho U_{c_2} = \lambda\delta(1+\tau_2) \end{aligned}\right\} \quad \frac{U_{c_1}}{U_{c_2}} = \frac{(1+\tau_1)}{(1+\tau_2)}\frac{\beta\rho}{\delta} \qquad (\text{I}''')$$

$$\left.\begin{aligned} &l)\ U_{l_1} = -\lambda\omega_1 \\ &\beta\rho U_{l_2} = -\lambda\delta\omega_2 \end{aligned}\right\} \quad \frac{U_{l_1}}{U_{l_2}} = \frac{\omega_1\beta\rho}{\omega_2\delta} \qquad (\text{II}''')$$

212. Can time-varying tax rates serve as a commitment technology for consumers? With hyperbolic discounting and no commitment technology, higher present tax rates on consumption relative to future rates can improve welfare (compared to tax smoothing) by shifting the consumption path toward the optimal one under commitment. This comes from the fact that there is a path of tax rates that can replicate the ratio of marginal conditions in consumption under commitment and tax-smoothing by changing the relative price of present and future consumption.

213. Specifically, given that there is no commitment technology, consumers will re-optimize their plans at t=1; therefore, the government can maximize welfare (as the consumer would have done with a commitment technology at t=0) by setting time-specific consumption taxes to replicate the marginal rate of substitution that would prevail under commitment and tax-smoothing. This implies that, without a commitment technology, period 1 consumption with variable taxes will be lower than consumption under tax-smoothing.

Since consumption taxes do not affect labor decisions, the allocation of labor would still remain tilted toward the future relative to the commitment case.

D. Can Variable Tax Rates Be Effectively Used?

214. Several implementation issues can impinge on the effective use of variable tax rates, even when favorable theoretical cases can be identified. This section discusses operational issues and identifies potential shortcomings.

215. At the outset, there are several general implementation issues that need to be paid serious attention in practice. The timing of information and the lagged effect of policy changes need to be analyzed in light of the potential to exacerbate cyclical movements; for instance, the use of variables taxes may end up increasing rather than reducing cyclical fluctuation given that there is a lag between the time at which economic activity starts to slowdown, the authorities are able to identify the situation, taxes are changed, and that change has an impact on consumption behavior. In this regard, the characteristics of the country's shocks and cyclical patterns must be carefully taken into account. In addition, the ability to correctly distinguish transitory from permanent shocks is of central importance to guide smoothing policies since only the former would merit such a policy.

216. In Section II and III we found some particular theoretical cases that could lend support to the use of variable taxes. We also shed light on the specific conditions that need to be present for such policy to be warranted. Thus, in Section II we considered the case when tax rates are used to stimulate consumption in presence of liquidity constraints;[91] when tax breaks are used to relieve cash-strapped consumers, welfare would increase depending on tax distortions vis-à-vis how binding the credit constraint is. Then, the tax structure of the country will need to be carefully taken into account to investigate its potential distortion effects under variable taxes.

217. In Section III, we analyzed the case when taxes are used to restrain consumption under time-consistency problems in the allocation of consumption induced by hyperbolic discounting. The story portrayed there can be generally interpreted to represent cases in which there are shocks to consumers' discount rates. The case for using consumption taxes to solve the time-consistency problem faced by this type of consumer is highly tentative; the case of hyperbolic discounting can be observational equivalent to the exponential discounting case (Laibson (1996)), where there is no time consistency problem and no need to use variable taxes, and thus its practical relevance is seriously hampered.

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[91] In line with the caveats expressed above, it must be emphasized that the results derived in that section were in a setting where the timing, type and duration of the shock was perfectly known; nevertheless, the use of tax rates was not a first-best policy.

218. Other key implementation issues relate to how tax administration would be affected by the new regime. This requires careful investigation of the additional administrative costs and the potential for increased evasion. Some immediate candidates to look upon, for example, are the potential for setbacks arising from VAT credits on inventories (and the incentives to alter the timing of recording of transactions) and from the link of income tax payments to past performance (which would diminish the effectiveness of the tax break). Moreover, as Budnevich and Le Fort (1997) point out, the inflationary impact of changes in consumption taxes need to be reckoned, specially in countries with inflation targeting frameworks.

219. Political economy questions are also of utmost importance; any temporary change in tax rates will have the desired effect as long as it is truly perceived as such. This highlights the importance of the institutional framework under which this policy is pursued. A rules-based approach will address time-consistency problems but may prove to be too rigid for the judgment calls that this policy may require; more discretional arrangements may lessen the effectiveness of a variable tax policy on credibility grounds. Therefore, this trade-off would need to be considered carefully before deciding on the institutional changes to be introduced to make such a scheme operational.[92]

220. Finally, by assuming that only private agents face credit constraints the case portrayed in Section II where the government can effectively play a role in smoothing consumption may be overestimated. The relaxation of this assumption will compromise the ability to play that role. In this context, the government's unrestricted access to financing may not be so immediate in practice (because, for example, Ponzi games cannot be credibly ruled out) which lessens its ability to pursue countercyclical policies.

E. Conclusion and Policy Implications

221. This paper has sought to answer two questions regarding fiscal policy through time-varying tax rates: whether the use of variable taxes can increase welfare in some circumstances, and whether these can be effectively implemented in practice.

(i) *Are* there circumstances in theory when variable taxes can improve welfare?

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[92] In the case of the U.S. in 1968, the Congress authorized the government for a given period of time to change income tax rates at discretion within a pre-established range. In Japan in late 1997 and 1998 the government's stimulus package included temporary income tax rebates; this was done through congress simultaneously with a revised budget. In Thailand, VAT rates were reduced through an administrative measure for a period of two years (from 10 to 7 percent) following the economic fallout of the Asian crisis.

We identified two cases where variable taxes, under certain conditions, can improve welfare: that of binding credit constraints and of hyperbolic discounting. The first case is characterized by under-consumption and a temporary reduction in tax rates can be used to boost consumption and improve welfare if tax distortions relative to the burden of the credit constraint are small. Nevertheless, the use of tax rates is not a first-best policy and no comparison has been done with other alternatives. In the second case, hyperbolic discounting generates a time-consistency problem for the allocation of consumption and a transitory increase in tax rates to restrain consumption is considered. The story portrayed in that section is one of a shock to preferences, more specifically to the rate of discount, that induces a front-loaded path of consumption that is sub-optimal. Time-varying tax rates can increase welfare by shifting the inter-temporal allocation of consumption toward the one that would prevail without the time-consistency problem.

(ii) Can variable taxation be effectively implemented in practice?

Even when some specific theoretical cases can be identified, several implementation issues can interfere with the effective use of variable taxes.

222. General questions such as whether the government can accurately distinguish permanent from transitory shocks or whether it can act in a timely manner to avoid exacerbating the effect of shocks need to be addressed to evaluate these policies.

223. Moreover, since variable taxes can boost consumption and welfare under binding credit constraints only if taxes are not too distorting, then the advisability of this policy will depend on the tax structure of the country. In the case where tax rates are used to restrain consumption under hyperbolic discounting, the practical hurdle rests on the difficulty to identify such cases. This is because the case of hyperbolic discounting can be observational equivalent to the exponential discounting case.

224. Other key implementation issues relate to the effect of variable taxes on tax administration (administrative costs and the potential for increased evasion), political economy and time consistency problems, the government's own credit constraints and thus its ability to play a role in smoothing consumption, and the institutional changes that would need to be introduced.

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Table 1. Chile: Aggregate Demand and Supply

	1994	1995	1996	1997	1998	1999
	I. Annual Percentage Change (At current prices)					
Aggregate demand	17.2	21.6	11.1	11.6	6.3	-0.5
Domestic expenditure	14.7	20.3	13.7	12.3	7.6	-3.4
Private sector	14.9	19.5	11.4	12.9	7.8	-3.3
Consumption	16.7	17.1	13.4	11.7	8.7	0.3
Investment	8.9	28.1	4.8	16.9	4.8	-15.5
Public sector	19.0	15.9	27.3	10.9	9.8	3.6
Consumption 1/	18.0	19.5	14.7	13.8	11.7	9.5
Investment	21.3	8.3	56.3	6.1	6.4	-7.6
Change in inventories 2/	-0.6	1.5	0.2	0.0	-0.4	-1.3
Exports 3/	26.8	26.1	2.8	9.3	1.4	10.9
Aggregate supply	17.2	21.6	11.1	11.6	6.3	-0.5
Gross domestic product	19.0	20.9	9.2	11.7	6.2	2.4
Imports 3/	11.2	24.1	17.5	11.5	6.6	-9.8
Memorandum items:						
GNP at market prices	17.6	21.9	9.5	12.2	7.2	2.3
GDP deflator	12.6	9.3	1.7	4.0	2.7	3.6
	(At constant 1986 prices)					
Aggregate demand	7.0	14.9	8.8	9.2	2.9	-5.6
Domestic expenditure	5.5	16.2	7.9	9.1	1.9	-9.9
Private sector	7.1	14.1	6.9	9.7	3.0	-7.1
Consumption	8.2	9.8	9.4	8.2	3.5	-3.0
Investment	4.0	27.5	0.1	14.1	1.9	-18.8
Public sector	7.0	5.6	22.3	4.3	3.7	-4.2
Consumption 1/	1.9	4.2	4.0	5.0	3.9	2.5
Investment	15.8	7.8	49.4	3.5	3.5	-11.2
Change in inventories 2/	-1.4	3.5	-0.6	0.6	-1.1	-3.4
Exports 3/	11.6	11.0	11.8	9.4	5.9	6.9
Aggregate supply	7.0	14.9	8.8	9.2	2.9	-5.6
Gross domestic product	5.7	10.6	7.4	7.4	3.4	-1.1
Imports 3/	10.1	25.0	11.8	12.9	2.1	-14.3
Memorandum items:						
GNP at market prices	2.9	10.8	8.4	7.7	5.4	-1.1
GNP adjusted for terms of trade effects	7.9	16.9	3.5	8.3	1.5	-1.5
	II. Percent of Nominal GDP					
Aggregate demand and supply	128.0	128.7	130.9	130.9	131.0	127.3
Domestic expenditure	98.7	98.2	102.2	102.7	104.1	98.2
Consumption	74.6	72.4	75.3	75.5	77.6	77.0
Private sector	64.6	62.6	65.0	65.0	66.6	65.2
General government	9.9	9.8	10.3	10.5	11.1	11.8
Fixed capital formation	23.3	23.9	24.9	25.5	25.2	21.3
Private sector	18.5	19.6	18.8	19.7	19.4	16.0
Public sector	4.8	4.3	6.1	5.8	5.8	5.2
Change in inventories	0.8	1.9	2.0	1.7	1.2	-0.1
Exports 3/	29.3	30.5	28.7	28.1	26.9	29.1
Imports 3/	28.0	28.7	30.9	30.9	31.0	27.3
External resource gap (-)	1.3	1.8	-2.2	-2.7	-4.1	1.8

Sources: Central Bank of Chile; and Fund staff estimates.

1/ General government.

2/ Weighted by the contribution to domestic expenditure in the previous year.

3/ Goods and nonfactor services.

Table 2. Chile: Savings and Investment

(As percent of nominal GDP)

	1994	1995	1996	1997	1998	1999
Gross domestic investment	24.1	25.8	26.9	27.2	26.5	21.1
Private investment 1/	19.3	21.5	20.8	21.4	20.7	15.9
Public investment	4.8	4.3	6.1	5.8	5.8	5.2
External savings	3.1	2.1	5.1	5.0	5.7	0.1
Gross national savings	21.0	23.7	21.8	22.3	20.8	21.0
Private savings	16.1	16.8	15.3	16.9	17.5	19.3
Public savings 2/	4.8	7.0	6.5	5.3	3.3	1.7
Memorandum items:						
Gross domestic savings	25.4	27.6	24.7	24.5	22.4	23.0
Net transfers from abroad	0.7	0.5	0.7	0.7	0.6	0.7

Source: Central Bank of Chile, and Fund staff estimates.

1/ Includes changes in stocks.

2/ Includes central bank losses.

Table 3. Chile: Sectoral Origin of GDP

(At constant 1986 market prices)

	1994	1995	1996	1997	1998	1999
	(Billions of Chilean pesos)					
GDP at market prices	6,147.6	6,801.0	7,305.1	7,845.1	8,109.4	8,020.7
Agriculture and forestry	441.5	464.3	470.4	452.1	465.5	460.0
Fishing	86.3	100.0	109.8	120.0	123.9	126.0
Mining	482.8	527.8	611.0	659.3	686.0	801.9
Manufacturing	1,027.4	1,104.8	1,140.3	1,203.6	1,185.5	1,177.5
Electricity, gas, and water	155.1	166.9	160.7	177.6	186.2	189.5
Construction	324.0	356.2	386.9	416.9	415.3	374.0
Commerce	992.6	1,133.1	1,241.0	1,356.4	1,425.9	1,375.4
Transport, storage, and communicatio	452.0	518.3	571.0	644.5	716.7	735.8
Financial services	833.6	915.1	977.7	1,053.6	1,090.9	1,079.8
Other services 1/	1,352.4	1,514.5	1,636.4	1,761.0	1,813.5	1,700.7
	(Annual percentage change)					
GDP at market prices	5.7	10.6	7.4	7.4	3.4	-1.1
Agriculture and forestry	6.0	5.2	1.3	-3.9	3.0	-1.2
Fishing	16.3	15.9	9.7	9.3	3.2	1.7
Mining	8.9	9.3	15.8	7.9	4.1	16.9
Manufacturing	4.1	7.5	3.2	5.6	-1.5	-0.7
Electricity, gas, and water	6.2	7.6	-3.8	10.5	4.8	1.8
Construction	-1.1	9.9	8.6	7.8	-0.4	-10.0
Commerce	5.1	14.2	9.5	9.3	5.1	-3.5
Transport, storage, and communicatio	5.4	14.7	10.2	12.9	11.2	2.7
Financial services	7.1	9.8	6.8	7.8	3.5	-1.0
Other services 1/	6.5	12.0	8.1	7.6	3.0	-6.2
	(As percent of total)					
GDP at market prices	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture and forestry	7.2	6.8	6.4	5.8	5.7	5.7
Fishing	1.4	1.5	1.5	1.5	1.5	1.6
Mining	7.9	7.8	8.4	8.4	8.5	10.0
Manufacturing	16.7	16.2	15.6	15.3	14.6	14.7
Electricity, gas, and water	2.5	2.5	2.2	2.3	2.3	2.4
Construction	5.3	5.2	5.3	5.3	5.1	4.7
Commerce	16.1	16.7	17.0	17.3	17.6	17.1
Transport, storage, and communicatio	7.4	7.6	7.8	8.2	8.8	9.2
Financial services	13.6	13.5	13.4	13.4	13.5	13.5
Other services 1/	22.0	22.3	22.4	22.4	22.4	21.2

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Includes imputed banking charges, import duties, and value-added tax on imports.

Table 4. Chile: National Accounts at Current Prices

	1994	1995	1996	1997	1998	1999
Consumption expenditure	15,957.6	18,730.5	21,279.8	23,834.5	26,017.6	26,442.9
General government	2,128.5	2,543.4	2,918.1	3,319.8	3,708.3	4,060.4
Private sector	13,829.1	16,187.1	18,361.7	20,514.8	22,309.3	22,382.5
Gross domestic investment	5,155.7	6,673.8	7,598.3	8,594.4	8,874.1	7,255.0
Fixed capital formation	4,980.3	6,177.1	7,039.8	8,044.0	8,461.0	7,302.2
Public sector	1,016.6	1,100.7	1,720.8	1,825.6	1,943.2	1,796.1
Private sector	3,963.8	5,076.4	5,319.0	6,218.4	6,517.9	5,506.0
Change in stocks	175.4	496.7	558.5	550.5	413.1	-47.2
Domestic expenditure	21,113.3	25,404.3	28,878.2	32,429.0	34,891.7	33,697.9
External sector 1/	281.9	471.4	-609.8	-861.7	-1,378.4	628.8
Exports	6,269.5	7,904.9	8,125.5	8,878.2	9,004.4	9,989.3
Imports	-5,987.6	-7,433.5	-8,735.3	-9,739.9	-10,382.9	-9,360.5
GDP at market prices	21,395.2	25,875.7	28,268.4	31,567.3	33,513.3	34,326.7
Less: Net factor payments abroad	-1,072.3	-1,106.4	-1,153.5	-1,141.7	-910.1	-957.6
GNP at market prices	20,322.9	24,769.3	27,114.9	30,425.6	32,603.2	33,369.1
Less: Indirect taxes net of subsidies	-2,955.1	-3,488.2	-4,025.3	-4,398.9	-4,457.0	-4,728.0
GNP at factor cost	17,367.8	21,281.1	23,089.6	26,026.6	28,146.2	28,641.1
Less: Provision for consumption of fixed capital	-1,957.3	-2,269.8	-2,618.1	-2,889.2	-4,728.0	-3,135.0
NNP at factor cost = national income	15,410.6	19,011.3	20,471.5	23,137.4	23,418.2	25,506.1

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Goods and nonfactor services.

Table 5. Chile: National Accounts at Constant (1986) Prices

	1994	1995	1996	1997	1998	1999
Consumption expenditure	4,691.8	5,122.5	5,575.7	6,015.6	6,226.6	6,075.7
General government	528.2	550.3	572.2	601.0	624.6	640.1
Private sector	4,163.5	4,572.3	5,003.5	5,414.6	5,602.0	5,435.6
Gross domestic investment	1,825.1	2,449.4	2,592.9	2,898.9	2,858.7	2,109.5
Fixed capital formation	1,682.7	2,078.1	2,263.4	2,523.8	2,580.2	2,139.7
Public sector	343.5	370.3	553.3	572.8	592.6	526.3
Private sector	1,339.2	1,707.8	1,710.1	1,951.0	1,987.6	1,613.4
Changes in inventories	142.5	371.4	329.5	375.1	278.5	-30.2
Domestic expenditure	6,516.9	7,572.0	8,168.6	8,914.6	9,085.3	8,185.2
External sector 1/	-369.3	-771.0	-863.4	-1,069.4	-975.9	-164.5
Exports	2,211.2	2,454.1	2,743.3	3,001.8	3,180.3	3,398.5
Imports	-2,580.5	-3,225.1	-3,606.7	-4,071.2	-4,156.2	-3,563.0
GDP at market prices	6,147.6	6,801.0	7,305.1	7,845.1	8,109.4	8,020.7
Less: Net factor payments abroad	-480.7	-522.8	-501.6	-516.4	-385.1	-381.5
GNP at market prices	5,666.9	6,278.1	6,803.5	7,328.8	7,724.3	7,639.2
Less: Indirect taxes net of subsidies	-849.1	-916.8	-1,040.2	-1,093.2	-1,078.5	-1,104.7
GNP at factor cost	4,817.8	5,361.3	5,763.3	6,235.5	6,645.8	6,534.4
Less: Provision for consumption of fixed capital	-661.3	-763.6	-841.8	-906.5	-924.0	-918.6
Plus: Terms of trade effect	468.6	917.3	611.7	709.2	425.5	384.8
NNP at factor cost = national income	4,625.2	5,515.1	5,533.2	6,038.2	6,147.4	6,000.6

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Goods and nonfactor services.

Table 6. Chile: Indicators of Mining Output

	1994	1995	1996	1997	1998	1999
	(Index, 1990 = 100)					
Total	131.4	146.2	177.6	193.3	206.1	241.5
Metallic minerals	137.3	153.9	189.8	205.0	219.9	259.8
Copper	135.5	155.3	194.5	212.6	229.3	274.4
Molybdenum	115.3	129.4	125.9	154.8	184.5	197.2
Lead	41.5	84.3	122.7	71.8	29.9	15.2
Zinc	120.0	140.8	143.2	136.6	64.3	128.3
Gold	134.2	162.1	193.1	173.9	159.3	166
Silver	146.5	159.1	175.2	166.2	204.2	210.8
Iron	104.8	102.2	110.1	105.9	110.5	103.5
Manganese	158.6	177.5	158.4	158.1	121.3	102.2
Nonmetallic minerals 1/	84.0	83.7	78.9	97.9	94.2	93.8
Limestone	174.5	164.1	170.7	160.4	175.1	150
Coal	55.5	54.1	52.6	50.2	11.6	17.1
Petroleum	62.8	53.2	46.8	43.0	41.2	39.2
	(Thousands of metric tons)					
Copper	2,219.9	2,488.6	3,115.8	3392.0	3686.9	4382.6
CODELCO	1,139.9	1,164.7	1,246.7	1326.3	1501.0	1615.0
Private sector	1,086.0	1,323.4	1,869.1	2065.7	2185.9	2767.6
By product						
Refined copper	1,277.4	1,491.5	1,748.2	2116.6	2334.9	2665.7
Blister	183.0	174.7	243.1	154.0	176.3	169.6
Other	759.5	822.4	1,124.5	1121.4	1175.7	1547.3
	(Annual percentage changes)					
Total	6.7	11.3	21.5	8.8	6.6	17.2
Metallic minerals	7.9	12.1	23.3	8.0	7.3	18.1
Copper	3.5	14.6	25.2	9.3	7.9	19.7
Molybdenum	7.1	12.2	-2.7	23.0	19.2	6.9
Lead	35.6	103.1	45.6	-41.5	-58.4	-49.2
Zinc	1.9	17.3	1.7	-4.6	-52.9	99.5
Gold	10.0	20.8	19.1	-9.9	-8.4	4.2
Silver	-2.7	8.6	10.1	-5.1	22.9	3.2
Iron	16.7	-2.5	7.7	-3.8	4.3	-6.3
Manganese	-0.7	11.9	-10.8	-0.2	-23.3	-15.7
Nonmetallic minerals 1/	-7.0	-0.4	-5.7	24.1	-3.8	-0.4
Limestone	12.8	-6.0	4.0	-6.0	9.2	-14.3
Coal	-3.6	-2.5	-2.8	-4.6	-76.9	47.4
Petroleum	-13.4	-15.3	-12.0	-8.1	-4.2	-4.9

Source: National Bureau of Statistics, as reported in the Monthly Bulletin of the Central Bank of Chile

1/ Includes iodine and nitrate.

Table 7. Chile: Indicators of the Manufacturing Sector

(Annual percentage changes)

	1994	1995	1996	1997	1998	1999
Production						
Consumer goods						
Nondurables	6.6	6.3	5.6	0.1	6.7	-5.1
Durables	7.3	7.4	-1.7	0.0	-16.0	-20.2
Transport equipment	1.8	-2.2	-0.6	19.9	-17.0	-14.4
Capital goods	12.0	8.1	7.0	18.1	4.0	-18.0
Intermediate goods						
For industry	1.2	4.5	3.1	8.0	3.3	9.9
For construction	-0.1	5.9	8.3	6.6	2.1	-10.1
For mining	9.6	15.7	10.4	8.9	1.8	9.6
For agriculture	14.5	-4.7	-18.8	-1.0	-48.8	47.8
Packaging and accessories	0.3	15.3	12.8	0.3	2.6	3.7
Energy, fuels, and lubricants	8.5	7.4	1.0	4.4	6.3	4.7
Office furniture	5.7	9.6	2.5	9.0	-0.3	-7.8
Sales						
Consumer goods						
Nondurables	5.7	6.7	3.9	3.5	2.9	-2.2
Durables	4.8	4.8	0.5	-2.7	-12.6	-18.1
Transport equipment	-2.5	-2.3	-2.7	32.2	-15.4	-12.1
Capital goods	6.8	14.5	4.1	24.8	1.1	-16.6
Intermediate goods						
For industry	-3.2	2.9	4.9	10.0	1.8	1.8
For construction	-0.1	6.8	9.9	5.6	1.1	-7.8
For mining	6.4	17.4	8.8	9.9	7.9	8.7
For agriculture	12.1	8.0	-22.6	5.3	-44.5	27.2
Packaging and accessories	4.4	18.3	6.7	-1.0	5.5	4.1
Energy, fuels, and lubricants	9.7	8.8	4.9	0.2	5.9	8.6
Office furniture	7.4	8.4	5.6	3.8	1.2	-3.2

Source: Chilean Association of Manufacturers (SOFOFA).

Table 8. Chile: Population, Labor Force, and Employment

	1994	1995	1996	1997	1998	1999
	(In thousands of persons)					
Total population 1/	13,994.4	14,210.4	14,418.9	14,622.4	14,821.7	15,017.8
Population 15 years and older 1/	9,896.9	10,052.3	10,199.7	10,375.7	10,564.8	10,728.1
Labor force 2/	5,458.8	5,497.1	5,521.9	5,618.4	5,721.9	5,822.7
Employed 2/	5,033.7	5,092.3	5,164.0	5,274.6	5,369.3	5,258.1
Unemployed 2/	425.1	405.2	357.9	343.8	352.5	564.6
	(In percent)					
Unemployed (as percentage of the labor force)						
Total	7.8	7.4	6.5	6.1	6.2	9.7
Metropolitan Santiago Region	8.3	7.5	7.1	7.1	6.7	10.5
Participation rates						
Labor force as percentage of total population	39.2	38.8	38.4	38.5	38.3	38.6
Labor force as percentage of population over 15 years of age	55.5	54.9	54.2	54.2	53.8	54.0
	(Annual percentage change)					
Total population	1.6	1.5	1.5	1.4	1.4	1.3
Labor force	2.6	0.7	0.5	1.7	1.8	1.8
Employment	1.1	1.2	1.4	2.1	1.8	-2.1
Unemployment	22.9	-4.7	-11.7	-3.9	2.5	60.1

Source: National Bureau of Statistics (INE), and Fund staff estimates.

1/ Estimated level on June 30 of each year
2/ Annual averages

Table 9. Chile: Index of Nominal Wages

	1995	1996	1997	1998	1999
	(Annual averages)				
Overall	136.3	156.3	169.9	183.3	194.0
Mining	121.9	135.7	146.5	155.7	166.9
Manufacturing	140.9	156.6	170.1	180.9	187.5
Electricity, gas, and water	128.4	145.7	155.5	166.2	176.5
Construction	138.2	148.0	150.3	156.7	150.9
Trade, restaurants, and hotels	143.0	157.9	171.5	185.9	195.5
Transportation and communications	145.9	157.6	171.8	189.1	207.1
Financial services and insurance	129.4	142.1	152.8	166.5	183.9
Social services	146.4	166.9	184.4	202.2	217.4
	(Annual percentage changes)				
Overall	13.6	11.3	8.7	7.9	5.8
Mining	7.3	11.3	8.0	6.3	7.2
Manufacturing	12.6	11.1	8.6	6.4	3.7
Electricity, gas, and water	12.0	13.5	6.7	6.9	6.2
Construction	14.6	7.1	1.6	4.2	-3.6
Trade, restaurants and hotels	13.6	10.4	8.6	8.4	5.1
Transportation and communications	16.4	8.0	9.0	10.1	9.5
Financial services and insurance	10.0	9.8	7.5	9.0	10.4
Social services	16.5	14.0	10.4	9.7	7.5
Memorandum items:					
Consumer price inflation (annual average)	8.2	7.4	6.1	5.1	3.3
Minimum wage	13.1	11.9	11.2	12.7	12.4
Real wages	4.8	4.1	2.4	2.7	2.4

Source: National Bureau of Statistics (INE).

Table 10. Chile: Consumer Price Index

(Base: Dec 1998 = 100)

	All items	Food	Housing	Housing equipment	Clothing	Trans-portation	Health	Education and recreation	Others	Core inflation index 1/
				(Period averages, annual percentage change)						
1998	5.1	3.8	4.6	4.6	-4.0	5.5	8.4	11.7	8.9	5.8
1999	3.3	0.3	2.5	1.0	-3.2	9.0	6.1	5.7	13.7	4.0
				(End of period, annual percentage change)						
1994 December	8.9	7.0	10.4	5.5	3.7	8.7	13.1	19.4	6.7	9.5
1995 December	8.2	9.0	7.5	5.2	-5.5	12.1	10.8	10.0	9.2	7.5
1996 December	6.6	4.1	8.6	4.6	-4.7	9.6	9.5	13.1	7.2	7.4
1997 December	6.0	9.2	4.6	4.7	-8.4	2.3	8.8	12.8	1.9	5.4
1998 March	5.3	6.6	4.6	5.3	-6.3	0.9	9.0	13.2	4.9	5.0
June	5.4	4.5	4.3	4.9	-3.1	6.6	8.3	12.0	6.5	6.0
September	4.8	1.8	5.3	4.0	-4.1	7.2	8.4	10.8	9.2	5.9
December	4.7	0.6	4.4	4.0	-0.1	7.7	8.1	7.8	21.8	6.3
1999 March	4.1	-0.3	3.4	2.5	-1.8	9.9	8.0	6.2	18.6	5.5
June	3.8	1.2	2.5	1.0	-3.5	7.4	6.8	5.7	15.6	4.2
September	2.9	0.2	1.5	0.1	-0.9	9.6	5.1	4.6	11.9	3.2
December	2.3	1.0	1.5	-1.1	-4.0	9.8	4.9	4.3	0.6	2.1
2000 March	3.4	1.5	3.5	-2.0	-4.4	16.0	4.7	4.3	-3.1	2.9

Source: National Bureau of Statistics (INE).

1/ Excludes fuel and fresh fruits and vegetables.

Table 11. Chile: Social Indicators

	1987	1990	1992	1994	1996	1998
Incidence of poverty 1/						
Indigent						
Total	17.4	12.9	8.8	7.6	5.8	5.6
Urban	16.7	12.4	8.6	7.1	5.0	5.1
Rural	20.6	15.2	9.8	9.8	9.4	8.7
Poor, but not indigent						
Total	27.7	25.7	23.8	19.9	17.4	16.1
Urban	26.9	26.0	23.8	19.8	16.8	15.6
Rural	30.9	24.3	23.6	21.1	21.2	18.9
Total poor						
Total	45.1	38.6	32.6	27.5	23.2	21.7
Urban	43.6	38.4	32.4	26.9	21.8	20.7
Rural	51.5	39.5	33.4	30.9	30.6	27.6
Income distribution 2/						
First quintile	4.3	4.4	4.6	4.5	4.2	4.1
Fifth quintile	57.2	56.9	56.3	55.5	56.6	56.9
Ratio of income of fifth quintile to income of first quintile	13.3	12.9	12.2	13.2	13.8	13.9
Other indicators of social welfare						
Illiteracy 3/	6.1	6.3	5.7	4.9	4.8	4.6
School enrollment 4/						
Elementary school (6-13 years of age)	96.4	96.8	97.4	97.6	98.2	98.3
Secondary school (14-17 years of age)	80.9	80.5	82.2	83.9	85.9	86.9
Post secondary (18-24 years of age)	...	24.7	26.5	29.6	33.8	...
Life expectancy at birth 5/	71.7	72.0	74.3	74.6	75.2 7/	75.2 7/
Infant mortality rate 6/	18.5	16.0	14.3	12.0	11.1	10.3

Source: Ministry of Cooperation and Planning (MIDEPLAN).

1/ Percent of population.
2/ Distribution of national income by quintiles of households.
3/ Percent of population over 15 years of age.
4/ Percent of the age group enrolled.
5/ Years.
6/ Per 1,000 live births.
7/ Estimate for 1995-2000

Table 12. Chile: Summary Operations of the Combined Public Sector

	1994	1995	1996	1997	1998	1999
	(In billions of Chilean pesos)					
Nonfinancial public sector						
Total revenue	7,237.6	8,465.3	9,452.5	10,178.9	10,328.8	10,438.7
Current revenue	7,056.6	8,394.3	9,174.0	10,058.3	10,258.8	10,388.6
General government 1/	4,902.7	6,152.2	6,812.2	7,503.5	7,654.6	7,553.3
Public enterprises	2,999.5	3,598.2	3,571.7	3,791.0	3,508.0	3,789.5
Net transfers from public enterprises	-845.5	-1,356.1	-1,209.8	-1,236.2	-903.8	-954.3
Capital revenue	181.0	71.0	278.4	120.6	70.0	50.2
General government	52.0	59.1	23.6	37.7	45.2	26.9
Public enterprises	152.2	11.8	254.8	82.9	24.9	23.2
Total expenditure	6,806.1	7,536.1	8,865.3	9,876.0	10,719.9	11,301.7
Current expenditures	5,813.5	6,435.4	7,144.5	8,050.4	8,776.7	9,505.6
General government 2/	3,866.6	4,472.8	5,087.5	5,696.8	6,429.0	7,002.4
Public enterprises	1,946.9	1,962.6	2,057.1	2,353.6	2,347.7	2,503.1
Capital expenditures 3/	992.7	1,100.7	1,720.8	1,825.6	1,943.2	1,796.1
General government 4/	732.4	798.8	1,018.4	1,181.5	1,303.1	1,390.3
Public enterprises	284.2	301.9	702.4	644.1	640.1	405.8
Overall surplus or deficit	431.5	929.2	587.1	302.9	-391.1	-863.0
Deposited to the Copper Stabilization Fund	-36.2	-278.7	-78.0	-43.2	161.6	233.4
Central bank cash result	-207.1	-157.6	-196.3	-331.7	-372.8	-373.4
Combined public sector overall balance	268.2	771.6	390.8	-28.8	-763.9	-1,236.4
Privatization receipts	0.0	11.0	2.8	74.1	20.5	158.3
Financing needs	-268.2	-782.6	-393.6	-45.4	743.4	1,078.1
Foreign	-94.5	-633.0	-32.5	-62.1	183.4	158.8
Domestic (including statistical discrepancies)	-173.7	-149.5	-361.1	16.7	559.9	919.2
	(In percent of GDP)					
Nonfinancial public sector						
Total revenue	33.8	32.7	33.4	32.2	30.8	30.4
Current revenue	33.0	32.4	32.5	31.9	30.6	30.3
General government 1/	22.9	23.8	24.1	23.8	22.8	22.0
Public enterprises	14.0	13.9	12.6	12.0	10.5	11.0
Net transfers from public enterprises	-4.0	-5.2	-4.3	-3.9	-2.7	-2.8
Capital revenue	0.8	0.3	1.0	0.4	0.2	0.1
General government	0.2	0.2	0.1	0.1	0.1	0.1
Public enterprises	0.7	0.0	0.9	0.3	0.1	0.1
Total expenditure	31.8	29.1	31.4	31.3	32.0	32.9
Current expenditures	27.2	24.9	25.3	25.5	26.2	27.7
General government 2/	18.1	17.3	18.0	18.0	19.2	20.4
Public enterprises	9.1	7.6	7.3	7.5	7.0	7.3
Capital expenditures 3/	4.6	4.3	6.1	5.8	5.8	5.2
General government 4/	3.4	3.1	3.6	3.7	3.9	4.1
Public enterprises	1.3	1.2	2.5	2.0	1.9	1.2
Overall surplus or deficit	2.0	3.6	2.1	1.0	-1.2	-2.5
Deposited to the Copper Stabilization Fund	-0.2	-1.1	-0.3	-0.1	0.5	0.7
Central bank cash result	-1.0	-0.6	-0.7	-1.1	-1.1	-1.1
Combined public sector overall balance	1.3	3.0	1.4	-0.1	-2.3	-3.6
Privatization receipts	0.0	0.0	0.0	0.2	0.1	0.5
Financing	-1.3	-3.0	-1.4	-0.1	2.2	3.1
Foreign	-0.4	-2.4	-0.1	-0.2	0.5	0.5
Domestic (including statistical discrepancies)	-0.8	-0.6	-1.3	0.1	1.7	2.7
Memorandum items:						
Nonfinancial public sector						
Current account balance	5.8	7.6	7.2	6.4	4.4	2.6
Military expenditure 5/	3.4	3.1	3.2	3.1	3.5	3.1
Nominal GDP (in billions of Chilean pesos)	21,395	25,876	28,268	31,567	33,513	34,327

Sources: Ministry of Finance; Central Bank of Chile; and Fund staff estimates.

1/ Excludes taxes paid and transfers made by the public enterprises.
2/ Includes amount transferred directly by CODELCO for military purchases.
3/ Includes net-lending.
4/ Includes capital transfers to the private sector.
5/ Includes military pensions and amounts transferred directly by CODELCO for military purchases assuming that these transfers are spent in the same year.

Table 13. Chile: Summary Operations of the General Government

	1994	1995	1996	1997	1998	1999
	(In billions of Chilean pesos)					
Total revenue	4,954.6	6,211.3	6,835.8	7,541.2	7,699.7	7,580.3
Current revenue	4,902.7	6,152.2	6,812.2	7,503.5	7,654.6	7,553.3
Tax	4,405.9	5,455.7	6,010.4	6,565.4	6,585.5	6,466.9
Nontax	530.1	696.5	801.8	938.1	1,069.0	1,086.5
Capital revenue	52.0	59.1	23.6	37.7	45.2	26.9
Total expenditure	4,599.0	5,271.6	6,105.9	6,878.3	7,732.1	8,392.8
Current expenditure	3,866.6	4,472.8	5,087.5	5,696.8	6,429.0	7,002.4
Wages	854.1	1,000.3	1,159.3	1,325.1	1,491.1	1,645.7
Pensions	1,282.5	1,465.0	1,698.3	1,897.7	2,144.7	2,442.0
Interest	217.4	198.9	171.7	143.4	238.6	123.0
Other	1,150.6	1,808.7	2,058.2	2,330.6	2,554.5	2,791.8
Capital expenditure	732.4	798.8	1,018.4	1,181.5	1,303.1	1,390.3
Overall surplus or deficit (-)	355.7	939.7	729.9	662.9	-32.4	-812.5
Current account	1,036.1	1,679.4	1,724.7	1,806.7	1,225.6	550.9
Capital account	-680.4	-739.7	-994.8	-1,143.8	-1,257.9	-1,363.4
Privatization receipts	0.0	11.0	2.8	74.1	20.5	158.3
Financing needs	-355.7	-950.7	-732.7	-737.1	11.9	654.2
Foreign	-99.7	-606.2	-281.9	-184.2	-93.9	147.8
Domestic (including statistical discrepancies)	-256.0	-344.4	-450.8	-552.8	105.8	506.4
Of which: deposited in the Copper Stabilization Fund (deposit -)	-33.7	-278.7	-78.0	-43.2	161.6	233.4
	(In percent of GDP)					
Total revenue	23.2	24.0	24.2	23.9	23.0	22.1
Current revenue	22.9	23.8	24.1	23.8	22.8	22.0
Tax	20.6	21.1	21.3	20.8	19.7	18.8
Nontax	2.5	2.7	2.8	3.0	3.2	3.2
Capital revenue	0.2	0.2	0.1	0.1	0.1	0.1
Total expenditure	21.5	20.4	21.6	21.8	23.1	24.4
Current expenditure	18.1	17.3	18.0	18.0	19.2	20.4
Wages	4.0	3.9	4.1	4.2	4.4	4.8
Pensions	6.0	5.7	6.0	6.0	6.4	7.1
Interest	1.0	0.8	0.6	0.5	0.7	0.4
Other	5.4	7.0	7.3	7.4	7.6	8.1
Fixed investment	3.4	3.1	3.6	3.7	3.9	4.1
Overall surplus or deficit(-)	1.7	3.6	2.6	2.1	-0.1	-2.4
Current account	4.8	6.5	6.1	5.7	3.7	1.6
Capital account	-3.2	-2.9	-3.5	-3.6	-3.8	-4.0
Privatization receipts	0.0	0.0	0.0	0.2	0.1	0.5
Financing needs	-1.7	-3.7	-2.6	-2.3	0.0	1.9
Foreign	-0.5	-2.3	-1.0	-0.6	-0.3	0.4
Domestic (including statistical discrepancies)	-1.2	-1.3	-1.6	-1.8	0.3	1.5
Of which: deposited in the Copper Stabilization Fund (deposit -)	-0.2	-1.1	-0.3	-0.1	0.5	0.7

Sources: Ministry of Finance; and Fund staff estimates.

Table 14. Chile: General Government Revenue

	1994	1995	1996	1997	1998	1999
	(In billions of Chilean pesos)					
Total revenue	4,954.6	6,211.3	6,835.8	7,541.2	7,699.7	7,580.3
Current revenue	4,902.7	6,152.2	6,812.2	7,503.5	7,654.6	7,553.3
Taxes	4,408.6	5,455.7	6,010.4	6,565.4	6,585.5	6,466.9
Taxes on income and property	1,188.4	1,667.8	1,555.6	1,691.2	1,461.5	1,368.0
Personal and business income tax	805.4	939.1	1,135.9	1,231.2	1,308.1	1,217.1
Net taxes of CODELCO 1/	353.0	706.0	404.7	443.0	132.1	131.1
Property tax	30.0	22.7	15.0	16.9	21.3	19.7
Real estate	20.7	13.0	3.9	3.4	7.4	6.3
Other	9.2	9.7	11.1	13.5	13.9	13.4
Taxes on goods and services	2,452.5	2,870.8	3,390.0	3,768.9	3,958.5	3,989.6
Value-added tax (net) 2/	1,908.0	2,218.1	2,597.0	2,844.0	2,969.0	2,909.0
Excise tax	393.3	476.5	574.1	669.1	740.1	817.8
Stamp tax	135.2	155.1	197.7	234.3	229.4	245.4
Other	16.1	21.1	21.2	21.6	20.0	17.4
Taxes on international trade	424.9	532.0	613.0	612.0	604.3	524.7
Pension contributions	312.9	349.1	403.1	449.5	496.8	527.0
Other taxes	29.9	36.0	48.8	43.8	64.3	57.6
Nontax revenue	494.0	696.5	801.8	938.1	1,069.0	1,086.5
Sales of goods and services	241.0	276.1	342.0	358.0	403.2	451.1
Transfers from public enterprises	44.8	141.3	149.9	196.5	235.5	201.0
Other revenue	208.2	279.1	309.9	383.6	430.3	434.4
Capital revenue	52.0	59.1	23.6	37.7	45.2	26.9
Sale of assets	52.0	59.1	23.6	37.7	45.2	26.9
Loan recovery	114.9	135.1	147.5	153.2	154.2	152.4
	(In percent of GDP)					
Total revenue	23.2	24.0	24.2	23.9	23.0	22.1
Current revenue	22.9	23.8	24.1	23.8	22.8	22.0
Taxes	20.6	21.1	21.3	20.8	19.7	18.8
Taxes on income and property	5.6	6.4	5.5	5.4	4.4	4.0
Personal and business income tax	3.8	3.6	4.0	3.9	3.9	3.5
Net taxes of CODELCO 1/	1.6	2.7	1.4	1.4	0.4	0.4
Property tax	0.1	0.1	0.1	0.1	0.1	0.1
Real estate	0.1	0.1	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0
Taxes on goods and services	11.5	11.1	12.0	11.9	11.8	11.6
Value-added tax (net) 2/	8.9	8.6	9.2	9.0	8.9	8.5
Excise tax	1.8	1.8	2.0	2.1	2.2	2.4
Stamp tax	0.6	0.6	0.7	0.7	0.7	0.7
Other	0.1	0.1	0.1	0.1	0.1	0.1
Taxes on international trade	2.0	2.1	2.2	1.9	1.8	1.5
Pension contributions	1.5	1.3	1.4	1.4	1.5	1.5
Other taxes	0.1	0.1	0.2	0.1	0.2	0.2
Nontax revenue	2.3	2.7	2.8	3.0	3.2	3.2
Sales of goods and services	1.1	1.1	1.2	1.1	1.2	1.3
Transfers from public enterprises	0.2	0.5	0.5	0.6	0.7	0.6
Other revenue	1.0	1.1	1.1	1.2	1.3	1.3
Capital revenue	0.2	0.2	0.1	0.1	0.1	0.1
Memorandum item:						
Tax revenue excluding net taxes from CODELCO	19.0	18.4	19.8	19.4	19.3	18.5

Sources: Ministry of Finance; and Fund staff estimates.

1/ Including deposits by CODELCO for military purchases under Law 13,196.
2/ Net of rebates.

Table 15. Chile: General Government Expenditure

	1994	1995	1996	1997	1998	1999
	(In billions of Chilean pesos)					
Total expenditure	4,599.0	5,271.6	6,105.9	6,878.3	7,732.1	8,392.8
Current expenditure	3,866.6	4,472.8	5,087.5	5,696.8	6,429.0	7,002.4
Wages and salaries 1/	854.2	1,000.3	1,159.3	1,325.1	1,491.1	1,645.7
Purchases of goods and services 2/	494.7	589.8	625.4	687.1	731.7	695.3
Pension payments 3/	1,282.5	1,465.0	1,698.3	1,897.7	2,144.7	2,442.0
Other transfers and subsidies to private recipients	988.2	1,191.6	1,390.3	1,593.8	1,757.1	2,039.8
Interest on public debt	218.3	198.9	171.7	143.4	238.6	123.0
Other 4/	29.9	27.2	42.4	49.6	65.8	56.7
Capital expenditure	732.4	798.8	1,018.4	1,181.5	1,303.1	1,390.3
Fixed investment	653.8	729.6	884.5	992.7	1,074.9	1,039.7
Net capital transfers	78.6	69.1	133.9	188.8	228.2	350.6
Memorandum items:						
Current expenditures excluding interest and Law	3,556.1	4,138.8	4,806.1	5,435.5	6,091.7	6,762.0
Transfers under Law 13,196	92.2	135.1	109.7	117.9	98.6	117.5
On-lending to private sector	98.1	89.0	110.6	125.8	136.0	153.6
	(In percent of GDP)					
Total expenditure	21.5	20.4	21.6	21.8	23.1	24.4
Current expenditure	18.1	17.3	18.0	18.0	19.2	20.4
Wages and salaries 1/	4.0	3.9	4.1	4.2	4.4	4.8
Purchases of goods and services 2/	2.3	2.3	2.2	2.2	2.2	2.0
Pension payments 3/	6.0	5.7	6.0	6.0	6.4	7.1
Other transfers and subsidies to private recipients	4.6	4.6	4.9	5.0	5.2	5.9
Interest on public debt	1.0	0.8	0.6	0.5	0.7	0.4
Other 4/	0.1	0.1	0.2	0.2	0.2	0.2
Capital expenditure	3.4	3.1	3.6	3.7	3.9	4.1
Fixed investment	3.1	2.8	3.1	3.1	3.2	3.0
Capital transfers and net-lending	0.4	0.3	0.5	0.6	0.7	1.0
Memorandum items:						
Current expenditures excluding interest and Law	16.6	16.0	17.0	17.2	18.2	19.7
Transfers under Law 13,196	0.4	0.5	0.4	0.4	0.3	0.3
Military expenditure 5/	3.4	3.1	3.2	3.1	3.5	3.1
Social spending	13.8	13.3	14.3	14.4	0.0	0.0
On-lending to private sector	0.5	0.3	0.4	0.4	0.4	0.4

Sources: Ministry of Finance; and Fund staff estimates.

1/ Includes employer contributions to the social security system.
2/ Assumes that funds transferred under Law 13,196 by CODELCO to an account for military purchases are spent in the same year.
3/ Includes cash transfers of accumulated contributions of currently retired persons who in the past had moved to a private system.
4/ Includes net expenditure of the Petroleum Stabilization Fund.
5/ Includes military pensions and amounts transferred directly by CODELCO for military purchases assuming that these transfers are spent in the same year.

Table 16. Chile: Operations of the Public Enterprises

	1994	1995	1996	1997	1998	1999
	(In billions of Chilean pesos)					
	I. All Public Enterprises					
Operating surplus before taxes and transfers	1,052.6	1,635.7	1,514.6	1,437.4	1,160.3	1,286.4
Taxes and transfers	845.5	1,356.1	1,209.8	1,236.2	903.8	954.3
Current account surplus	207.1	279.5	304.8	201.2	256.5	332.1
Capital revenue	152.2	11.8	254.8	82.9	24.9	23.2
Capital expenditure	284.2	301.9	702.4	644.1	640.1	405.8
Overall surplus or deficit (-)	75.1	-10.5	-142.8	-360.0	-358.7	-50.5
	II. CODELCO					
Operating surplus before taxes and transfers	388.2	881.1	568.2	585.0	313.7	384.5
Taxes and transfers	350.0	706.0	404.7	443.0	132.1	131.1
Current account surplus	38.2	175.1	163.4	141.9	181.6	253.4
Capital revenue	142.7	3.2	239.6	72.5	10.7	2.1
Capital expenditure	160.0	140.6	455.2	416.2	359.6	233.9
Overall surplus or deficit (-)	20.9	37.7	-52.2	-201.8	-167.3	21.6
	III. Other Public Enterprises					
Operating surplus before taxes and transfers	664.4	754.6	946.4	852.5	846.6	901.9
Taxes and transfers	495.5	650.1	805.1	793.2	771.7	823.2
Current account surplus	168.9	104.5	141.3	59.3	74.9	78.7
Capital revenue	9.5	8.6	15.2	10.4	14.2	21.1
Capital expenditure	124.2	161.3	247.2	227.9	280.5	171.9
Overall surplus or deficit (-)	44.7	-56.9	-105.9	-168.6	-205.6	-93.2
	(In percent of GDP)					
	I. All Public Enterprises					
Operating surplus before taxes and transfers	4.9	6.3	5.4	4.6	3.5	3.7
Taxes and transfers	4.0	5.2	4.3	3.9	2.7	2.8
Current account surplus	1.0	1.1	1.1	0.6	0.8	1.0
Capital revenues	0.7	0.0	0.9	0.3	0.1	0.1
Capital expenditure	1.3	1.2	2.5	2.0	1.9	1.2
Overall surplus or deficit (-)	0.4	0.0	-0.5	-1.1	-1.1	-0.1
	II. CODELCO					
Operating surplus before taxes and transfers	1.8	3.4	2.0	1.9	0.9	1.1
Taxes and transfers	1.6	2.7	1.4	1.4	0.4	0.4
Current account surplus	0.2	0.7	0.6	0.4	0.5	0.7
Capital revenues	0.7	0.0	0.8	0.2	0.0	0.0
Capital expenditure	0.7	0.5	1.6	1.3	1.1	0.7
Overall surplus or deficit (-)	0.1	0.1	-0.2	-0.6	-0.5	0.1
	III. Other Public Enterprises					
Operating surplus before taxes and transfers	3.1	2.9	3.3	2.7	2.5	2.6
Taxes and transfers	2.3	2.5	2.8	2.5	2.3	2.4
Current account surplus	0.8	0.4	0.5	0.2	0.2	0.2
Capital revenues	0.0	0.0	0.1	0.0	0.0	0.1
Capital expenditure	0.6	0.6	0.9	0.7	0.8	0.5
Overall surplus or deficit (-)	0.2	-0.2	-0.4	-0.5	-0.6	-0.3

Source: Ministry of Finance.

Table 17. Chile: Summary Operations of CODELCO

	1994	1995	1996	1997	1998	1999
	(In billions of Chilean pesos)					
Current revenue	1,258.2	1,665.5	1,354.7	1,540.2	1,333.6	1,520.0
Sales of goods and services	1,180.4	1,580.9	1,289.8	1,470.2	1,296.4	1,463.7
Other	82.3	84.6	64.9	70.0	37.3	56.2
Current expenditure	870.0	784.4	786.6	955.2	1,019.9	1,135.4
Wages and salaries 1/	292.5	248.1	269.1	282.1	274.9	298.5
Purchases of goods and services	562.4	518.8	493.9	642.8	708.3	789.5
Interest payments	15.8	17.6	23.5	30.2	36.6	47.5
Operating surplus	388.2	881.1	568.2	585.0	313.7	384.5
Less: taxes and transfer payments	-418.6	-760.4	-492.1	-590.9	-278.8	-255.3
Plus: transfer receipts	65.6	54.4	87.4	147.8	146.7	124.2
Current account surplus or deficit (-)	38.2	175.1	163.4	141.9	181.6	253.4
Capital revenue	142.7	3.2	239.6	72.5	10.7	2.1
Capital expenditure	160.0	140.6	455.2	416.2	359.6	233.9
Overall surplus or deficit (-)	21.0	37.7	-52.2	-201.8	-167.3	21.6
Financing	-21.0	-37.7	52.2	201.8	167.3	-21.6
Foreign	18.2	17.2	4.7	92.2	228.2	-48.5
Domestic	-39.2	-54.9	47.4	109.5	-60.9	26.9
Memorandum items:						
CODELCO average export price 2/	104.9	133.2	97.6	100.0	72.3	69.2
Average price at the London Metal Exchange 2/	104.9	133.2	103.2	103.2	75.0	71.3
Copper Stabilization Fund: deposits(+)/withdrawa	0.2	1.1	0.3	0.1	-0.5	-0.7
Transfers to the military under Law 13,196 3/	0.4	0.5	0.4	0.4	0.3	0.3

Sources: Ministry of Finance; and Fund staff estimates.

1/ Includes employer contributions to the social security system.
2/ U.S. cents per pound.
3/ In percent of GDP.

Table 18. Chile: Fiscal Impulse 1/

	1995	1996	1997	1998	1999	Proj. 2000
	(In percent of nominal GDP)					
Actual						
Revenue 2/	21.6	23.2	22.9	22.9	22.1	21.5
Expenditure 3/	18.9	20.4	20.6	21.6	23.1	21.9
Trend						
Revenue	21.2	21.2	21.2	21.2	21.2	21.2
Expenditure	20.5	20.5	20.5	20.7	21.6	21.2
Actual less trend						
Revenue	0.4	2.0	1.7	1.7	0.9	0.4
Expenditure	-1.6	-0.2	0.1	0.9	1.5	0.7
	(In percent)					
Total impulse 4/	0.3	-0.2	0.6	0.7	1.5	-0.3
Revenue impulse 5/	0.4	-1.6	0.3	-0.1	0.8	0.5
Expenditure impulse 5/	-0.1	1.5	0.2	0.8	0.6	-0.8

Sources: Ministry of Finance; and Fund staff estimates.

1/ Operations of the general government only.
2/ Excludes proceeds from privatization and taxes and transfers from CODELCO.
3/ Excludes interest payments, transfers to private pension funds for balances accumulated under the previous public pension scheme, and military purchases financed by earmarked transfers from CODELCO.
4/ Sum of the revenue and expenditure impulses.
5/ Change in the difference between actual and trend revenue (expenditure) in relation to the preceding year.

Table 19. Chile: Real Interest Rates on Central Bank Notes and Operations of the Financial System

(In percent per annum)

	Central Bank Notes			Financial System Operations 90 to 365 Days	
	Interbank 1/	90 Days	8 Years	Loans	Deposits
1994	...	6.4	6.1	9.3	6.4
1995	6.1	6.1	6.2	8.5	5.9
1996	7.3	7.3	6.3	9.3	6.9
1997	6.9	6.8	6.5	8.8	6.4
1998	12.8	9.6	7.5	11.9	9.5
January	18.9	8.5	7.1	10.2	7.8
February	8.7	8.5	7.2	10.6	8.2
March	8.4	8.3	7.1	10.2	8.0
April	8.8	8.3	7.1	10.2	8.2
May	8.5	8.3	7.2	10.4	8.3
June	14.4	8.5	7.3	11.1	9.0
July	16.5	9.3	7.5	13.2	10.8
August	13.2	10.7	7.8	13.2	10.6
September	25.8	17.6	8.9	19.1	15.7
October	12.6	10.6	8.0	13.7	11.6
November	9.7	8.3	7.3	10.9	8.3
December	8.3	8.0	7.2	10.3	7.9
1999	5.8	6.0	6.5	8.2	5.9
January	7.6	7.3	6.8	9.8	7.4
February	7.2	7.2	6.6	9.3	6.9
March	7.0	7.2	-	9.2	6.9
April	6.5	6.9	6.4	9.2	6.9
May	6.1	6.1	6.3	8.2	6.1
June	5.5	5.4	6.1	7.8	5.3
July	4.9	5.2	6.4	7.2	5.0
August	4.9	5.1	6.5	7.3	5.0
September	5.0	5.0	6.5	7.5	5.0
October	5.0	5.1	6.6	7.3	5.1
November	5.0	5.7	6.7	7.7	5.4
December	4.8	5.7	6.7	7.9	5.5
2000	5.3	5.5	6.7	7.6	5.2
January	5.0	5.3	6.6	7.3	5.1
February	5.3	5.7	6.7	7.6	5.2
March	5.4	5.6	6.7	7.9	5.4

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Since May 29, 1995 the interest rate on overnight operations between the central bank and commercial banks has been the main operating target of monetary policy. The values reported here are the equivalent real rate in annual terms. The central bank targets this rate.

Table 20. Chile: Private Sector Holdings of Financial Assets

	1994	1995	1996	1997	1998	1999
I. Annual Rates of Growth in Percent						
(In nominal terms)						
Total liabilities (private sector) 1/	24.4	21.0	16.9	16.3	9.7	15.7
Currency	14.5	17.7	9.5	14.6	-0.9	21.7
Demand and sight deposits	23.7	26.2	10.9	17.4	-7.5	23.0
Narrow money (M1A)	20.6	23.5	10.5	16.6	-5.5	22.6
Savings and time deposits	18.8	28.9	26.2	11.9	13.1	0.3
Broad money (M3)	19.3	27.4	22.0	13.0	8.5	5.2
Pension fund liabilities	31.5	15.0	13.0	15.9	8.6	24.3
Letters of credit	47.8	54.7	29.0	62.3	1.8	10.1
Foreign currency deposits 2/	-10.9	-1.8	-16.1	1.5	86.4	45.5
(In real terms) 3/						
Total liabilities (private sector) 1/	14.2	11.8	9.6	9.7	4.8	13.1
Currency	5.1	8.8	2.7	8.0	-5.3	19.0
Demand and sight deposits	13.5	16.6	4.0	10.7	-11.6	20.3
Narrow money (M1A)	10.7	14.1	3.6	9.9	-9.7	19.9
Savings and time deposits	9.0	19.1	18.4	5.5	8.0	-1.9
Broad money (M3)	9.5	17.8	14.5	6.6	3.6	2.8
Pension fund liabilities	20.7	6.3	6.0	9.3	3.7	21.5
Letters of credit	35.7	43.0	20.9	53.0	-2.7	7.7
Foreign currency deposits 2/	-18.3	-9.3	-21.3	-4.3	78.1	42.2
II. Distribution						
By issuer	100.0	100.0	100.0	100.0	100.0	100.0
Central bank 4/	3.7	3.6	3.4	3.3	3.0	3.2
Bank and nonbank	45.8	48.4	50.3	50.5	51.4	48.0
Pension funds	50.5	48.0	46.3	46.1	45.6	48.8
By asset	100.0	100.0	100.0	100.0	100.0	100.0
Currency	3.7	3.6	3.4	3.3	3.0	3.2
Demand and sight deposits	8.0	8.4	7.9	8.0	6.7	7.1
Narrow money (M1A)	11.8	12.0	11.3	11.3	9.8	10.3
Savings and time deposits	31.2	33.2	35.8	34.4	35.5	30.6
Broad money (M3)	42.9	45.2	47.1	45.8	45.2	40.9
Pension fund liabilities	50.5	48.0	46.3	46.1	45.6	48.8
Letters of credit	3.1	4.0	4.4	6.1	5.7	5.4
Foreign currency deposits 2/	3.5	2.8	2.1	1.9	3.5	4.9

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Includes liabilities of pension funds to the private sector, but excludes intrafinancial flows as well as central bank notes and treasury notes in hands of the private sector.
2/ Foreign deposits are valued at end-of-period exchange rates.
3/ Nominal changes deflated by changes in the consumer price index.
4/ Excludes central bank promissory notes.

Table 21. Chile: Operations of the Financial System

(Percentage change with respect to liabilities to the private sector at the beginning of the period) 1/

	1994	1995	1996	1997	1998	1999
Net international reserves	13.0	1.8	0.9	9.0	-1.2	1.2
Central bank	13.8	0.7	-0.2	5.2	-2.0	-3.6
Rest of the financial system	-0.8	1.1	1.1	3.9	0.8	4.9
Net domestic assets	23.7	10.9	7.9	6.9	12.5	3.9
Nonfinancial public sector (net)	-1.9	-1.9	-0.2	-2.0	2.1	2.6
Private sector	16.4	18.0	12.6	11.7	4.1	2.0
Central bank promissory notes	-0.5	-1.1	-2.3	-3.7	2.5	0.2
Other assets (net)	9.7	-4.1	-2.2	0.9	3.9	-0.8
Net medium- and long-term foreign liabilities	0.2	-0.2	-2.9	-0.3	-2.9	-5.9
Central bank	0.1	-1.0	-2.9	0.0	0.0	0.0
Rest of the financial system	0.1	0.9	0.0	-0.3	-2.9	-5.9
Liabilities to the private sector	24.4	21.0	16.9	16.3	9.7	15.7
Narrow money	2.5	2.8	1.3	1.9	-0.6	2.2
Savings and time deposits	6.1	9.0	8.7	4.3	4.5	0.1
Other liabilities 2/	15.8	9.2	6.9	10.1	5.8	13.4
Memorandum items:						
Growth of banking system credit to private sector 3	15.3	27.5	20.8	18.0	11.2	3.0
Medium- and long-term foreign liabilities of the central bank (in millions of U.S. dollars)	1,933.1	1,491.6	3.4	3.1	2.9	2.4
Medium- and long-term foreign liabilities of commercial banks (in millions of U.S. dollars)	882.3	1,108.0	1,215.3	1,257.3	868.7	73.4
Narrow money/GDP ratio	9.8	10.0	10.1	10.6	9.4	11.2
Broad money/GDP ratio 4/	35.8	37.7	42.1	42.6	43.5	44.7
Total liabilities to private sector/GDP ratio	83.3	83.4	89.3	93.0	96.3	109.2
Inflation rate (CPI; 12-month percentage change, end-of-period)	8.9	8.2	6.6	6.0	4.7	2.3

Sources: Central Bank of Chile; Superintendency of Pension Funds Administrators; and Fund staff estimates.

1/ Flows measured at constant end-of-period exchange rates.
2/ Includes dollar deposits, mortgage bonds, and deposits with pension funds.
3/ Annual percentage change. Excludes pension funds.
4/ Broad money includes narrow money (M1A) plus savings and time deposits.

Table 22. Chile: Operations of the Central Bank

(Percentage change with respect to liabilities to the private sector at the beginning of the period) 1/

	1994	1995	1996	1997	1998	1999
Net international reserves	340.1	19.5	-5.9	114.0	-27.9	-120.9
Net domestic credit	-27.6	-247.9	-209.3	-139.2	195.3	-11.3
Net credit to the nonfinancial public sector 2/	-48.3	-19.1	-24.1	-40.7	30.6	82.2
Net credit to financial intermediaries	-232.6	-164.9	-67.0	-116.5	-29.7	-64.9
Central bank promissory notes	-13.2	-29.5	-62.9	-108.5	73.7	5.2
Credit to the private sector	1.6	-4.1	-5.6	-30.6	29.1	13.6
Capital and reserves	23.3	7.2	52.0	64.9	36.2	-5.8
Other	241.6	-37.4	-101.8	92.2	55.4	-41.6
Net medium- and long-term foreign liabilities	3.6	-66.4	-190.1	0.0	0.0	-0.1
Liabilities to the private sector	14.5	17.7	9.5	14.6	-0.9	21.7
Currency	14.5	17.7	9.5	14.6	-0.9	21.7
Memorandum items:						
Annual flows of net international reserves (in millions of U.S. dollars)	3,668.0	1,059.9	1,180.8	3,209.0	-2,066.1	-683.3
Change in medium- and long-term foreign liabilities (in millions of U.S. dollars)	20.8	-441.5	-1,488.2	-0.3	-0.2	-0.5
Inflation rate (CPI; 12-month percentage change, end-of-period)	8.9	8.2	6.6	6.0	4.7	2.3

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Flows measured at constant end-of-period exchange rates.

2/ Excludes holdings of treasury notes on account of the 1983-86 capitalization of the central bank, which are included in other net domestic assets.

Table 23. Chile: Operations of Banks, Nonbanks, and Pension Funds

(Percentage change with respect to liabilities to the private sector at the beginning of the period) 1/

	1994	1995	1996	1997	1998	1999
I. Bank and Nonbank Financial Intermediaries						
Net international reserves	-1.7	2.3	2.2	7.7	1.6	9.5
Net domestic assets	20.8	26.7	19.4	9.2	8.6	-4.2
Nonfinancial public sector	-0.9	-3.6	-0.4	-1.6	1.5	-0.7
Net credit to financial intermediaries	2.2	1.6	-6.4	-7.4	-5.0	-4.3
Credit to the private sector	21.6	35.8	26.5	24.7	11.7	1.7
Capital and reserves	-2.9	-3.0	-2.4	-2.7	-2.3	-1.5
Other	0.8	-4.1	2.1	-3.7	2.7	0.6
Net medium- and long-term foreign liabilities	0.9	1.1	0.4	0.1	-1.2	-2.5
Liabilities to the private sector 2/	18.2	27.9	21.2	16.7	11.4	7.8
II. Pension Funds						
Net international reserves	0.0	0.0	0.0	0.0	0.0	0.0
Net domestic assets	30.9	15.7	12.6	15.1	3.6	14.1
Nonfinancial public sector	1.1	1.0	1.8	0.4	0.6	1.0
Net credit to financial intermediaries 3/	17.6	10.3	10.8	13.8	9.0	10.8
Credit to the private sector	12.3	3.5	-0.2	0.8	-6.0	1.5
Capital, reserves, and other	-0.1	1.0	0.0	0.2	0.0	-0.1
Net medium- and long-term foreign liabilities	-0.6	0.7	-0.4	-0.8	-5.0	-10.2
Liabilities to the private sector	31.5	15.0	13.0	15.9	8.6	24.3

Sources: Central Bank of Chile; Superintendency of Pension Funds Administrators; and Fund staff estimates.

1/ Flows measured at constant end-of-period exchange rates.
2/ Excludes deposits of pension funds.
3/ Consists mostly of holdings of central bank promissory notes, commercial bank letters of credit, and time and savings deposits.

Table 24. Chile: Summary Accounts of the Financial System

(End-of-period stocks; in billions of Chilean pesos)

	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999
	(Ch$407.13=US$1)		(Ch$424.97=US$1)		(Ch$439.81=US$1)		(Ch$473.8=US$1)		(Ch$527.7=US$1)	
Net international reserves	4,328.4	5,064.3	5,276.2	5,804.7	5,999.1	8,021.1	8,625.5	8,003.9	8,899.8	9,819.6
Central bank	5,480.9	6,027.6	6,281.6	6,576.0	6,797.3	7,846.6	8,437.6	7,576.9	8,424.3	7,762.6
Rest of the financial system 1/	-1,152.5	-963.2	-1,005.5	-771.3	-798.3	174.5	188.0	427.0	475.5	2,057.1
Net domestic assets	15,030.8	18,014.4	17,874.8	20,368.3	20,208.4	22,162.4	21,632.2	24,105.1	23,288.4	25,545.2
Nonfinancial public sector (net)	-1,508.4	-1,843.7	-1,907.1	-1,945.0	-2,003.4	-2,513.2	-2,675.3	-2,068.3	-2,290.3	-1,458.2
Private sector	14,125.6	17,330.9	17,406.8	20,119.0	20,179.5	23,144.6	23,267.2	24,484.2	24,705.5	25,350.0
Central bank promissory notes	-1,556.9	-1,752.9	-1,752.9	-2,245.0	-2,245.0	-3,174.9	-3,174.9	-2,451.0	-2,451.0	-2,400.1
Other assets (net)	3,970.5	4,280.2	4,128.0	4,439.3	4,277.3	4,705.8	4,215.1	4,140.2	3,324.3	4,053.5
Net medium- and long-term foreign liabilities	1,146.2	1,058.4	1,104.7	517.9	536.0	554.3	597.2	413.0	459.9	40.0
Central bank	787.0	607.3	633.9	1.4	1.5	1.3	1.4	1.4	1.5	1.3
Rest of the financial system	359.2	451.1	470.9	516.5	534.5	553.0	595.7	411.6	458.4	38.7
Liabilities to the private sector	17,828.9	21,572.4	21,599.1	25,240.4	25,259.1	29,373.0	29,416.3	32,270.1	32,398.3	37,482.0
Narrow money	2,096.1	2,588.7	2,588.7	2,859.6	2,859.6	3,333.6	2,990.9	3,171.2	3,333.6	3,149.0
Savings and time deposits	5,555.6	7,161.8	7,161.8	9,040.3	9,040.3	10,118.7	9,512.2	11,016.3	10,118.7	11,442.3
Other liabilities 3/	10,177.1	11,821.9	11,848.6	13,340.5	13,359.2	15,920.7	16,913.3	18,082.6	18,946.0	22,890.7

Sources: Central Bank of Chile; Superintendency of Pension Funds Administrators; and Fund staff estimates.

1/ Consists of commercial banks, including the *Banco del Estado*, insurance companies, and the pension funds.
2/ Excludes holdings of treasury notes on account of the 1983-85 capitalization of the central bank. These notes are included in other assets.
3/ Includes mortgage bonds, U.S. dollar deposits, and deposits with pension funds.

Table 25. Chile: Summary Accounts of the Central Bank

(End-of-period stocks; in billions of Chilean pesos)

	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999
	(Ch$407.13=US$1)		(Ch$424.97=US$1)		(Ch$439.81=US$1)		(Ch$473.8=US$1)		(Ch$527.7=US$1)	
Net international reserves	5,480.9	6,027.6	6,281.6	6,576.0	6,797.3	7,846.6	8,437.6	7,576.9	8,424.3	7,762.6
In millions of U.S. dollars	13,466.5	14,805.0	14,805.0	15,474.0	15,474.0	17,840.9	17,840.9	15,991.8	15,991.8	14,710.2
Net domestic assets	-3,565.2	-4,178.0	-4,405.5	-5,242.3	-5,463.5	-6,463.2	-7,054.1	-6,346.1	-7,193.3	-6,296.4
Net credit to the nonfinancial public sector 1/	-1,178.2	-1,305.6	-1,368.5	-1,556.9	-1,615.0	-1,964.3	-2,125.3	-1,825.0	-2,045.5	-1,245.1
Net credit to financial intermediaries	-5,576.3	-6,673.2	-6,673.2	-7,198.0	-7,198.0	-8,196.9	-8,196.9	-8,488.8	-8,488.8	-9,120.5
Central bank promissory notes	-1,556.9	-1,752.9	-1,752.9	-2,245.0	-2,245.0	-3,174.9	-3,174.9	-2,451.0	-2,451.0	-2,400.1
Credit to the private sector	-35.8	-63.4	-66.2	-110.0	-113.9	-376.1	-405.1	-118.9	-132.5	0.0
Capital and reserves	-294.9	-247.0	-266.2	141.3	127.1	683.8	646.7	1,002.6	943.4	886.9
Other	5,077.0	5,864.2	5,721.6	5,726.4	5,581.2	6,565.1	6,201.4	5,535.0	4,981.1	5,582.4
Net medium- and long-term foreign liabilities	787.0	607.3	633.9	1.4	1.5	1.3	1.4	1.4	1.5	1.3
In millions of U.S. dollars	1,933.1	1,491.6	1,491.6	3.4	3.4	3.1	3.1	2.9	2.9	2.4
Liabilities to the private sector	665.3	782.9	782.9	857.3	857.3	982.2	982.2	973.3	973.3	1,184.8
Currency in circulation	665.3	782.9	782.9	857.3	857.3	982.2	982.2	973.3	973.3	1,184.8

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Excludes holdings of treasury notes on account of the 1983-86 capitalization of the central bank, which are included in other net domestic assets.
2/ Substandard loans to the private sector taken over by the central bank in 1984-87.

Table 26. Chile: Summary Accounts of Banks and Nonbanks Financial Intermediaries 1/

(End-of-period stocks; in billions of Chilean pesos)

	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999
	(Ch$407.13=US$1)		(Ch$424.97=US$1)		(Ch$439.81=US$1)		(Ch$473.8=US$1)		(Ch$527.7=US$1)	
Net international reserves	-1,152.5	-963.2	-1,005.5	-771.3	-798.3	174.5	188.0	427.0	475.5	2,057.1
In millions of U.S. dollars	-2,830.8	-2,365.9	-2,365.9	-1,815.0	-1,815.0	396.7	396.7	901.1	901.1	3,898.1
Net domestic assets	9,677.4	11,854.9	11,943.6	13,977.1	14,040.8	15,214.9	15,287.5	16,567.9	16,694.4	15,991.0
Nonfinancial public sector	-438.5	-733.8	-734.3	-772.7	-772.9	-977.6	-978.6	-748.5	-750.0	-869.0
Net credit to financial intermediaries	308.2	437.0	437.0	-233.2	-233.2	-1,175.0	-1,175.0	-1,921.4	-1,921.4	-2,638.0
Credit to the private sector	10,624.7	13,546.2	13,624.9	16,396.6	16,460.9	19,596.0	19,747.6	21,488.6	21,723.3	22,010.9
Capital and reserves	-1,370.4	-1,612.7	-1,612.7	-1,863.2	-1,863.2	-2,204.7	-2,204.7	-2,551.6	-2,551.6	-2,808.5
Other	553.5	218.2	228.7	449.6	449.2	-23.7	-101.7	300.8	194.1	295.4
Net medium- and long-term foreign liabilities	359.2	451.1	470.9	516.5	534.5	553.0	595.7	411.6	458.4	38.7
In millions of U.S. dollars	882.3	1,108.0	1,108.0	1,215.3	1,215.3	1,257.3	1,257.3	868.7	868.7	73.4
Liabilities to the private sector	8,165.7	10,440.5	10,467.3	12,689.4	12,708.0	14,836.4	14,879.7	16,583.3	16,711.5	18,009.3

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Excludes the pension funds.

Table 27. Chile: Summary Accounts of Pension Funds

(End-of-period stocks; in billions of Chilean pesos)

	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999
	(Ch$407.13=US$1)		(Ch$424.97=US$1)		(Ch$439.81=US$1)		(Ch$473.8=US$1)		(Ch$527.7=US$1)	
Net international reserves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
In millions of U.S. dollars	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net domestic assets	8,916.5	10,328.0	10,327.1	11,630.7	11,628.5	13,399.9	13,387.9	13,870.3	13,774.4	15,845.4
Nonfinancial public sector	108.3	195.7	195.7	384.5	384.5	428.7	428.7	505.2	505.2	655.9
Net credit to financial intermediaries	5,365.2	6,291.6	6,291.6	7,413.7	7,413.7	9,031.7	9,031.7	10,250.6	10,250.6	11,839.5
Credit to the private sector	3,536.8	3,848.1	3,848.1	3,832.4	3,832.4	3,924.8	3,924.8	3,114.6	3,114.6	3,339.1
Capital and reserves	2.1	9.6	9.6	2.7	2.7	10.8	10.8	12.9	12.9	5.2
Other	-93.7	-7.4	-8.3	0.0	-2.2	14.7	2.7	-0.1	-96.0	11.0
Net medium- and long-term foreign liabilities	-81.4	-21.0	-22.0	-63.1	-65.3	-154.5	-166.5	-843.2	-939.1	-2,442.5
Liabilities to the private sector	8,997.9	10,349.0	10,349.0	11,693.8	11,693.8	13,554.4	13,554.4	14,713.5	14,713.5	18,287.9

Sources: Central Bank of Chile; Superintendency of Pension Funds Administrators; and Fund staff estimates.

Table 28. Chile: Pension Funds—Selected Indicators

(End-of-period values; unless otherwise indicated)

	1994	1995	1996	1997	1998	1999
	(In thousands of persons)					
Number of affiliates	5,014.4	5,320.9	5,571.5	5,780.4	5,966.1	6,105.7
Contributors (*cotizantes*) 1/	2,879.6	2,961.9	3,121.1	3,296.4	3,149.8	3,262.3
	(In percent per annum)					
Real rate of return of pension funds	18.2	-2.5	3.5	4.7	-1.1	16.3
	(As a percentage of annual GDP)					
Total assets of pension funds	42.1	40.0	41.4	42.9	43.9	53.3
	(As a percentage of total assets)					
Pension funds portfolio composition						
Total assets	101.0	100.1	100.0	100.0	100.0	100.0
Government securities	40.4	39.5	42.1	39.6	41.0	34.6
Financial institutions instruments	20.4	23.1	24.6	30.1	32.1	33.7
Firms shares and debentures	39.3	37.2	32.8	29.0	21.2	18.3
Foreign assets 2/	0.9	0.2	0.5	1.2	5.7	13.4
Other	0.0	0.1	0.0	0.1	0.1	0.0

Sources: Central Bank of Chile; Superintendency of the AFPs; and Fund staff estimates.

1/ Includes all workers affiliated to an AFP that during the specified month pay, or declare and do not pay, the contributions to the pension fund.

2/ Until May 1993 pension funds were not allowed to invest in foreign assets. Currently, they can invest up to 16 percent of the value of the fund.

Table 29. Chile: Export and Import Values, Volumes, and Prices, and Terms of Trade

	1994	1995	1996	1997	1998	1999
	(Annual percentage changes)					
Export values (f.o.b.)	26.1	38.1	-3.9	8.2	-11.0	5.3
Volumes	9.8	11.5	13.4	10.4	7.3	8.1
Prices	15.1	23.8	-15.2	-2.0	-17.1	-2.6
Import values (c.i.f.)	6.7	34.5	12.7	10.3	-4.5	-19.4
Volumes	6.5	24.4	11.8	15.6	0.8	-16.4
Prices	-0.4	8.1	0.3	-4.5	-5.2	-3.5
Terms of trade	15.6	14.5	-15.5	2.6	-12.6	0.9
Memorandum items:						
Noncopper exports	23.7	29.5	-1.7	4.8	-3.3	2.4
Volumes	11.7	9.5	7.3	4.7	7.4	4.9
Prices	10.8	18.3	-8.4	0.0	-10.0	-2.4
	(In thousands of metric tons)					
Export volumes						
Copper	2,070	2,347	2,885	3,432	3,651	4,205
Fishmeal	1,164	1,325	1,053	927	496	589
Whitened wood pulp	1,244	1,353	1,382	1,333	1,434	1,546
Fresh fruit (grapes)	459	443	513	472	490	473
Fresh fish	166	188	217	244	278	262
	(U.S. dollars per metric ton)					
Export prices						
Copper 1/	0.93	1.25	0.95	0.90	0.66	0.64
Fishmeal	386	474	578	594	697	473
Whitened wood pulp	470	826	449	441	407	422
Fresh fruit (grapes)	1,039	1,200	1,079	1,328	1,158	1,150
Fresh fish	3,712	4,117	3,589	3,731	3,425	4,173

Sources: Central Bank of Chile; and Fund staff estimates.

1/ U.S. dollars per pound.

Table 30. Chile: Exports (f.o.b.) by Main Categories

	1994	1995	1996	1997	1998	1999
	(In millions of U.S. dollars)					
Total	11,604	16,024	15,405	16,663	14,830	15,616
Mining products	5,191	7,850	7,324	8,132	6,505	6,934
Copper	4,242	6,487	6,029	6,841	5,332	5,889
CODELCO	2,226	3,116	2,391	2,942	2,348	2,332
Other	2,016	3,371	3,638	3,899	2,984	3,557
Other	949	1,363	1,295	1,291	1,173	1,045
Agricultural and fishery products	1,960	2,398	2,442	2,566	2,560	2,666
Fresh fruit	923	1,117	1,205	1,194	1,180	1,121
Fresh fish and mollusks 1/	683	858	878	966	1,014	1,166
Other	354	423	360	405	366	378
Semi-industrial and industrial products	4,453	5,776	5,639	5,965	5,765	6,016
Fishmeal	449	628	608	550	346	278
Woodchips	164	233	171	147	131	133
Woodpulp	716	1,229	725	680	689	773
Other	3,124	3,687	4,134	4,589	4,599	4,833
	(In percent of total exports)					
Total	100.0	100.0	100.0	100.0	100.0	100.0
Mining products	44.7	49.0	47.5	48.8	43.9	44.4
Copper	36.6	40.5	39.1	41.1	36.0	37.7
Agricultural and fishery products	16.9	15.0	15.9	15.4	17.3	17.1
Fresh fruit	8.0	7.0	7.8	7.2	8.0	7.2
Fresh fish and mollusks 1/	5.9	5.4	5.7	5.8	6.8	7.5
Other	3.1	2.6	2.3	2.4	2.5	2.4
Semi-industrial and industrial products	38.4	36.0	36.6	35.8	38.9	38.5
Fishmeal	3.9	3.9	3.9	3.3	2.3	1.8
Woodchips	1.4	1.5	1.1	0.9	0.9	0.9
Woodpulp	6.2	7.7	4.7	4.1	4.6	4.9
Other	26.9	23.0	26.8	27.5	31.0	30.9
	(In percent of GDP)					
Total	22.8	24.6	22.5	22.2	20.4	23.2
Copper	8.3	9.9	8.8	9.1	7.3	8.7

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Includes frozen and semi-processed fish and mollusks.

Table 31. Chile: Imports (c.i.f.) by Type of Goods 1/

	1994	1995	1996	1997	1998	1999
	(In millions of U. S. dollars)					
Total imports	11,820	15,900	17,823	19,662	18,779	15,137
Consumer goods	1,934	2,850	3,346	3,616	3,463	2,833
Intermediate goods	6,643	8,864	9,703	10,557	10,205	9,008
Crude oil	768	925	1,190	1,242	897	1,100
Petroleum products	373	495	671	650	595	699
Other	5,502	7,443	7,842	8,665	8,713	7,209
Capital goods	3,243	4,187	4,774	5,490	5,112	3,297
Memorandum item:						
Imports of automobiles	407	687	799	839	636	401
	(In percent of total imports)					
Total imports	100.0	100.0	100.0	100.0	100.0	100.0
Consumer goods	16.4	17.9	18.8	18.4	18.4	18.7
Intermediate goods	56.2	55.7	54.4	53.7	54.3	59.5
Crude oil	6.5	5.8	6.7	6.3	4.8	7.3
Petroleum products	3.2	3.1	3.8	3.3	3.2	4.6
Other	46.5	46.8	44.0	44.1	46.4	47.6
Capital goods	27.4	26.3	26.8	27.9	27.2	21.8
Memorandum item:						
Imports of automobiles	3.4	4.3	4.5	4.3	3.4	2.6
	(In percent of GDP)					
Total imports	23.2	45.9	42.6	44.2	36.9	23.2
Consumer goods	3.8	8.2	8.0	8.1	6.8	4.3
Intermediate goods	13.0	25.6	23.2	23.7	20.0	13.8
Crude oil	1.5	2.7	2.8	2.8	1.8	1.7
Petroleum products	0.7	1.4	1.6	1.5	1.2	1.1
Other	10.8	21.5	18.7	19.5	17.1	11.1
Capital goods	6.4	12.1	11.4	12.3	10.0	5.1
Memorandum item:						
Imports of automobiles	0.8	2.0	1.9	1.9	1.2	0.6

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Excludes imports through free trade zones.

Table 32. Chile: Capital Goods Imports (f.o.b.) by Type of Goods

(In millions of U.S. dollars)

	1994	1995	1996	1997	1998	1999
Total	3,186	4,088	4,645	5,176	4,787	3,130
Machinery and equipment	2,192	2,986	3,415	3,910	3,743	2,619
Textiles industry	33	39	26	27	25	25
Mechanical industry	36	34	37	22	31	26
Wood and furniture industry	19	35	40	28	23	19
Telecommunications	73	86	123	179	323	332
Loading-unloading	131	247	192	254	184	95
Earth moving	188	271	350	323	268	102
Generators, motors, and transformers	141	163	159	209	189	136
Computers	237	320	369	451	408	436
Pumps and compressors	56	74	71	91	79	44
Others	1,279	1,717	2,048	2,326	2,213	1,404
Transportation	995	1,102	1,231	1,266	1,044	511
Goods	190	336	334	357	232	87
Automobiles	148	133	142	175	129	66
Tractors	28	32	40	32	33	33
Ships	84	101	130	57	35	28
Other	545	501	585	645	615	297

Source: Central Bank of Chile.

Table 33. Chile: Direction of Trade
(In percent)

	1994	1995	1996	1997	1998	1999
Exports	100.0	100.0	100.0	100.0	100.0	100.0
Europe	25.3	29.4	25.9	25.7	29.2	27.4
European Union	24.3	27.1	23.9	24.4	28.1	25.9
Belgium and Luxembourg	1.8	2.4	1.6	1.6	2.3	1.8
France	3.5	3.1	2.6	2.7	3.0	3.1
Germany	5.0	5.1	4.8	4.4	3.6	3.5
Italy	3.1	3.7	3.1	2.9	4.5	4.0
Netherlands	3.0	2.7	2.6	2.5	2.9	3.2
Spain	1.9	1.9	1.8	2.0	1.9	2.1
Sweden	0.6	0.5	0.5	0.6	0.7	0.4
United Kingdom	4.5	6.5	5.8	6.2	7.9	6.8
Other 1/	1.1	1.1	1.2	1.4	1.2	1.0
Other	0.4	1.8	1.5	0.7	0.4	1.0
Western Hemisphere	38.9	33.8	37.3	37.2	42.2	42.0
Canada	0.6	0.6	0.9	0.8	1.0	1.1
LAIA countries	20.1	18.2	18.9	19.7	22.4	20.1
Andean Pact countries 2/	6.6	6.6	6.6	6.6	6.8	5.4
Argentina	5.5	3.6	4.6	4.6	5.0	4.6
Brazil	5.2	6.4	6.1	5.6	5.3	4.3
Mexico	1.8	0.8	1.0	2.2	3.3	3.9
Other	0.9	0.8	0.8	0.7	2.0	1.9
United States	17.3	14.4	16.6	15.9	17.7	19.4
Other	0.9	0.6	0.9	0.8	1.2	1.4
Rest of the world	35.8	36.7	36.8	37.0	28.6	30.7
China, People's Republic of	1.9	2.3	3.0	3.5	4.0	3.5
Japan	17.0	17.7	16.2	15.7	13.3	14.3
South Korea	5.0	5.5	5.6	5.8	2.6	4.3
Taiwan, Province of China	4.6	4.3	4.1	4.6	3.6	3.2
Other	7.3	7.0	7.8	7.4	5.2	5.3
Imports 3/	100.0	100.0	100.0	100.0	100.0	100.0
Europe	22.3	22.3	22.4	22.4	23.4	21.7
European Union	21.0	20.6	20.4	20.9	21.6	19.6
Belgium and Luxembourg	1.0	0.8	0.8	0.7	0.6	0.7
France	3.2	2.9	3.4	2.7	3.8	2.9
Germany	4.9	5.1	4.2	4.5	4.6	4.3
Italy	3.1	3.3	3.2	3.7	3.8	3.5
Spain	3.0	2.9	3.1	3.3	3.7	2.8
Sweden	1.0	1.3	1.6	1.9	1.4	1.9
United Kingdom	2.1	1.6	1.6	1.7	1.4	1.3
Other 1/	2.7	2.6	2.6	2.5	2.3	2.3
Switzerland	1.0	0.8	0.7	0.6	0.7	1.1
Other	0.3	0.9	1.4	0.8	1.1	1.0
Western Hemisphere	51.6	53.9	53.8	53.4	52.4	54.8
Canada	2.3	2.1	2.4	2.3	2.8	2.8
LAIA countries	25.3	26.3	26.8	27.4	26.4	30.7
Andean Pact countries 2/	5.0	4.9	5.3	4.8	4.1	5.5
Argentina	8.4	9.0	9.4	9.7	10.7	13.9
Brazil	8.8	7.8	6.1	6.6	6.1	6.7
Mexico	2.3	3.9	5.3	5.7	4.8	4.0
Other	0.9	0.6	0.7	0.6	0.8	0.7
United States	23.1	24.7	23.7	22.9	22.6	20.8
Other	0.9	0.8	0.9	0.7	0.6	0.4
Rest of the world	26.1	23.9	23.8	24.2	24.2	23.6
China, People's Republic of	3.2	3.2	3.7	3.8	4.3	4.9
Japan	8.8	6.6	5.5	5.6	5.6	4.4
South Korea	2.9	3.4	3.2	3.1	3.1	2.8
Taiwan, Province of China	1.4	1.3	1.3	1.2	1.1	1.1
Other	9.8	9.3	10.1	10.5	10.1	10.4

Source: Central Bank of Chile.

1/ Austria, Denmark, Finland, Greece, Ireland, and Portugal as of 1995.
2/ Bolivia, Colombia, Ecuador, Peru, and Venezuela.
3/ Excludes imports through Free Trade Zones.

Table 34. Chile: Net International Reserves of the Financial System

(In millions of U.S. dollars)

	1994	1995	1996	1997	1998	1999
Central bank	13,467	14,805	15,474	17,841	15,992	14,710
Assets	13,757	14,805	15,474	17,841	15,992	14,710
Gold 1/	652	643	637	533	322	317
SDRs 2/	1	3	2	1	8	19
Reserve position at the Fund	0	0	50	313	602	403
Foreign exchange	13,087	14,137	14,781	16,991	15,049	13,977
Payment agreements (net)	17	22	4	2	11	-5
Liabilities (-)	-290	0	0	0	0	0
Short-term liabilities	0	0	0	0	0	0
Liabilities to the IMF	-290	0	0	0	0	0
Commercial banks 3/	-2,829	-2,364	-1,814	398	902	3,899
Assets	535	474	587	1,153	1,783	4,172
Gold 1/	2	2	2	1	1	2
Foreign exchange	533	472	585	1,152	1,781	4,170
Liabilities (-)	-3,364	-2,838	-2,400	-755	-880	-273
Short-term loans	-3,311	-2,823	-2,384	-747	-870	-260
Foreign bank deposits	-54	-15	-16	-9	-11	-13
Financial system	10,638	12,441	13,660	18,239	16,894	18,610
Assets	14,292	15,279	16,061	18,994	17,774	18,882
Liabilities	-3,655	-2,838	-2,400	-755	-880	-273
Memorandum item:						
Medium- and long-term financial system liabilities (-)	-2,616	-2,548	-1,070	-909	908	4,553
Central bank	-1,933	-1,492	-3	-3	-3	-2
Assets	455	0	0	0	0	0
Liabilities	2,388	1,492	3	3	3	2
Commercial banks	-882	-1,108	-1,215	-1,257	-869	-73
Assets	12	16	19	104	444	1,103
Liabilities	894	1,124	1,234	1,361	1,313	1,176
Pension funds	200	52	148	351	1,780	4,629
Assets	200	52	148	351	1,780	4,629

Sources: Central Bank of Chile; and Fund staff estimates.

1/ Valued at end-of-period market price
2/ SDRs are valued at end-of-period rates with respect to the U.S. dollar.
3/ Includes *Banco del Estado*.

I. Summary of Tax System as of November 30, 1999

(All amounts in Chilean pesos)

Tax	Nature of Tax	Exemptions and Deductions	Rates
I. Central Government			
1. Taxes on net income and profits			
1.1 Tax on corporations			
1.1.1 Corporate income tax	A tax on earned income by corporations called First Category Tax. Paid on income from manufacturing, commerce, mining and other extractive activities, real estate, services and activity of agricultural enterprises. In agriculture, income of farmers whose annual sales do not exceed 8,000 UTM and who own the land they work, is presumed to be 10 percent of the value of fixed capital. For those farming land that they do not own, income is presumed to be 4 percent of the fixed capital. Income from nonagricultural real estate is presumed to be 7 percent of its value. Companies whose average monthly income over the latest three years was less than 250 UTM can opt for a simplified system according to which they pay the tax on the sum of distributed profits and the differences in company's own capital between the beginning and the end of the year.	Companies that declare this tax on the basis of detailed accounts can take credit of 4 percent on investment in fixed capital, up to a total of 500 UTM. 1/ **Exempt**: General government, municipalities, savings, social security and mutual-assistance associations, central bank, charitable institutions. Companies in Region 12—Magellan and Antarctic, and companies in Duty Free Zones.	15 percent.
1.1.2 Tax on indirect distributions (Article 21 DL 824)	A tax on cash payments by corporations and payers of the tax referred to in (1.5) for expenses not considered necessary. Also taxable are loans made by partnerships to their individual partners.		35 percent.
1.2 Tax on financial income (Article 20, No. 2, DL 824)	A tax on resident individuals, applicable to income generated by the ownership of shares of foreign corporations.	None.	15 percent.
1.3 Special taxes on small business			
1.3.1 Tax on small artisan miners	A tax on miners who have at most five employees, and on partnerships or cooperatives of at most six miners. The base is the net sales of minerals.	None.	A variable rate between 1 percent and 4 percent which depends on the world price of minerals.
1.3.2 Tax on street vendors	A fixed tax on street vendors	None.	Market vendors, half UTM per year. Stationed vendors, half UTM per year.
1.3.3 Tax on newsstands	A tax on vendors of newspapers, magazines, and related printed material.	None.	0.5 percent of the value of the sales. If also selling cigarettes, lotteries, etc., add 1/4 UTM per year.
1.3.4 Tax on small workshops	A tax on sole proprietors of small workshops.	None.	3 percent of gross revenue (1.5 percent if predominant source of income is production of goods), due monthly.

(All amounts in Chilean pesos)

Tax	Nature of Tax	Exemptions and Deductions	Rates
			Annual make-up payment required if sum of inflation-adjusted payments fall short of two December UTMs.
1.3.5 Tax on small fishing enterprises	A tax on small fishing enterprises operating one or two boats.	None.	0.5 UTM if gross tare is under 4 tons; 1 UTM if gross tare is between 4 and 8 tons; 2 UTM if gross tare is between 8 and 15 tons.
1.4 Taxes on income of mining and transportation companies			
1.4.1 Tax on income of miners	When not determined according to (1.1.1) or (1.3.1), for miners with annual sales not exceeding 36,000 tons of nonferrous minerals and/or 6,000 UTA the income is imputed by applying a factor on net sales. For copper, gold and silver the factor varies between 4 percent and 20 percent, depending on the world price of these metals. For other minerals the factor is 6 percent. The scheme includes the sales of processed minerals, provided they are mostly of own extraction.	None.	15 percent of net income.
1.4.2 Tax on income of transportation companies	Net income of city or road transportation companies (either passengers or cargo) whose annual sales do not exceed 3,000 UTM is imputed as 10 percent of the value of the vehicle.	None.	15 percent of net income.
1.5 Additional tax on foreign residents	A tax on the income from Chilean sources made available to nonresidents. Tax base includes royalties, technical assistance, interest paid by nonfinancial entities, insurance premia, earnings of Chileans living abroad, and remittances of foreign investors under the Foreign Investment Statute (DL 600).	**Exempt:** new equity originated from taxed profits; return of capital; interest on debt of government, central bank, CODELCO, and on Latin American Banking Acceptances; payments abroad for freight insurance services (not premia), telecommunications, and processing of Chilean products.	35 percent general. 30 percent on amounts paid to nonresidents for the use of trademarks, patents, formulas and advisory services. 20 percent on personal work in scientific, cultural and sport activities; on engineering services performed abroad; and on movie and television rights. 5 percent on gross value of foreign participation on ship freights, to and from Chile, granted exemption on the basis of reciprocity. 4 percent on interest earned on deposits in authorized financial institutions, loans granted by foreign banks, bonds and debentures denominated in foreign currency, and bonds, debentures and other paper denominated in foreign currency issued by the Government of Chile or the Central Bank of Chile. Foreign investors under the Foreign Investment Statute (DL 600) may opt, when signing the initial investment contract, for a 42 percent tax rate that is guaranteed for a period of 10 years. **Tax credit** of 0, 10 or 15 percent of the amount remitted, according to the rate at which it was taxed.
1.6 Tax on state-owned enterprises (Decree-law 2,398)	A surtax applies to state enterprises	**Exempt:** the central bank, enterprises organized as stock corporations, and enterprises belonging in part to the private sector.	40 percent on the share of the state in profits.

I. Summary of Tax System as of November 30, 1999

(All amounts in Chilean pesos)

Tax	Nature of Tax	Exemptions and Deductions	Rates
1.7 Taxes on individuals			
1.7.1 Personal income tax (Decree-law 824)	The personal income tax, called Second Category Tax, paid on income from wages, salaries, bonuses, and all other revenue ratios for personal services, pensions, and income obtained through representation expenditures. For farm workers, income base is the same as that used for Social Security Contributions. All income earned by individuals is subject to a Global Complementary Tax at the same rates as the Second Category Tax. All taxes paid before on the same income (First Category, fees, etc.) and a tax credit of 10 percent of one UTA are netted out to determine the Net Complementary Tax due.	**Exemptions**: Income up to 10 UTM. **Deductibles**: 20 percent of investment in shares if by December 31, the investment took place more than 360 days ago; up to 50 UTA, 50 percent, and then 20 percent, of dividends from corporations and capital gains or losses from sale of equity; for taxpayers covered by Art. 57 bis b), average effective rate applied to the year's net savings; if net savings is less than zero, tax must be paid.	**Income Classes 2/** — **Percent Rate** 10–30 UTM — 5 30–50 UTM — 10 50–70 UTM — 15 70–90 UTM — 25 90–120 UTM — 35 Over 120 UTM — 45 Income of farm workers in excess of 10 UTM — 3.5
1.7.2 Tax on taxi-drivers	Instead of the tax referred in (1.7.1) taxi drivers who do not own the car pay a fixed monthly tax.	None.	3.5 percent on the value of two UTMs.
2. Social security contributions	Private social security system is funded by a levy on all civilian wages and salaries. Additional levy required to purchase invalidity and survival insurance. There are various differentiated rates for persons still in the public security system. There is no tax on employers.	**Exempt**: military personnel; remuneration in excess of 60 UF. 3/	10 percent for pensions and 3.5 percent for insurance.
	Health insurance	**Exempt**: remuneration in excess of 60 UF.	7 percent.
3. Property taxes			
3.1 Net wealth tax	None.		
3.2 Additional real estate tax	A surtax to the municipal real estate tax (II.1) is imposed by the General Government. The surtax applies to nonfarm real estate. It is collected together with the municipal tax.		
	(i) For municipalities that have agreed to the reappraisal of real estate:	**Exempt**: houses valued at less than Ch$33.6 million (1999 prices).	0.025 percent of municipal real estate tax.
	(ii) For other municipalities, until December 31, 1999 or the date municipal authorities agree to the reappraisal of real estate, whichever is earlier:	**Exempt**: houses valued at less than Ch$18.8 million (1999 prices).	30 percent of municipal real estate tax.
3.3 Tax on gifts and inheritance (Law 16,271)	A progressive tax on net wealth obtained through gift or rights of inheritance. The tax is to be paid within two years from the date the transfer was effective.	**Excluded from the base**: low-valued houses and forests. **Exemptions**: spouses, parents, children up to 50 UTA for inheritance, up to 5 UTA for gifts; relatives up to fourth degree up to 5 UTA for gift and inheritance.	**Value of Inheritance of Gift** — **Percent Rate** Up to 80 UTA — 1.0 From 80 to 160 UTA — 2.5 From 160 to 320 UTA — 5.0 From 320 to 480 UTA — 7.5 From 480 to 640 UTA — 10.0 From 640 to 800 UTA — 15.0 From 800 to 1,200 UTA — 20.0 More than 1,200 UTA — 25.0

(All amounts in Chilean pesos)

Tax	Nature of Tax	Exemptions and Deductions	Rates
			Surcharge: spouses, parents, children exempt; relative up to fourth degree, 20 percent; other relatives, 40 percent.
4. Taxes on goods and services			
4.1 Value-added tax (Tit. II of DL 825)			
4.1.1 General value-added tax	A comprehensive and uniform tax on sales of goods and services. Includes construction industry (Law 18,630), sales to government, and importation.	**Exempt sales**: in-kind payments to employees, food provided on premises to employees and students, nonadvertisement income of television and radio stations, news services, mass transportation, schooling, charges by state hospitals and health institutions, sales by Casa de Moneda, state lottery, used cars (see 4.1.3). **Exempt imports**: defense and police weaponry and supplies, effects belonging to diplomats and employees of international organizations, donations to qualified institutions, tourists effects, in-transit items, inputs to be used in production for exportation, capital goods for qualified projects, artistic, cultural and sport performances and awards, international freight and travel, some international insurance premia, receipts subject to the income tax (such as interest, rents, personal services). **Deductions from the base**: rebates granted to buyers after sale, and refunds, net of canceled purchases. Tax credit granted for the tax paid on purchases of goods and services. **Exports not taxed**; reimbursement still granted for tax paid on purchases of inputs for exports. Advance tax credits can be granted on purchases related to qualified export-oriented projects, deductible from VAT credits on actual exports when the project comes on stream.	
4.1.2 Additional value-added tax on luxuries	Besides being subject to the general VAT tax, some goods are subject to an additional tax with a structure similar to the general VAT.	Tax credit granted for the additional tax paid on purchases of goods subject to the additional tax.	50 percent for jewelry, precious stones, fine furs, and tapestry, trailers, caviar, fireworks, airguns. 53 percent on whiskey, 30 percent on liquors, 25 percent on pisco. 15 percent on wine, and 13 percent on nonalcoholic beverages. 18 percent of the (net of the VAT) transaction price. **Alcohol Grade Scale** — **Percent Rate** Less than or equal to 35° — 27 More than 35° and less than 36° — 31 Major 36° and less than 37° — 35 Major 37° and less than 38° — 39 Major 38° and less than 39° — 43 More than 39° — 47 Whiskey — 53

I. Summary of Tax System as of November 30, 1999

(All amounts in Chilean pesos)

Tax	Nature of Tax	Exemptions and Deductions	Rates
4.1.3 Tax on sales of used automobiles	A tax on the sales of used motor vehicles, which excludes the VAT (but VAT is due if vehicle is bought abroad).	**Exempt**: mass transportation vehicles, trucks, vans, and pickups (provided driver and cargo compartments are not the same).	0.5 percent of the transaction price. Starting on January 1999 this tax started to be levied by municipalities.
4.1.4 Tax on imported cars (I)	The importation of motor vehicles, assembled or not, is subject to this addition to VAT. The base of the tax is the import value.	**Exempt**: passenger vehicles with 15 or more seats, tractors, trailers, other classified in position 87.03 of tariff, automobiles of less than 1,500 cc. Tax rate is lower for small pickup trucks.	Rate = (cc x 0.03 - 45), where cc stands for number of cubic cm of piston displacement. The rate is then lowered by a percentage (equivalent to 80 percent in 1997) that has been increased by 10 percent yearly since 1990. Small trucks and buses with 500–2,000 kg payload capacity are subject to a 75 percent rebate on the tax rate with a maximum effective rate of 15 percent. Maximum tax in 1999: US$7,503.55 per vehicle.
4.1.5 Tax on imported cars (II)	In addition to the tax (4.1.4), the importation of motor vehicles, assembled or not, for passengers or cargo, which can carry up to 2,000 kg is subject to this addition to VAT. The base is the import value in excess of US$15,000.00	The exemption list is the same as for (4.1.4).	85 percent.
4.2 Selective excises			
4.2.1 Tax on tobacco	A tax on sales of cigarettes, cigars and processed tobacco. The tax base is the consumer price (with the inclusion of the tax itself).	**Exempt**: small amounts brought by passengers for self-consumption; exports.	45.4 percent on cigarettes, 42.9 percent on tobacco products, 46 percent on cigars. Starting in January 1999 these rates changed respectively to 50.4 percent, 47.9 percent and 51 percent.
4.2.2 Surcharge on tobacco	A surcharge on sales of tobacco.	**Exempt**: small amounts brought by passengers for self-consumption; exports.	10 percent.
4.2.3 Tax on gasoline and diesel	A tax on the first sale or importation of gasoline and diesel oil.	In the case of diesel oil, a tax credit is given against the VAT if the vehicle is not used for transportation.	4.4084 UTM per cubic meter of gasoline. 1.5 UTM per m3 of diesel oil. The rate on gasoline increased to 5.2 on January 2000 and will increase to 6 on January 2001.
5. Taxes on international transactions			
5.1 Import duties			
5.1.1 General tariff	A general and uniform tariff. The base is the customs value; if unknown, the c.i.f. value. The tax is assessed in U.S. dollars.	**Exempt**: boat engines and worktools for small fishery and imports for use in Region XII (for South) enjoying preferential treatment. **Reduced rate**: special vehicles for the handicapped pay half the normal rate.	9 percent normal, 5 percent on imports to free zone (rate valid from April 1, 1999 to March 31, 2000). Starting in January 2001 the rate will be reduced to 8 percent, in January 2002 to 7 percent and in 2003 to 6 percent. Surtaxes ranging from 5 percent to 24 percent and countervailing duties can be imposed on import prices intended to seriously harm domestic industry. If imported goods are used as input of export goods, the exporter can claim return of the tax paid. The tax on the import of capital goods can be deferred up to seven years.
5.1.2 Fee on exempt imports (Article 221 Law 16,840)	A charge ("tasa de despacho") imposed on all goods exempt of custom duties.	None.	5 percent on c.i.f. value.
5.1.3 Equalization duties (Article 12 Law 18,525)	Duties on the importation of certain commodities adjusted so as to keep the domestic prices of wheat, oilseeds, cooking	None.	Rates fluctuate in response to the changing prices of each commodity in world markets.

Tax	Nature of Tax	Exemptions and Deductions	Rates
	oil and sugar within a band related to past world prices. These price bands are revised annually.		
5.2 Export duties	None.		
5.3 Other customs duties	Chile also has the following customs revenues, not detailed here: extension of provisional admissions of foreigners (DEC.Hac.175/74), charge for storage in private warehouses prior to payment of duties (Article 140 ss. Ord), consular rights on ships and airplanes, balance of insurance policies, outturn of customs actions.		
6. Other taxes			
6.1 Stamp duties (see also 5.1.2)			
6.1.1 Tax on credit instruments	A tax on financial papers. The specific amounts, expressed in Chilean pesos, are revised twice a year according to inflation.	None.	Per check drawn on domestic banks Ch$120. Per check issued without enough provision, or per unpaid draft of promissory note: 1 percent of value, minimum Ch$2,013. For checks only, a maximum of one UTM. Credit instruments: 0.1 percent of value, per month, maximum 1.2 percent. Starting on January 2002 these rates will change respectively to 0.134 percent and 1.608 percent. Contracts at call: 0.5 percent. Starting on January 2002 this rate will increase to 0.67 percent.
6.2 Fee on mining licenses (Law 18,248)	A tax on rights of exploration and mining concessions.	None.	Rights of exploration: one-time payment of 2 percent of one UTM depending on extension of land. Mining concessions: 10 percent of one UTM per hectare per year.
6.3 Taxes on gambling	Three taxes are imposed on games of chance: (i) a tax on the selling price of the sport lottery (Sistema de Pronosticos Deportivos), not including the tax itself, and on the tickets of the national lottery system (Polla Chilena de Beneficiencia and the Concepcion lottery). (ii) a specific tax on each individual admission at casinos; (iii) an ad-valorem tax on horse racing bets.		15 percent on lotteries. 0.07 x 1 UTM per casino admissions. 3 percent on horse racing bets.
6.4 Taxes on civil registration	A tax on the issuance of certificates of birth, marriage, residence of aliens, criminal records, police ID, family data, passports-- details not available.		
II. Municipalities			
1. Real estate tax	Annual tax on value of real estate land. 40 percent of the proceeds is distributed to the municipality of origin and 60 percent goes to a common fund, which in turn is distributed according to social criteria.	**Exempt:** houses valued at less than Ch$9.4 million (1999 prices).	2 percent of land value before reappraisal. Once reappraised, 1.4 percent if value exceeds Ch$33.6 million; and 1.2 percent if value is below Ch$33.6 million.
2. Motor vehicle duties	Two fees are imposed on motor vehicles:	None.	On a progressive scale according to the vehicle's value.

I. Summary of Tax System as of November 30, 1999

(All amounts in Chilean pesos)

Tax	Nature of Tax	Exemptions and Deductions	Rates
	(i) a fee on motor vehicle permits, paid annually. (50 percent of proceeds goes to the municipalities' common fund.) (ii) a fee on motor vehicles transactions (50 percent of proceeds goes to the municipalities' common fund.)		1 percent of the vehicle's value.
3. Business duties	A fee charged for vehicle permits, paid annually. (100 percent of proceeds goes to the municipalities' common funds).	None.	

Sources: Ministry of finance, *Dirección de Presupuestos, Cálculo de Ingresos Generales de la Nación Correspondiente al Año 2000*, Santiago: November 1999 and information provided by the Chilean authorities.

1/ UTA stands for *Unidad Tributaria Anual* (annual tax unit), and corresponds to 12 times the value of a December's UTM (*Unidad Tributaria Mensual*) or monthly tax unit. The UTM is adjusted each month according to the change in average price level in the second-past month. In December 1999 one UTM was worth Ch$26,388 and reflected changes in the price level as per December 31, 1998.

2/ The monthly withheld tax on labor income is computed using the same progressive schedule, but using UTM instead of UTA.

3/ UF stands for *Unidad de Fomento*, a price reference unit widely used in financial contracts which is adjusted daily. A schedule from the 10th of each month to the 9th of the subsequent month reflects changes in the price level in the previous month. On December 31, 1999, one UF was worth Ch$15,066.96 and reflected changes in the price level as per December 31, 1998.

Chile: Selected Monetary and Banking Measures, January 1999–March 2000

January 1999

January 26

It was decided to reduce the benchmark interest rate by 55 basis points, from UF+7.8 percent to UF+7.25 percent annually. It was also decided to reduce interest rates on the liquidity line of credit tranches, setting the first tranche at the benchmark rate while the second and third tranches were set at UF+9.25 percent and UF+11.25 percent, respectively.

January 28

As of this date, banks and finance companies may no longer take in and invest funds through bearer bonds convertible into letters of credit.

March 1999

March 9

The benchmark interest rate was reduced to UF+7.0 percent, a reduction of 25 basis points. Similarly, interest rates on the liquidity line of credit tranches were reduced to UF+7.0 percent, UF+9.0 percent, and UF+11.0 percent, respectively. In addition, the liquidity deposit rate was set at UF+5.75 percent.

April 1999

April 6

The benchmark interest rate was reduced by 50 basis points from UF+7.0 percent to UF+6.5 percent. In addition, interest rates on the liquidity line of credit tranches were adjusted by the same amount to UF+6.5 percent, UF+8.5 percent, and UF+10.5 percent, respectively. Also, the liquidity deposit rate was reduced from UF+5.75 percent to UF+5.25 percent.

April 22

Following the establishment of the European Monetary Union, operations conducted in the currencies of the 11 participating member countries through December 1998 began to be denominated in euros. Therefore, the regulations governing asset and liability operations in foreign currency were amended accordingly.

April 27

To limit the various risks facing the banking industry, the regulations governing maturity matching applicable to banks and finance companies were enhanced and regulations on interest rate matching were established. The new provisions on maturity matching establish the required ratios between asset and liability operations with residual maturities of less than 30 days and those with residual maturities of less than 90 days. For the former, the ratio must be satisfied by domestic and foreign currency operations considered separately, while in the latter case they are considered jointly.

Interest rate matching, for its part, limits the vulnerability of asset and liability operations in domestic and foreign currency to interest rate fluctuations. In this case, it was established that the total mismatch in such operations may not, as a whole, exceed the equivalent of 8 percent of the core capital of the respective bank or finance company.

Since matching interest rates limits the risks of derivatives operations, it was deemed appropriate to expand the range of derivative products that financial institutions may develop in the domestic market among themselves or with third parties domiciled or resident in the country or abroad. Accordingly, authorization was granted for transactions involving futures, forwards, swaps, and combinations of these in domestic and foreign currency (banks only), domestic and foreign interest rates (banks only), and authorized indexing units of accounts. Similarly, the prior authorization requirement for foreign interest-rate derivatives was abolished.

Also, the restrictions contained in Chapter V.A.1 of the Compendium of Financial Regulations pertaining to external borrowing by banks and finance companies for periods of less than one year were abolished, as the new regulations in force on asset and liability operations duly protect against the risks resulting from said borrowing.

May 1999

May 6

The benchmark interest rate was reduced by 50 basis points from UF+6.5 percent to UF+6.0 percent. In addition, interest rates on the liquidity line of credit tranches were adjusted by the same amount to UF+6.0 percent, UF+8.0 percent, and UF+10.0 percent, respectively. The liquidity deposit rate was reduced from UF+5.25 percent to UF5.0 percent.

May 27

Banking enterprises were authorized to invest abroad an additional amount equivalent to 70 percent of their respective actual net worth in financial instruments having short- or long-term risk classifications equal to or greater than A1+ or AA-, or their equivalents. It was similarly established that this additional margin will not be subject to the requirement of 100 percent provision.

It was also established that financial investments solely in time deposits with banks established abroad which are rated at least A1+ or AA- will be subject to an individual limit per issuer of up to 30 percent of the actual net worth of the Chilean bank making the investment.

June 1999

June 1

The benchmark interest rate was reduced by 25 basis points from UF+6.0 percent to UF+5.75 percent. In addition, interest rates on the liquidity line of credit tranches were adjusted by the same amount to UF+5.75 percent, UF+7.75 percent, and UF+9.75 percent, respectively, and the liquidity deposit rate was reduced from UF+5.0 percent to UF+4.75 percent.

June 10

Financial institutions were authorized to sell or assign adjustable-rate coupon notes (PRC) and adjustable-rate dollar notes (PRD) in fractional amounts based on a coupon or a portion of the rights.

Similarly, to generate a deeper foreign exchange market, authorization was granted for operations involving repurchases of instruments expressed, adjustable, or payable in foreign currency and carried out between financial institutions, in foreign currency within one bank business day.

It was decided also to abolish the additional margin applicable to the purchase of letters of credit issued by financial institutions in order to adjust the regulations governing such purchases to current general market conditions.

June 21

The benchmark interest rate was adjusted downward by 75 basis points from UF+5.75 percent to UF+5.0 percent annually. Similarly, interest rates on the liquidity line of credit tranches were reduced by the same amount to UF+5.0 percent, UF+7.0 percent, and UF+9.0 percent, respectively. Also, the liquidity deposit rate was set at UF+4.0 percent.

June 24

The regulations governing interbank borrowing were adjusted so that ceilings on such borrowing may be exceeded to the extent that the excess amount is guaranteed with paper issued by the Central Bank of Chile or by the government and its agencies, excluding its enterprises. It was determined that sight deposits, resources, and other claims will be excluded from the calculation of the aforementioned interbank limits.

July 1999

July 27

"Optional Adjustable Issue Coupons" (C.E.R.O.) in *Unidades de Fomento* (UF) and dollars will be issued to replace "Adjustable-Rate Coupon Notes" (PRC) and "Adjustable-Rate Dollar Notes" (PRD), respectively, presented for exchange. This increases the power of financial institutions to sell or assign notes in fractions based on a coupon and, therefore, those entities wishing to exercise this option shall replace and exchange notes with all coupons remaining to maturity for the aforementioned C.E.R.O. notes.

In addition, financial institutions were authorized to assign and sell these new notes under repurchase agreements to other institutions and to individuals and legal entities. It should be emphasized that implementation of these notes is pending the issuance of the corresponding operating regulations.

September 1999

September 14

It was decided to raise the mismatch ceiling in nonadjustable Chilean currency applicable to banking enterprises and finance companies from two to four times the core capital of the respective financial institution

September 16

To promote long-term financing of financial institutions, the factor applicable to one of the ceilings on Pension Funds' investment in securities issued by banks and finance companies was increased from 0.7 to 1.0. Accordingly, the ceiling is increased from 70 percent of the equity capital of the issuing financial institution to 100 percent.

December 1999

December 9

The volume of financial investments by issuer that may be effected abroad by Chilean banking enterprises was increased from 5 percent to 50 percent of their actual net worth. Securities must be low risk, issued, or guaranteed by governments or central banks of foreign countries.

Banking enterprises were also permitted to purchase foreign currency loans and participate in syndicated loans abroad.

Also, banking enterprises were authorized to use credit derivatives acquired abroad as instruments for covering the risk of nonpayment of fixed-income foreign currency investments and instruments.

December 16

The range of investments by banks and financial institutions that may be sold or transferred to securitizing enterprises or securitized credit investment funds was expanded. This made it possible to combine loans from the consumer credit portfolio, securities issued by the Central Bank of Chile (PDBC, PRBC, PRC, PRD, CERO in UF and in dollars), bank bonds and bonds issued by corporations, junior bonds, and pension contribution recognition bonds.

January 2000

January 27

It was decided to raise the benchmark interest rate by 25 basis points, from UF+5.0 percent to UF+5.25 percent annually. It was also decided to increase the interest rates on the liquidity credit line tranches, setting the first tranche at the benchmark rate, while the second and third tranches were set at UF+7.25 percent and UF+9.25 percent, respectively. The liquidity deposit rate was set at UF+4.25 percent.

March 2000

March 16

Having adapted the relevant automated processes, the Central Bank of Chile implemented its Optional Adjustable Issue Coupons (CERO) created in July 1999. These make it possible to split PRC and PRD coupons. CERO notes in UF and dollars are issued only by the Central Bank of Chile to replace and in exchange for PRCs and PRDs, respectively, as their holders wish.

Also, the Board of the Central Bank of Chile decided to raise the Bank's benchmark interest rate by 25 basis points, setting it at UF+5.5 percent. Similarly, interest rates on the liquidity line of credit tranches were adjusted to UF+5.5 percent, UF+7.5 percent, and UF+9.5 percent. The liquidity deposit rate was increased to UF+4.5 percent.

March 31

The resolution on matching regulations for domestic and foreign currency applicable to financial institutions that was adopted in April 1999 entered into effect. In addition, a technical adjustment was made to this regulation to allow the excess liquidity in foreign currency with the same maturity to be used to satisfy the aforesaid domestic currency ceiling.

Chile: Main Exchange Regulation Measures, January 1999–May 2000

January 1999

January 18

Holders of reserve deposits on external loans were permitted to request their release if they ask to be included in the substitute mechanism established in Chapter XIV of the Compendium of International Exchange Regulations (CIER). This mechanism will be applied over the period required to complete one year, but not exceeding nine months.

January 19

The external financing of productive investments with Chapter XIV foreign loans was authorized provided that these loans are converted into domestic currency and the investment schedule is the same as the loan disbursement schedule.

January 28

The overall ceiling on pension funds' investments abroad was raised from 12 percent to 16 percent of the value of the respective fund. The ceiling on investments in foreign variable-income instruments was raised from 6 percent to 8 percent.

February 1999

February 3

The ceiling on investment abroad by insurance companies was raised. For general insurance companies, the maximum margin authorized rose from 15 percent to 20 percent; for life insurance companies, the ceiling was raised from 10 percent to 15 percent.

April 1999

April 15

The ceiling on foreign investment by pension funds in variable income securities was raised from 8 percent to 10 percent of the funds they administer.

Various regulations in the CIER were replaced with new regulations providing significant exchange liberalization, opening of the capital account, and simplification of administrative procedures. (These modifications entered into force on June 1.)

The principal changes introduced in Chapter XIV were as follows:

- Entities other than banks and financial institutions were permitted to issue bonds with maturities of less than four years, and the risk classification requirements for longer-term issues were eased.

- Debtors in compliance with certain basic requirements were excused from the obligation to obtain prior authorization from the Central Bank of Chile.

- The obligation to convert foreign exchange obtained from foreign loans into domestic currency on the formal exchange market was abolished.

- Investors were allowed to dispose of the foreign exchange brought in or of the proceeds of its conversion into domestic currency. This conversion must take place on any date prior to the remittance of the capital abroad.

- Provided that certain regulatory requirements are met, banking enterprises were allowed to process requests to bring in capital from abroad in the form of loans, investments, and capital contributions without prior recourse to the Central Bank of Chile.

The new Chapter XIII of the CIER contained the following innovations:

- The requirement of prior central bank authorization for financial credits and credit lines was eliminated (this obligation was retained for bond issues only).

- The obligation to convert foreign exchange arising from the operations regulated by this Chapter into domestic currency is abolished.

Otherwise, the exchange restrictions established in the CIER were renewed for a period of one year.

May 1999

May 27

Chapter XXIX was incorporated into Title I of the CIER, which regulates transactions involving foreign securities or stock deposit certificates in the international stock exchanges known as offshore stock exchanges. In the main, these regulations provided that:

(i) Repatriation of capital, profits, dividends or earnings realized by individual and institutional domestic investors from foreign securities or stock deposit certificates would be considered repatriation of foreign investment.

(ii) Investments, deposits, or loans made by such investors on foreign securities or stock deposit certificates would be considered executed abroad.

(iii) Investors resident abroad must use foreign capital to effect offshore stock exchange transactions, while those resident in Chile may use both foreign currency and foreign exchange acquired in the formal exchange market.

(iv) It was established that transactions involving foreign securities and stock deposit certificates would be carried out in stock exchanges established in Chile, and that these transactions should be effected through stock exchange brokers who are members of the respective stock exchange, in U.S. dollars.

June 1999

June 30

Foreign currency interbank loans were permitted, the obligation for banks to convert the foreign exchange resulting from loans to each other having been eliminated.

July 1999

July 8

It was established that resources obtained by exporters under export-financing loans may be converted on either the formal or informal foreign exchange market, at any time they choose to do so. In addition, the procedures for contracting these loans were simplified, requiring only that they be paid with foreign exchange corresponding to export proceeds.

The requirement for prior central bank authorization was eliminated for various types of foreign exchange outflows, including bonuses, royalties, technical assistance, labor contracts in foreign currency, leasing, export promotion expenditure, cultural and recreational activities, and others.

September 1999

September 2

The formal commitment to the exchange rate band was suspended. It was announced that the Central Bank of Chile would intervene in the exchange market only in exceptional circumstances and that it would provide information about any such decisions. Nevertheless, in accordance with current regulations, the former central parity rate would continue to be calculated and published as a medium-term reference for the market and for use in existing contracts based on this rate.

November 1999

November 4

Permission was granted to exchange houses within the formal exchange market to purchase and sell foreign currency in connection with export repatriation and import cover operations.

November 25

It was established that transactions involving primary issues and redemptions of shares in open or closed foreign funds may be transacted outside stock exchanges established in Chile, and that these transactions must be effected through stock exchange brokers who are members of the respective stock exchange. Furthermore, it was established that all transactions regulated by Chapter XXIX could be effected in euros.

December 1999

December 9

Banks were authorized to sell the foreign exchange arising from foreign currency time deposits.

Commercial banks were authorized to contract credit derivatives to cover their fixed-income portfolios and their commercial investments against the risk of debtor nonpayment. The counterparty in such derivative contracts must be domiciled abroad and have a rating of AA- or better.

The margin for lower-risk foreign financial investments by banks was widened, both for time deposits in banking entities established abroad and for securities issued or guaranteed by foreign governments or central banks. For these two types of investment, the size of any single investment abroad by an individual bank was subject to limits of 30 percent and 50 percent, respectively, of the bank's effective capital.

The period for acquiring foreign exchange in the formal exchange market to be used for import payments was extended from 90 to 360 days.

February 2000

February 3

Banks were allowed to issue Deposit Certificates abroad, under the same conditions as those needed to issue bonds.

April 2000

April 17

The exchange regulations in the CIER were renewed for a period of one year.

April 20

Chilean companies were authorized to also list their shares in foreign markets in which American Depository Receipts (ADRs) are not traded, as long as they comply with the same conditions that apply for issuing ADRs. At the same time, investment funds for development of companies and real estate investment were authorized to subscribe their quotas in foreign markets.

May 2000

May 10

Chilean banks were authorized to provide guarantees or finance to foreign financial institutions, but only in operations related to the financing of international trade between third countries.

May 11

The one-year withholding requirement for foreign investments covered by Chapter XIV of the CIER was eliminated. Along with this measure, it was announced that:

- Banks and third parties were authorized to trade forward contracts with foreign counterparts involving Chilean currency (either the peso or the inflation-indexed UF).

- Banks were allowed to hedge credit risk associated with their fixed-income portfolio and commercial loans with residents, using financial derivatives, for both local and foreign currency.

- The regulation authorizing the issuance abroad of peso- or UF-denominated bonds was revised so that such instruments would be treated, for regulatory purposes, as obligations payable in foreign currency. (One immediate implication was that the tax applied to interest payments on UF-denominated bonds issued abroad was reduced from 35 percent to 4 percent.)