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Exchange Rates, Monetary Policy and Wages:
a Case Study of Chile*

by

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Introduction

The principle role of a devaluation is to bring about an increase in the domestic price of traded relative to non-traded goods, thereby facilitating a switch in production from the domestic to the foreign account. As is well known, to be successful in this regard, the devaluation must be accompanied by supporting monetary and wage policies such that the initial improvement in the prices of traded relative to non-traded goods is not completely eroded by domestic inflation. In short, a devaluation, to have real effects, must bring about a decrease in the real returns to one of the economy's factors of production, labour being the most likely candidate in the short run.

Of the various approaches to a devaluation reported in the literature it is only the monetary approach¹ which explicitly

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¹ See Johnson (1977) for a general description.

illustrates the role played by accompanying monetary policy in determining the likely success (measured in terms of achieving a given improvement in the balance of payments) of the devaluation. This approach views a foreign account deficit in terms of a disequilibrium between the quantity of money demanded and the quantity of money supplied, with the role of devaluation being to facilitate the adjustment of actual to desired real money balances. By raising domestic prices and thereby decreasing the real value of the money stock (the price of money in terms of goods) the devaluation can bring about an increase in the nominal amount of money demanded. Its success in stimulating the foreign account is therefore conditional on the extent to which the initial reduction in real balances is not offset by domestic credit creation. Thus, viewed from this perspective, for a given scenario on money wages, a devaluation becomes logically equivalent to a contraction in the nominal stock of money at an unchanged exchange rate.

However, while a given improvement in the foreign account can be achieved by alternative policy mixes of exchange rate, money wage and domestic money supply changes, each policy mix will have different implications for key economic variables such as the level of real domestic absorption, the level and composition of industry output and employment, the rate of inflation and the level and distribution of factor returns. A knowledge of the likely consequences for these and other variables is important in choosing a policy package which, while having

prospects for achieving the necessary improvement in the foreign account, is at the same time both technically and politically feasible. In this respect the magnitude of the desired foreign account improvement is of particular importance. If large, the required contraction in domestic credit might prove technically infeasible in the absence of a devaluation. Moreover, the expenditure and employment reductions caused by a domestic monetary deflation might be considered politically unacceptable. On the other hand, a devaluation accompanied by a sympathetic though not unduly severe monetary policy might well achieve the foreign exchange target without a contraction in domestic output and employment while still holding the increase in domestic inflation to an acceptable level.

This paper analyses, using a comparative-static general equilibrium model built along neoclassical lines, a range of devaluation, monetary and wage policy mixes for the Chilean economy. By quantifying the short-run implications of each policy mix for key economic variables at the macroeconomic and sectoral level it enables judgements to be made about their effectiveness in reaching specified targets and their feasibility.

The focus on Chile is particularly appropriate. In acknowledging the failure of recent policies¹ to achieve external and internal balance within a politically acceptable time period and in recognition of the financial imprudence of continuing to

¹ Essentially a tight domestic monetary stance to sustain the peso- $\$$ US exchange rate.

fund the foreign account deficit with equity capital from abroad, the Chilean authorities in June 1982 introduced a stabilisation package aimed at stimulating the balance of trade and employment. Key feature of the package was an 18 per cent devaluation of the peso against the \$ US (from 39 to 46 pesos per dollar) with the prospects of further mini devaluations of about 0.8 per cent at monthly intervals.¹ In addition, automatic money wage indexation to movements in domestic prices was abolished, money wage cuts were implemented for selected public servants, new conditions (more favourable for constraining money wages) for wage negotiations were laid down and further privatisation of the economy was announced.

The paper is structured as follows. Section 2 briefly documents the extent of internal and external disequilibrium which had arisen in Chile prior to the introduction of the above-mentioned stabilisation package. Section 3 describes the quantitative framework supporting the study. Results of the short run impact of the devaluation under different assumptions about accompanying monetary and wage policies are presented in Section 4. Section 5 contains a short summary.

2. The Lead-up to the Chilean Devaluation

The so-called Chilean economic miracle which followed in the

¹ Two months later the peso was allowed to float freely against the dollar. The empirical analysis later however is confined to the initial devaluation of 18 per cent.

wake of the large-scale reforms initiated in 1975¹ faltered in 1981 with a slump in the real growth rate from 10.0 to 5.5 per cent. The growth rate for 1982 is projected to be negative. A substantial component of the growth rate contraction can be attributed to a deterioration in the foreign account. Following a 16 per cent contraction in the fob value of exports and a 20 per cent expansion in the fob value of imports the balance of trade deficit increased from \$ US 764 million in 1980 to \$ US 2,600 million in 1981. This was the main factor causing the current account deficit to increase from \$ 2,000 million to \$ US 4,800 million over the same period.²

This foreign account imbalance, which can be attributed largely to a deterioration in the international competitiveness of the Chilean traded goods sector, reflects the interaction of two factors. The first centres around the management of the peso-\$ US exchange rate, fixed at 39 pesos/\$ US in mid 1979.³ This parity was maintained until June 1982 despite a

¹ The reform package adopted (see Douglas (1981) for details) was fiercely market-oriented. Key elements included; (i) the opening up of the economy to trade (via the removal of quantitative restrictions on all imports except motor vehicles and the reduction in ad valorem tariffs from an average nominal rate of 105 per cent in 1973 to a flat 10 per cent in 1979), (ii) the elimination of controls on both product and factor prices, (iii) the pursuit of balanced domestic budgets via monetary restraint, and (iv) the privatisation of many public sector enterprises.

² To sustain this deficit without invoking stabilisation measures required a sharp increase in foreign borrowing.

³ The exchange rate has been a key instrument in the Chilean liberalisation and stabilisation programs of recent years. Exchange rate policy was initially that of a managed crawl. After 1978 a variation of the fixed exchange rate system, involving the preannouncement of its path to be followed over a specified period, was introduced. In mid 1979 the rate became fixed. The fixing was undertaken to maintain monetary discipline on the economy in an effort to break inflationary expectations.

considerably higher domestic inflation rate in Chile than in the USA over the period¹ and despite, in the latter part of the period, a steady revaluation of the \$ US against the currencies of Chile's other major trading partners.² The second concerns a severe decline in the foreign terms of trade over the period, principally through a reduction in world (\$ US and hence peso) copper prices of 25 - 30 per cent. With export earnings from copper representing around 50 per cent of total export earnings and with export proceeds accounting for around 30 per cent of the Chilean GDP a world price decline of this magnitude is equivalent, *ceteris paribus*, to a short run Chilean GDP decline of about 3-4 per cent.

Within the Chilean traded goods sector import competing industries operated in an environment of rising domestic costs relative to the local prices of competing imports thus limiting their ability to pass on cost increases in the form of higher domestic selling prices. For the heavily export oriented copper sector the situation was one of rising production costs relative to world selling prices in local currency.

Both internal and external adjustment to a foreign terms of trade decline such as that recently experienced by Chile could in principle be achieved by a sufficient reduction in real factor

¹ Between June 1979 and December 1981 the rate of inflation in Chile (as measured by the consumer price index) increased by 72 per cent compared with 27 per cent in the USA.

² Major trading partners with Chile are USA, Japan, Brazil, Federal Republic of Germany and Venezuela. For the June 1979 to December 1981 period Chile's real effective exchange rate against these countries (calculated by applying import weights to movements in nominal exchange rates and inflation rates between Chile and the countries) appreciated by 67 per cent.

prices (to correspond with their now reduced marginal products) together with a contraction in real absorption (to correspond with the economy's reduced income). Whatever policy package is used to achieve this,¹ it must involve a devaluation of the real exchange rate to provide the necessary stimulus to traded relative to non-traded industries. It is not surprising, in view of the effective revaluation of the real exchange rate over 1981 and up until the stabilisation package of June 1982, that both the balance of trade and domestic employment² deteriorated so sharply.

3. Analytical Framework

The analysis of alternative policy mixes is undertaken using a ten sector comparative-static general equilibrium model of the Chilean economy. While this model focuses unashamedly on the real side of the economy,³ it also contains a simple monetary sector. The inclusion of linkages between real and monetary aggregates⁴ permits a determination of the separate effects on economic variables of changes in the domestic component of the money supply and changes in the exchange rate. It thus allows the effects of a devaluation to be studied in different monetary environments. Nevertheless, it should be noted at the outset that the model does

¹ See Dick et al (1982) for a quantification of some alternatives.

² Official figures show an increase in the unemployment rate from 11 per cent of the workforce in mid 1981 to around 23 per cent by mid 1982.

³ The real side of the model represents a somewhat simplified version of the ORANI multisectoral general equilibrium model system developed for the Australian economy. See Dixon et al (1982).

⁴ Such linkages are not generally a part of comparative-static general equilibrium models.

not attempt to capture the monetary approach to the balance of payments. In particular, there is no treatment of short-run capital flows.¹ The adjustment to the foreign account and the domestic money supply following a devaluation occurs entirely via the balance of trade. Furthermore, while the model explains the behaviour of real aggregate domestic absorption, it does not contain equations to describe movements in its component parts (aggregate household consumption, private investment, government spending).

The model is centred around an input-output system of accounts, permitting the incorporation of a systematic treatment of many types of commodity and factor flows, e.g., commodity flows from domestic and imported sources to current production, capital creation, households, government and exports, and factor flows (labour by occupation, fixed capital, land) to industries for use in current production. Its structure pays close attention to microeconomic theory, emphasising the role of relative prices and substitution prospects in explaining trade flows and the composition of domestic economic activity. This neoclassical flavour is particularly appropriate for Chile given the essentially open free market character of the real side of its economy.

Major behavioural postulates underlying the structural equations are that;

(i) Producers choose their inputs to minimise production costs of

¹ Capital flow equations are, from a theoretical viewpoint, easy to formulate. To make them operational however requires a knowledge of the elasticity of capital flows to changes in domestic relative to world interest rates. In the Chilean case the problem is complicated by various controls on capital movements and by monopoly elements in domestic capital markets. For these reasons, capital flows are treated as exogenous.

a given output subject to three level constant returns to scale industry production functions. At the first level is the Leontief assumption of no substitution between input categories or between them and an aggregate of the primary factors. At the second are CES functions describing substitution between domestic and imported sources of each input category and between primary factors (aggregate labour, fixed capital, land). At the third are CES functions describing substitution between different occupations within the aggregate labour category.

- (ii) Households choose their purchases to maximise an additive nested utility function subject to an aggregate budget constraint. The nests of commodity categories contain CES functions describing substitution prospects in consumption between domestic and imported sources of each category.

An algebraic listing of the structural equation system expressed in linear percentage form (the form in which the model is solved) is given in Appendix A. The Appendix partitions the equations into six groups;

1. Final Demands. These relationships for domestic and imported commodities are given by equations (1) - (2) (household demands), (3) (demands for inputs to capital creation), (4) (other, mainly government, demands) and (5) (export demands). Main features are the allowance for relative-price-induced substitution between domestic and imported sources of supply in (1) and (3), together with households being able to substi-

tute between different commodity categories (2), and the provision for commodity exports to influence world prices (5).

2. Industry Inputs. Equations (6) - (9) indicate that industries can substitute between domestic and imported sources of their intermediate inputs,¹ between primary factors (labour, capital, land), and between different labour occupations.
3. Zero Pure Profits. It follows from the assumption of constant returns to scale production technology and competitive behaviour that profits can accrue only to factors of production. Equations (10) - (13) represent the zero pure profits conditions for the activities current production, capital creation, importing and exporting respectively.
4. Market Clearing. Equations (14) - (17) equate supply with demand for domestically produced commodities,² occupational labour, fixed capital and land. Note that (15) - (17) simply require that factor employment levels be satisfied. They do not necessarily impose full employment assumptions.
5. Monetary Sector. The money supply is assumed to be determined by applying a constant multiplier to the monetary base which is in turn decomposed into a domestic component (credit to the private and public sectors) and an international component (international reserves). The demand for money is specified

¹ The allowance for imperfect substitution between domestic and imported goods in production and consumption, i.e., deviation from purchasing power parity, is a key feature of the model's structure.

² Because commodities from foreign and domestic sources are treated as distinct commodities, imports are not added to domestic production in determining total supplies.

to be a function of the domestic price level, gross domestic product (with unitary demand elasticity) and expected inflation¹ (reflecting the opportunity cost of holding money).

Equation (18) provides the link between the real and money sides of the model by equating money supply with money demand. Equation (18a) defines the foreign component of money.²

6. Miscellaneous Equations. Most of these are self-explanatory being definitional in character. Equations (23) - (25), which determine the allocation of investment across industries, require further comment. They follow from the assumptions that; (i) investment takes one period to install, (ii) investors have an expected rate of return schedule from new investment which is downward sloping, and (iii) aggregate investment is allocated across industries to equate expected rates of return.³

From the linear system in Tables A1 and A2 we see that there are $4gh + 11g + 9h + rh + 2r + 15$ equations in $4gh + 15g + 11h + rh + 3r + 21$ variables. The model is closed by assigning values to a selection of $4g + 2h + r + 6$ variables. Solution values for the remaining variables are obtained by simple matrix methods.

¹ The expected inflation variable is always exogenous to the model. This requires a scenario on the likely change in expected inflation associated with the shock under study. For simplicity, in the experiments reported later, a value of zero is assigned to this variable. Thus the results abstract from any changes in expected inflation that could be expected to follow from the various policy packages considered.

² Implicit in (18a) is that net capital flows and additional items in the balance of payments other than the balance of trade can be regarded in the short run as being independent of the shocks under study.

³ See Dixon et al (1982, section 19).

4. Experiments and Results

For a specified closure,¹ the model is first used to quantify the sensitivity of endogenous variables to three policy instruments; (i) the nominal exchange rate (ϕ), (ii) the domestic component of the money stock (M_n^d), and (iii) the economy-wide money wage level (F_1).² From these results, detailed projections for five policy packages involving different combinations of changes in the above-mentioned instruments are generated. That is, we determine x , the percentage change in an endogenous model variable X , according to;

$$x = \eta_{X,\phi} \phi + \eta_{X,M_n^d} m_n^d + \eta_{X,F_1} f_1 \quad (i)$$

where $\eta_{X,\phi}$, η_{X,M_n^d} and η_{X,F_1} are respectively the elasticities³ of endogenous variable X with respect to unitary percentage changes in ϕ , M_n^d and F_1 , and ϕ , m_n^d and f_1 denote the exogenously imposed percentage changes in these variables.

Before describing the policy packages it is important to explain the key assumptions⁴ characterising the economic environment in which the model elasticities of Appendix B (and hence the policy packages are generated. Firstly, the adjustment horizon

¹ The closure is set out in Appendix B.

² In most countries the money wage rate could not be considered a policy instrument. The recently introduced Chilean package does however suggest that the authorities are in a position to exert some influence on money wages. This variable is therefore introduced into one of the proposed policy packages.

³ The elasticities are listed in Appendix B.

⁴ These assumptions are imposed by the particular selection of exogenous variables (Appendix B).

is short-run. This is imposed by holding industry capital stocks constant. Since industry investment is endogenous the short-run corresponds to a calendar time period long enough for industries to alter their investment plans (and hence the demands faced by industries producing capital goods) in response to the changes in their growth prospects following the devaluation and accompanying money supply and money wage changes, but short enough for the effects of the investment plans on capital stocks to be ignored. A period of two years is postulated as being necessary for the various price and quantity adjustments initiated by the exogenous shocks to work their way through the economy. Secondly, the labour market is demand determined with firms able to employ as much labour as they require at the specified nominal wage. Thirdly, changes in real domestic absorption caused by the policy shocks are assumed to be balanced, i.e., involving equiproportional changes in the components (household consumption expenditure, private investment expenditure, government expenditure).¹ Fourthly, the nominal exchange rate is specified exogenously, being assumed under the control of the monetary authorities.² The balance of trade is endogenous however. Fifthly, the domestic component of the monetary base is exogenous, reflecting the fact that the authorities have direct control over the volume of domestic credit. Note however that with the foreign component of the monetary base endogenous via the balance of trade, the nominal money supply is also endogenous.

With the actions of the authorities in controlling the exchange rate affecting the composition of, rather than the overall level of, the money supply, domestic credit policy becomes

¹ As noted earlier the model does not contain equations to describe the separate behaviour of these components.

² This was the situation up until the currency float of August, 1982.

an important instrument for influencing the foreign account and domestic economic activity. The model mechanisms whereby changes in domestic credit policy affect employment, GDP, the balance of trade, absorption and the overall money supply emphasise the adjustment of trade volumes to changes in relative prices.

Referring to the results in Appendix B, a 1 per cent contraction in the domestic component of the monetary base (m_n^d), leads, given the particular set of trade elasticities,¹ to a contraction in the consumer price index of 0.0334 per cent. With fixed nominal wages, this implies an increase in real wages of the same amount, causing aggregate labour demand to decline by 0.0476 per cent.

With industry and hence aggregate employment of land and capital assumed fixed, real GDP is effectively determined by aggregate labour demand.² The ensuing GDP contraction is 0.0147 per cent.

Next, we note that with the nominal exchange rate fixed the decrease in $\epsilon^{(3)}$ and hence devaluation of the real exchange rate provides a stimulus to the balance of trade sufficient to increase

¹ The extent to which the domestic price level decreases following the contraction in m_n^d depends on the size of the trade elasticities (the elasticities of substitution between imported and domestic products and the foreign demand elasticities for Chilean exports). Increasing these elasticities, causes domestic prices to approach world prices (purchasing power parity). Hence the projection for the consumer price index ($\epsilon^{(3)}$) approaches zero. However, while the relative price difference between the domestic economy and overseas is reduced the sensitivity of trade volumes to a given relative price change is increased. The net effect is a smaller fall in $\epsilon^{(3)}$ being compensated for by a larger gain in the balance of trade (ΔB) and the foreign component of the money stock (m_n^f). At the other extreme (nearly exogenous trade as the trade elasticities approach zero), decreases in m_n^d will be highly effective in decreasing $\epsilon^{(3)}$ and the nominal money supply.

² We can write that $gdp \approx S_\ell \ell$ where gdp and ℓ are respectively the percentage changes in real GDP and aggregate labour demand and S_ℓ is the share of payments to labour in the economy's total value added. Because of differences in labour intensity across industries (which as indicated by footnote 1 on p. 20, are considerable) this relationship will hold only as an approximation.

the foreign component of the monetary base by 0.9939 per cent such that the overall money supply contracts by only 0.0481 per cent. Finally, to satisfy the national income identity (in which GDP and the balance of trade have already been determined by aggregate labour demand and the real exchange rate respectively), real absorption must contract by 0.0599 per cent.

The Alternative Policy Packages

The first three options describe various forms of domestic monetary response to a nominal devaluation. All of these assume a labour market of constant money wages. That is, an x per cent increase in the domestic price level following the devaluation brings about an x per cent reduction in real wages. The fourth, also conducted in a labour market of constant money wages, involves a purely deflationary domestic monetary stance at a constant nominal exchange rate. The fifth incorporates changes in all three instruments, the nominal exchange rate, the domestic component of the money stock and the money wage rate.

Option (i) reflects a passive monetary response. The 18 per cent nominal devaluation takes place in a monetary environment in which the domestic component of the money stock is held constant by the authorities. Option (ii) however involves an

active monetary response. Following the 18 per cent devaluation the authorities are assumed to contract the domestic component of the money stock by an amount sufficient to hold real domestic absorption constant.

Option (iii), which represents a considerably more severe version of (ii), may be termed the complete sterilization option. Following the 18 per cent devaluation the authorities are assumed to bring about a contraction of the domestic component of money just sufficient to offset the expansion in the money supply from the increase in the foreign component of money associated with the balance of trade improvement. That is, at the new equilibrium, the growth rate of the money supply remains unchanged by the devaluation.

Option (iv) represents a purely deflationary monetary stance. With fixed money wages and a fixed nominal exchange rate the authorities contract the domestic component of money to achieve a targeted improvement in the balance of trade (that evident in option (i), the devaluation - constant domestic component of the money stock package).

Option (v) uses all three policy instruments to achieve specified targets for three variables, the balance of trade, the domestic price level and aggregate employment. It is assumed that the authorities wish to devise an exchange rate-money supply-money wage package capable of, (i) improving the balance of trade by 909 million 1981 US dollars (about 50 per cent of the balance of trade deterioration which took place over 1981), (ii) increasing the aggregate demand for labour by 10.46 per cent (equivalent to

about half the official rate of unemployment at the end of 1981, and (iii) restraining the increase in domestic inflation (as measured by the model's consumer price index) to 5 percentage points. The model determines the percentage change in each of the policy instruments to achieve these targets and the resultant effect on macroeconomic and sectoral variables.¹

Results

Table 1 contains selected results for key macroeconomic and sectoral variables. It is important to emphasise their comparative static nature. The numbers represent percentage changes in the levels of the variables due solely to the postulated changes in exogenous variables (nominal exchange rate, domestic component of money, money wages), and not forecasts of the positions likely to be reached by these variables at a future date. Thus the figure in line 2 column 1 indicates that after an adjustment period of about 2 years, real domestic absorption would be 4.04 per cent above the level it would have reached at this point in time had the nominal exchange rate remained unchanged. In arriving at this projection, leads, lags and adjustment dynamics are ignored.

¹ These targets are somewhat arbitrary. Readers wishing to vary the targets can obtain projections of the required changes in the instruments comprising the policy package by solving the following system of simultaneous equations for ϕ , m_n^d and f_1 ;

$$\bar{\Delta B} = \eta_{B,\phi} \phi + \eta_{B,M_n^d} m_n^d + \eta_{B,F_1} f_1 \quad (\text{ii})$$

$$\bar{l} = \eta_{L,\phi} \phi + \eta_{L,M_n^d} m_n^d + \eta_{L,F_1} f_1 \quad (\text{iii})$$

$$\bar{\varepsilon}^{(3)} = \eta_{E(3),\phi} \phi + \eta_{E(3),M_n^d} m_n^d + \eta_{E(3),F_1} f_1 \quad (\text{iv})$$

where the η 's are the relevant elasticities (Appendix B) and $\bar{\Delta B}$, \bar{l} , $\bar{\varepsilon}^{(3)}$ are the values assigned to the balance of trade, employment and domestic price level targets respectively.

Table 1 - Projections of Some Devaluation - Money Supply - Money Wage Alternatives^(a)

Variable	Option (i) 18 per cent devaluation, fixed money wages and domestic component of money	Option (ii) 18 per cent devaluation, fixed money wages and real absorption	Option (iii) 18 per cent devaluation, fixed money wages and nominal money supply	Option (iv) 45.23 per cent decrease in domestic component of money, fixed money wages and nominal exchange rate	Option (v) Policy package (devaluation, domestic component of money and money wage changes)
<u>Macroeconomic</u>					
Real GDP	6.09	5.10	-0.47	-0.66	5.10
Real domestic absorption ^(b)	4.04	0.00	-22.67	-2.71	0.00
Aggregate exports	9.21	14.63	44.98	3.63	14.63
Aggregate imports	2.11	-3.03	-32.19	-3.48	-3.08
Balance of trade ^(a)	364.80	909.10	3231.90	364.80	909.10
Consumer price index	15.36	13.10	0.47	-1.51	5.00
Aggregate labour demand	13.68	10.46	-7.54	-2.15	10.46
Money wage	0.00	0.00	0.00	0.00	-3.10
Real wage ^(c)	-15.36	-13.10	-0.47	1.51	-13.10
Real returns to labour	-1.68	-2.64	-8.01	-0.64	-2.64
Labour's share of income ^(d)	-7.77	-7.74	-7.54	0.02	-7.74
Domestic component of money	0.00	-67.76	-445.99	-45.23	-82.99
Foreign component of money	44.94	112.07	488.21	44.95	112.07
Nominal money supply	21.45	18.20	0.00	-2.18	10.10
Real money supply ^(e)	6.09	5.10	-0.47	-0.66	5.10
Nominal exchange rate	18.00	18.00	18.00	0.00	9.90
Real exchange rate ^(f)	2.64	4.90	17.53	1.51	4.90
<u>Main commodity exports</u>					
2. Copper mining	1.53	1.94	4.21	0.27	1.94
4. Other mining	52.33	59.16	97.46	4.53	59.16
5. Food processing	40.51	30.05	256.92	21.14	80.06
7. Light manufacturing (export oriented)	22.63	31.20	79.27	5.74	31.20
<u>Main commodity imports</u>					
1. Agriculture	9.03	7.13	-3.19	-1.24	7.13
3. Crude Oil	7.06	4.18	-11.98	-1.93	4.13
6. Light manufacturing (import oriented)	1.76	-2.73	-27.94	-3.01	-2.73
8. Petroleum refining	2.64	-3.25	-36.30	-3.95	-3.25
9. Heavy manufacturing	1.40	-3.90	-33.43	-3.54	-3.90
<u>Sector Outputs</u>					
1. Agriculture	2.09	2.13	2.67	0.06	2.13
2. Copper mining	2.25	2.39	3.10	0.09	2.39
3. Crude oil extraction	2.49	2.31	1.33	-0.12	2.31
4. Other mining	30.03	32.95	49.34	1.96	32.95
5. Food processing	6.66	6.17	9.33	-0.32	6.17
6. Light manufacturing (import competing)	10.70	9.84	4.99	-0.58	9.84
7. Light manufacturing (export oriented)	12.91	14.71	24.77	1.20	14.71
8. Petroleum refining	6.33	4.22	-1.51	-1.45	4.22
9. Heavy manufacturing	11.19	9.72	1.51	-0.98	9.72
10. Services	5.73	3.10	-11.66	-1.76	3.10

(a) All projections are in percentage changes except the balance of trade which has units, millions of 1981 US dollars.

(b) The proportional composition of this absorption (between aggregate consumption, investment and government spending) is assumed constant.

(c) Calculated by deflating movements in money wages by movements in the model's consumer price index.

(d) Calculated as the percentage change in real returns to labour minus the percentage change in real GDP.

(e) Equivalent to the percentage change in real GDP.

(f) Calculated as the percentage change in the nominal exchange rate minus the percentage change in the model's consumer price index.

Option (i) Nominal devaluation with no offsetting domestic monetary contraction. This policy turns out to be excessively expansionary and inflationary. In a labour market of constant money wages the 18 per cent devaluation is able to bring about an increase in the domestic prices of traded relative to non-traded goods and hence decrease in the domestic price level relative to world prices in Chilean pesos (real exchange rate devaluation of 2.6 per cent).¹ This improves the balance of trade by about 16 per cent of the increase in the deficit which occurred over the 1980-81 period. With the domestic component of the money stock held constant the 45 per cent expansion in the foreign component results in an overall expansion in the money supply of 21 per cent. This finances an increase in the price level of 15 per cent and an expansion in real GDP of 6 per cent, the latter being made up of a 4 per cent expansion in real absorption in addition to the balance of trade improvement. The very large (15 per cent) reduction in real wages boosts aggregate employment by 14 per cent. Nevertheless, real returns to labour fall by 1.7 per cent implying a 7.8 per cent decrease in the share of the national income going to labour.²

At the sectoral level the improvement in the trade balance (which stimulates growth in export oriented and import competing industries) and real absorption (which stimulates growth in

¹ World import prices in domestic currency increase by 18 per cent. World export prices in domestic currency increase by slightly less. Commodity export expansion together with downwards sloping foreign demand curves (especially for copper) cause the foreign currency prices of exports to decline somewhat.

² This reflects the fact that at the new equilibrium, employment is more heavily concentrated in the less labour intensive industries.

domestic oriented industries) ensures growth in output and employment¹ in all sectors though with the bias clearly in favour of the traded industries. Factors important in explaining variations in industry output response are; trade linkages (export relatedness, import competitiveness), reliance on sales to the domestic economy, and the slope of the short run industry supply curve (itself a function of fixed factor intensity and the elasticity of substitution between primary factors). Largest output gainers are industries 4 and 7, both of which have strong sales linkages to exports (representing 46 and 30 per cent of total sales respectively). Both gain from their increased product prices in local currency relative to their domestic production costs. Furthermore foreign demand elasticities for their products are high. Industry 4's relatively high labour intensity (labour share of value added of 0.78) enhances its short run output flexibility. Next in line are the strongly import-competing industries 9 and 6². These industries are able to capture an increased share of the expanding domestic market through their strengthened competitive position against competing imports whose local prices increase by 18 per cent. Next are industries 5, 8 and 10 whose sales patterns are heavily oriented to the domestic economy. All are

¹ Since industry specific capital and land is assumed fixed, projections of an industry's labour demand may be computed by dividing its output projection by the share of its base period value added represented by labour payments. The shares are; 1 (0.22), 2 (0.38), 3 (0.18), 4 (0.78), 5 (0.36), 6 (0.49), 7 (0.41), 8 (0.80), 9 (0.63), 10 (0.51).

² As can be seen from equations (1), (3) and (6) the model specifies import competitiveness to be an increasing function of the elasticity of substitution between domestic and imported sources of the products of the industry (see Table A3) and the base period share of imports in total usage (representing 60 and 20 per cent respectively for the products of industries 9 and 6).

projected to experience output growth in line with that of the economy as a whole. The remaining industries (3,2,1) are projected to expand at a rate considerably below the average for the economy. All are extremely fixed factor intensive which is the main reason behind their subdued short-run output response.¹

Option (ii) Nominal devaluation with fixed real domestic absorption. In comparison with (i) this option is somewhat less expansionary and less inflationary. To hold domestic absorption constant requires that the domestic component of the money stock be contracted by 68 per cent. Nevertheless, the nominal money supply still expands by 18 per cent. With the pricing prospects of domestic oriented industries constrained by the constancy of domestic absorption the devaluation of the real exchange rate is now considerably higher leading to a much improved trade balance gain (equivalent to about 50 per cent of the balance of trade deterioration which occurred in 1981). Real wages contract by 13 per cent while aggregate labour demand increases by 10 per cent. At the sectoral level the economy's distribution of output and employment is more heavily in favour of the traded relative to the domestic oriented industries than in option (i).

Option (iii) Devaluation with a constant growth rate of the overall money supply. The results indicate that to achieve full sterilization of the monetary effects of the 18 per cent devaluation, that is, hold the growth rate of the money supply to that existing

¹ On the demand side, industry 2 is strongly export oriented (base period sales share to exports of 0.84). However, because of Chile's moderate share of copper exports in world copper trade (11 per cent), export expansion reduces the world price somewhat (foreign demand elasticity of 2.0).

before the devaluation, requires that the authorities contract the domestic component of the money stock by an enormous 446 per cent.¹ This in turn virtually, (though not completely) eliminates the domestic inflationary effects of the devaluation² but imposes an unrealistically severe contraction of 23 per cent in real domestic absorption. With the heavily contractionary domestic monetary stance constraining the overall increase in domestic prices to only 0.5 per cent, the very large (17.5 per cent) implied devaluation of the real exchange rate provides an enormous short term boost to the trade balance, equivalent to 1.8 times the balance of trade deterioration over 1981. Despite real wages falling by only 0.5 per cent, the decrease in the economy's aggregate employment (7.5 per cent) causes real returns to labour to fall by 8 per cent. The big boost to unemployment despite the small (0.5 per cent) contraction in GDP results from the enormous output (11.7 per cent) and employment (22.9 per cent) decline in the Services sector following the collapse in domestic absorption.³

¹ Recall however that the money multiplier is assumed constant. In practice the authorities could achieve the same change in the money supply with a smaller change in the domestic component and simultaneous action to reduce the money multiplier. While this would enhance the technical feasibility of achieving the constant money supply growth rate target it would not alter the fact that the achievement of this target involves an enormous deflation of the domestic economy.

² It is of interest in itself to note that in a multisectoral framework which allows for changes in industrial composition the devaluation can cause small changes in the domestic price level even though the domestic component of money is adjusted such that the nominal money supply remains constant.

³ This sector employed 65 per cent of the workforce in the base period. The heavily deflationary monetary stance results in a fall in the industry's output price of 16 per cent. The industry is virtually non-traded.

Option (iv) Contraction in the domestic component of the money stock with a fixed nominal exchange rate. The results indicate that a purely deflationary domestic monetary policy is in itself an effective means of improving the balance of trade. With the nominal exchange rate fixed, the devaluation of the real exchange rate is achieved by an absolute fall in the domestic price level which in turn follows from the contraction in output of domestic oriented industries.

By comparing the results with those in (i) we see that a 45 per cent contraction in the domestic component of money is required to produce the same trade balance improvement as achieved by the 18 per cent nominal devaluation with a constant domestic component of money. The resultant structures of the two economies and the implications for inflation, real wages, employment, absorption and GDP are however quite different. Whereas in (i) the devaluation resulted in a 15.4 per cent increase in the domestic price level and hence fall in real wages together with increases in employment and GDP the deflationary domestic monetary policy results in a 1.5 per cent decrease in the domestic price level and hence increase in real wages together with a 2.2 per cent contraction in aggregate employment, a 2.7 per cent contraction in absorption and a 0.7 per cent contraction in GDP.

At the sectoral level the boost to export oriented industries is less than in (i) and although import competing industries gain market share through reductions in their production costs relative to the prices of competing imports, this is insufficient to offset

output losses resulting from the contraction in the domestic market they supply. The heavily domestically-oriented Services sector is particularly hard hit.¹ While in (i) however labour's share of the higher national income decreased by 7.8 per cent, in (iv), with real wages increasing, labour's share of the decreased GDP actually increases slightly.

Option (v) Policy package of devaluation, domestic component of the money stock and money wage changes. Note that the balance of trade and employment targets in this option are the same as the projections for these variables obtained in option (ii). Option (v) however has one additional target (domestic price level) and one additional instrument (money wages). Thus a comparison of the results between (ii) and (v) enables implications to be drawn about the effectiveness of money wage reductions in modifying the size of the nominal devaluation and ensuing domestic inflation. The results indicate that to achieve the specified targets requires a policy package consisting of a nominal devaluation of 9.9 per cent, a reduction in the domestic component of money of 83 per cent and a cut in money wages of 8.1 per cent. With the increase in the consumer price index constrained to 5 per cent, this implies a real wage reduction of 13.1 per cent.

Note that the projections for all real variables are the same in (ii) and (v). Given the overlapping values for the balance of trade and employment in both experiments, this result simply serves to illustrate that the real effects of the devaluation follow entirely from the extent to which it is able to

¹ A collapse in domestic demand for this sector's output is a necessary prerequisite for a decrease in the domestic price level given that the exchange rate is held constant.

reduce real wages. In (ii), the 13.1 per cent reduction in real wages was achieved, in a labour market of constant money wages, by an 18 per cent nominal devaluation sufficient to increase the domestic price level by 13.1 per cent. In (v), in a labour market of flexible money wages, the same reduction in real wages is achieved by a lower (9.9 per cent) nominal devaluation, the real wage reduction being composed of an 8.1 per cent decrease in money wages and a 5 per cent increase in the domestic price level. The devaluation of the real exchange rate and all other real effects are however identical between (i) and (v).

Alternative Policy Packages

The policy package of option (v) is somewhat arbitrary. However, Appendix B contains sufficient information to enable readers to generate model projections for any chosen combination of nominal exchange rate, domestic component of money stock, and money wage instruments. This information may be used to, (a) generate results for specified changes in the instruments, or (b), solve for the instruments to meet specified targets (as was the case in (v)). Under (a), referring back to option (v), suppose for example that the authorities considered the nominal devaluation of 9.9 per cent and the contraction in the domestic component of money of 83 per cent to represent easily implementable changes but that the maximum cut in money wages that could be achieved was only 3 per cent. Then via the relevant elasticities in Appendix B and equations (ii) - (iv) we see that the model implies an improvement in the balance of trade of 884 million 1981 US dollars, an increase in employment of 6.1 per cent and an increase

in the domestic price level of 5.4 per cent.

As a final example of type (b), suppose that the authorities wished to know what would be required of the three instruments to simultaneously eliminate unemployment (that is, increase aggregate labour demand by 23 per cent), and improve the trade balance by \$ US 2,600 million (the extent of the trade deficit in 1981) without adding to the rate of inflation. The model solution of equations (ii) - (iv) indicates an exchange rate devaluation of 10.0 per cent together with a contraction in the domestic component of money of 185.7 per cent and a contraction in money (and hence real) wages of 28.5 per cent. Such a package does not appear to be politically feasible.

5. Summary

The paper has investigated the macroeconomic and sectoral implications of the recent 18 per cent Chilean devaluation under various assumptions about the accompanying domestic monetary environment and wage policy. The results suggest the following; (i) In an environment of constant money wages, the devaluation, if not accompanied by an offsetting contraction in the domestic component of the money stock, is extremely expansionary and inflationary, and hence of limited effectiveness in improving the trade balance. The implied very large fall in real wages does however provide a strong boost to aggregate employment. The effect of simultaneously contracting the domestic component of money and hence restraining the growth rate of

the nominal money supply is to reduce the rate of inflation associated with the devaluation and thus improve the trade balance at the expense of domestic absorption. With real wage flexibility downwards now restricted and with labour heavily concentrated in domestic oriented sectors, aggregate employment is sharply reduced. To carry out the domestic monetary contraction to the point where the growth rate in the domestic money supply remains unchanged requires an unrealistically severe reduction in the domestic component of money. While this achieves domestic price stability and hence an enormous devaluation of the real exchange rate and boost to the balance of trade, it causes a disastrous slump in absorption and employment.

(ii) Contracting the domestic component of money at a fixed nominal exchange rate in a constant money wage environment is an effective means of improving the balance of trade, the real exchange rate devaluation being achieved this time by an absolute fall in the domestic price level. Such a strategy however requires a contraction in real absorption and employment with particularly severe consequences for the growth prospects of domestic oriented industries. Nevertheless, the implied increase in real wages preserves labour's share of the reduced national income.

(iii) With money wages flexible downwards, given improvements in the balance of trade and employment can be achieved with lower domestic inflation and a smaller nominal devaluation. This is because the real effects of the devaluation follow entirely from the extent to which it is able to reduce real wages.

Given the urgent need for the Chilean authorities to stimulate both aggregate employment and the balance of trade, it is obvious that a policy which attempts, by domestic credit contraction, to fully sterilize the price effects of the devaluation, would, in an environment of money wage inflexibility, be quite inappropriate. In such an environment the devaluation must be allowed to boost the domestic rate of inflation. To dampen the increased inflation while still increasing employment requires that the authorities in addition bring about a contraction in money wages.

Finally, the paper has illustrated how a formal economy-wide framework can be used to assist policy makers in, (a) evaluating in some detail the implications of alternative proposed policy packages, and (b) arriving at the dimensions of a given policy package required to achieve specified targets. While the numerical projections it yields have obvious limitations, such a model framework provides a useful augmentation to other less rigorous methods of policy formulation.

Appendix A Technical Details of the Chilean Model

Table A1 The Linear Equation System

Identifier	Equation	Subscript Range	Number	Description
<u>1. Final Demands</u>				
(1)	$x_{is}^{(3)} = x_i^{(3)} - \sigma_i^{(3)} (p_{is} - \sum_{s=1}^2 S_{is}^{(3)} p_{is})$	$i=1, \dots, g$ $s=1, 2$	2g	Household demands for commodities by source
(2)	$x_i^{(3)} = q + \epsilon_i (c - q) + \sum_{k=1}^g n_{ik} p_k$	$i=1, \dots, g$	g	Household demands for commodities undifferentiated by source
(3)	$x_{(is)j}^{(2)} = y_j - \sigma_{ij}^{(2)} (p_{is} - \sum_{s=1}^2 S_{(is)j}^{(2)} p_{is})$	$i=1, \dots, g$ $s=1, 2$ $j=1, \dots, h$	2gh	Demands for inputs to capital creation
(4)	$x_{is}^{(5)} = c_R$	$i=1, \dots, g$ $s=1, 2$	2g	Other (mainly government) demands
(5)	$p_{i1}^e = - \gamma_i x_{i1}^{(4)} + f_{i1}^{(4)}$	$i=1, \dots, g$	g	Export demands
<u>2. Industry Inputs</u>				
(6)	$x_{(is)j}^{(1)} = z_j - \sigma_{ij}^{(1)} (p_{is} - \sum_{s=1}^2 S_{(is)j}^{(1)} p_{is})$	$i=1, \dots, g$ $s=1, 2$ $j=1, \dots, h$	2gh	Demands for intermediate inputs
(7)	$x_{vj}^P = z_j - \sigma_j^P (p_{vj}^P - \sum_{v=2}^3 S_{vj}^P p_{vj}^P - S_{1j}^P p_1^P)$	$v=2, 3$ $j=1, \dots, h$	2h	Demands for fixed capital (v=2) and land (v=3)
(8)	$x_{1j}^P = z_j - \sigma_j^P (p_1^P - \sum_{v=2}^3 S_{vj}^P p_{vj}^P - S_{1j}^P p_1^P)$	$j=1, \dots, h$	h	Demands for aggregate labour
(9)	$x_{1,q,j}^P = x_{1j}^P - \sigma_{1,j}^P (p_{1,q}^P - \sum_{q=1}^r S_{1,q,j}^P p_{1,q}^P)$	$q=1, \dots, r$ $j=1, \dots, h$	rh	Demands for labour of each occupation
<u>3. Zero Pure Profits Conditions</u>				
(10)	$p_{j1} = \sum_{i=1}^g \sum_{s=1}^2 H_{(is)j}^{(1)} p_{is} + \sum_{q=1}^r H_{1,q,j}^P p_{1,q}^P + \sum_{v=2}^3 H_{vj}^P p_{vj}^P$	$j=1, \dots, h$	h	- in production
(11)	$\pi_j = \sum_{i=1}^g \sum_{s=1}^2 H_{(is)j}^{(2)} p_{is}$	$j=1, \dots, h$	h	- in capital creation
(12)	$p_{i2} = p_{i2}^m + t_i + \phi$	$i=1, \dots, h$	g	- in importing
(13)	$p_{i1} = p_{i1}^e + v_i + \phi$	$i=1, \dots, g$	g	- in exporting
<u>4. Market Clearing</u>				
(14)	$z_j = \sum_{j=1}^h B_{(i1)j}^{(1)} x_{(i1)j}^{(1)} + \sum_{j=1}^h B_{(i1)j}^{(2)} x_{(i1)j}^{(2)} + B_{i1}^{(3)} x_{i1}^{(3)} + B_{i1}^{(4)} x_{i1}^{(4)} + B_{i1}^{(5)} x_{i1}^{(5)}$	$j=1, \dots, g$	g	Supply equals demand for - domestically produced commodities
(15)	$l_q = \sum_{j=1}^h B_{1,q,j} x_{1,q,j}^P$	$q=1, \dots, r$	r	- labour of each occupation
(16)	$k_j = x_{2j}^P$	$j=1, \dots, h$	h	- capital
(17)	$n_j = x_{3j}^P$	$j=1, \dots, h$	h	- land

Table A1 continued

Identifier	Equation	Subscript Range	Number	Description
<u>5. Monetary Sector</u>				
(18)	$S_d m_n^d + S_f m_n^f = \epsilon^{(3)} + \text{gdp} - \psi_3 w$		1	Supply equals demand for money
(18a)	$m_n^f = \frac{1}{R} 100 \Delta B$		1	Defines foreign reserves
<u>6. Miscellaneous</u>				
(19)	$x_{i2} = \sum_{j=1}^h B_{(i2)j}^{(1)} x_{(i2)j}^{(1)} + \sum_{j=1}^h B_{(i2)j}^{(2)} x_{(i2)j}^{(2)} + B_{i2}^{(3)} x_{i2}^{(3)} + B_{i2}^{(5)} x_{i2}^{(5)}$	$i=1, \dots, g$	g	Competitive import volume
(20)	$m = \sum_{i=1}^g (p_{i2}^m + x_{i2}) M_{i2}$		1	Foreign currency imports
(21)	$e = \sum_{i=1}^g (p_{i1}^e + x_{i1}^{(4)}) E_{i1}$		1	Foreign currency exports
(22)	$100\Delta B = Ee - Mm$		1	Balance of Trade
(23)	$r_j = Q_j (p_{2j}^P - \pi_j)$	$j=1, \dots, h$	h	Rate of return to capital
(24)	$y_j = k_j + B_j (r_j - \lambda)$	$j=1, \dots, h$	h	Industry investment
(25)	$\sum_j (\pi_j + y_j) T_j = i$		1	Investment budget
(26)	$p_1^P = \sum_{q=1}^r p_{1,q}^P S_{1,q}$		1	Price of labour in general
(27)	$p_k = \sum_{s=1}^2 S_{ks}^{(3)} p_{ks}$	$k=1, \dots, g$	g	General price of goods to households
(28)	$\epsilon^{(3)} = \sum_{i=1}^g \sum_{s=1}^2 W_{is}^{(3)} p_{is}$		1	Consumer price index
(29)	$\epsilon^{(2)} = \sum_{j=1}^h T_j \pi_j$		1	Capital goods price index
(30)	$c_R = c - \epsilon^{(3)}$		1	Aggregate real consumption
(31)	$i_R = i - \epsilon^{(2)}$		1	Aggregate real investment
(32)	$i_R - c_R = f_R$		1	Relationship between real consumption and investment
(33)	$l = \sum_{q=1}^r l_q \psi_{1q}$		1	Aggregate employment
(34)	$\kappa = \sum_{j=1}^h k_j \psi_{2j}$		1	Aggregate capital stock
(35)	$p_{1,q}^P = h_{1,q} \epsilon^{(3)} + f_{1,q} + f_1$	$q=1, \dots, r$	r	Allows for exogenous setting of wages
(36)	$\text{gdp} = S_c c_R + S_i i_R + S_g \left[\sum_{s=1}^2 \sum_{i=1}^g x_{is}^{(5)} S_{is}^{(5)} \right] + S_e e - S_m m$		1	Gross domestic product

Total equations = 4gh + 11g + 9h + rh + 2r + 15

Table A2 Chilean Model Variables

Variable	Number	Description
$x_{is}^{(3)}$	2g	Household demands for domestic and imported goods
$x_i^{(3)}$	g	Household demands for goods undifferentiated by source
P_{is}	2g	Price of good i from source s
q	1	Number of households
c	1	Aggregate money consumption
P_k	g	Price of consumer goods by type but not by source
$x_{(is)j}^{(2)}$	2gh	Demands for inputs (domestic and imported) for capital creation
y_j	h	Capital creation by using industry
$x_{is}^{(5)}$	2g	Other (mainly government) demands for domestic and imported goods
c_R	1	Aggregate real household expenditure
P_{i1}^e	g	F.o.b. foreign currency export prices
$x_{i1}^{(4)}$	g	Export demands
$f_{i1}^{(4)}$	g	Export demand shift variable
$x_{(is)j}^{(1)}$	2gh	Demands for inputs (domestic and imported) for current production
z_j	h	Industry outputs
x_{vj}^P	3h	Industry demands for labour in general, fixed capital and land
P_{vj}^P	2h	Rental prices of capital (v=2) and land (v=3) in each industry
P_1^P	1	Economy-wide price of labour in general
$x_{1,q,j}^P$	rh	Demands for labour by occupation and industry
$P_{1,q}^P$	r	Price of labour by occupation
π_j	h	Costs of units of capital
P_{i2}^m	g	C.i.f. foreign currency prices for competing imports
t_i	g	One plus the ad valorem rates of protection on imports
ϕ	1	Exchange rate (Chilean peso/foreign currency (\$ US))
v_i	g	One plus ad valorem export subsidies
l_q	r	Employment by occupation
k_j	h	Industry capital stocks
n_j	h	Industry land

Table A2 continued

Variable	Number	Description
m_n^d	1	Domestic component of money
m_n^f	1	Foreign component of money
$\epsilon^{(3)}$	1	Consumer price index
gdp	1	Gross domestic product
w	1	Expected inflation
ΔB	1	Balance of trade
x_{i2}	g	Commodity import volumes
m	1	Foreign currency value of imports
e	1	Foreign currency value of exports
r_j	h	Industry rates of return to capital
λ	1	Economy-wide expected rate of return
i	1	Aggregate nominal investment
$\epsilon^{(2)}$	1	Investment goods price index
i_R	1	Aggregate real investment
f_R	1	Shift term to set relationship between aggregate consumption and investment
ℓ	1	Aggregate employment
κ	1	Economy's aggregate capital stock
$f_{1,q}$	r	Shift term for occupational wages
f_1	1	Economy-wide wage shift variable

Total variables: $4gh + 15g + 11h + rh + 3r + 21$

Notes to Tables A1 and A2

The model distinguishes 10 domestic industries each producing its respective commodity i.e., g and h = 10. Hence $p_{j1} = p_{i1}$, $j = 1, \dots, h$, $i = 1, \dots, g$. (Labels for these are given in Table 1). The labour market is divided into two occupational categories, i.e., $r = 2$.

The nomenclature of variable subscripts and superscripts is as follows. Subscript s denotes the source of the commodity; s=1 (domestically produced), s=2 (imported). Subscript v denotes the type of primary factor; v=1 (aggregate labour, v=2 (fixed capital), v=3 (land). Subscript q denotes labour occupation; q=1 (qualified labour), q=2 (unqualified labour). Superscript "p" denotes a primary factor quantity or price, superscript "m" a foreign price for imports (cif) and superscript "e" a foreign price for exports (fob). Superscript (1) denotes the use of that variable in current production, (2) in capital creation, (3) by households, (4) exports and (5) by other (mainly government) demands. Note that there is no superscript on the local prices of domestic and imported commodities (the p_{is}). That is, the price of a commodity is assumed to be the same in all domestic end uses.

All variables are in percentage changes except the balance of trade, ΔB , which, because it can move through zero, is expressed in first differences.

Table A3 Coefficients of the Chilean Model

In the following list values for coefficients denoted IO were calculated from the official 1977 input-output tables for Chile.

$\sigma_i^{(3)}$ CES import-domestic substitution elasticities for good i in household consumption ($\sigma_i^{(3)}$),
 $\sigma_{ij}^{(1)}$ intermediate usage in industry j for current production ($\sigma_{ij}^{(1)}$), and as inputs to capital
 $\sigma_{ij}^{(2)}$ creation ($\sigma_{ij}^{(2)}$). A common value of 2.0 was assigned to all these elasticities. This
 σ_{ij} value, while judgemental, is consistent with estimates from the few published studies
in this area.

σ_j^P CES substitution elasticities among primary factors (σ_j^P), and amongst occupational labour
 $\sigma_{1,j}^P$ ($\sigma_{1,j}^P$) in industry j . Since relative wages between occupations were assumed fixed in all
experiments the values assigned to $\sigma_{1,j}^P$ (1.0 for all j), exert no influence on the
results. The following values for σ_j^P were used, 1. Agriculture (0.31), 2. Copper mining
(0.20), 3. Crude oil extraction (0.51), 4. Other mining (0.51), 5. Food processing (1.0),
6. Light manufacturing (import competing) (1.0), 7. Light manufacturing (export oriented)
(1.0), 8. Petroleum refining (1.0), 9. Heavy manufacturing (1.0), 10. Services (0.43).
The values for sectors 1,3,4 and 10 were drawn from the econometric estimates in Behrman
(1972). The value for sector 2 was set to reflect a short-run supply elasticity for
copper production of 0.1114, the supply elasticity reported in Lasaga (1981). Values for
the remaining sectors are based on the estimates reported in Corbo and Meller (1979).

ϵ_i } Expenditure (ϵ_i) and cross price (η_{ik} $i \neq k$) elasticities in household consumption for
 η_{ik} } good i . Estimates for ϵ_i were obtained from the Chilean household demand studies reported
in Lluch, Powell and Williams (1977) and Taborga (1973). The estimates used for each of
the ten groups are, 1. (0.60), 2. - 5. (0.75), 6. (1.10), 7. - 8. (1.41), 9. (1.62),
10. (1.18). Since the underlying household utility functions are assumed to be additive,
the matrix of uncompensated own price (η_{ii}) and cross price (η_{ik}) consumer demand
elasticities were generated via the Frisch formula from the ϵ_i , household budget shares
for good i (IO) and an estimate of the Frisch parameter (-2.525) (obtained from the
country per capital GDP - Frisch parameter relationship in Lluch, Powell and Williams
(1977)).

γ_i Reciprocals of the foreign demand elasticities for Chilean export commodity i . For all
commodity categories except copper, the "small country" assumption was approximated by
assigning a very small value (0.05) to the respective γ_i 's. For copper, a value of 0.5 was
used. This value is based principally on the world price elasticity of demand for copper
and the Chilean share in world copper exports.

Q_j } Industry investment parameters. Q_j is the ratio of the gross (before depreciation) to the
 B_j } net (after depreciation) rate of return in industry j . B_j is the reciprocal of the elasti-
 T_j } city of the expected rate of return schedule for industry j times the ratio of its gross
investment to its following year capital stock. T_j is the share of total investment
accounted for by industry j (IO). Values assigned to Q_j (1.41) and B_j (0.47-1.28) are
largely judgemental.

ψ_{1q} } Respectively the share of aggregate employment accounted for by occupation q and the
 ψ_{2j} } share of the economy's aggregate capital stock in industry j . The percentage share of skilled
(52.2) and unskilled (47.8) workers was obtained from República de Chile, encuesta
nacional del empleo. Values for ψ_{2j} are IO based.

$h_{1,q}$ Allows for indexation of occupational wages to consumer prices. The $h_{1,q}$ were set to zero.

S_c } Respectively the shares of GDP accounted for by aggregate consumption, investment, other
 S_i } (mainly government) domestic, export and import demand. IO.
 S_g }
 S_e }
 S_m }

Table A3 continued

$S_{(is)j}^{(1)}$ $S_{(is)j}^{(2)}$	}	Shares of good i from source s (domestic or imported) in industry j 's purchases of i for current production (1), and capital creation (2). IO.
$S_{is}^{(3)}$		Share of value of good i from source s in the total purchases of good i by households. IO.
S_{vj} $S_{1,q,j}$	}	Respectively the share of primary factor v in the total primary factor costs of industry j and the share of labour by occupation q in industry j 's total labour costs. IO.
$H_{(is)j}^{(1)}$ $H_{1,q,j}^P$ H_{2j}^P, H_{3j}^P	}	Respectively the share of industry j 's production costs represented by intermediate inputs of good i from source s , labour inputs of occupation q , fixed capital and land. IO.
$H_{(is)j}^{(2)}$		Cost share of good i from source s in industry j 's total purchases of good i for inputs to capital creation. IO.
$B_{(i1)j}^{(1)}$ $B_{(i1)j}^{(2)}$ $B_{i1}^{(3)}$ $B_{i1}^{(4)}$ $B_{i1}^{(5)}$	}	Respectively the share of the total sales of domestic good i absorbed by, inputs to industry j for current production (1), and for capital creation (2), by households (3), exports (4), and other (mainly government) demands (5). IO.
$B_{(i2)j}^{(1)}$ $B_{(i2)i}^{(2)}$ $B_{(i2)}^{(3)}$ $B_{i2}^{(5)}$	}	Respectively the share of the total sales of imported good i absorbed by, inputs to industry j for current production (1) and for capital creation (2), by households (3), and other (mainly government) demands (5). IO.
$B_{1,q,j}$ $S_{1,q}$	}	Share of the economy's employment of occupation q accounted for in industry j , and cost share of labour of type q in the economy's total labour cost respectively. IO.
$S_{is}^{(5)}$		Share of aggregate other demands accounted for by other demand for good i from source s . IO.
M_{i2} E_{i1} M E	}	The share of total foreign currency costs accounted for by imported good i (M_{i2}), the share of total foreign currency export earnings accounted for by exported commodity i (E_{i1}), the aggregate foreign currency value of imports (M), and the aggregate foreign currency value of exports (E). IO.
$W_{is}^{(3)}$		Expenditure weight of good i from source s in the model's index of consumer prices. IO.
S_d S_f	}	Respectively the shares of domestic and foreign component in total money supply. Obtained from IMF International Financial Statistics.
ψ_3		Elasticity of the demand for money with respect to expected inflation. An econometric study (Fischer and Mayer (1981)) yielded a value of 0.155. Note however that since the variable w is set exogenously to zero in all simulations ψ_3 plays no role in the model results.
R		Base period reserve stocks. Obtained from IMF International Financial Statistics.

Appendix B Elasticity of Variables with respect to Unitary Percentage Changes in;
Nominal Exchange Rate, Domestic Component of Money, Money Wage (a)

Variable	1 per cent increase in the nominal exchange rate (b) $\phi = 1.0$	1 per cent decrease in domestic component of money (b) $m_n^d = -1.0$	1 per cent decrease in money wage (b) $f_1 = -1.0$
<u>Macroeconomic</u>			
Real GDP	0.3384	-0.0147	0.3666
Real domestic absorption	0.2247	-0.0599	0.3395
Aggregate exports	0.5118	0.0802	0.3583
Aggregate imports	0.1171	-0.0769	0.2643
Balance of trade (c)	0.3531	0.1406	0.0841
Consumer price index	0.8534	-0.0334	-0.0827
Aggregate labour demand	0.7600	-0.0476	0.8511
Foreign component of money	2.4964	0.9939	0.5945
Nominal money supply	1.1918	-0.0481	0.2838
<u>Industry Outputs</u>			
1. Agriculture	0.1160	0.0013	0.1135
2. Copper Mining	0.1253	0.0019	0.1216
3. Crude oil extraction	0.1385	-0.0026	0.1434
4. Other mining	1.6681	0.0433	1.5852
5. Food processing	0.3698	-0.0071	0.3836
6. Light manufacturing (import competing)	0.5946	-0.0128	0.6190
7. Light manufacturing (export oriented)	0.7174	0.0266	0.6662
8. Petroleum refining	0.3542	-0.0320	0.4153
9. Heavy manufacturing	0.6217	-0.0217	0.6633
10. Services	0.3185	-0.0390	0.3931
<u>Main Commodity Exports</u>			
2. Copper mining	0.0852	0.0060	0.0739
4. Other mining	2.9072	0.1012	2.7134
5. Food processing	2.6953	0.4673	1.8021
7. Light manufacturing (export oriented)	1.2572	0.1270	1.0138
<u>Main Commodity Imports</u>			
1. Agriculture	0.5017	-0.0274	0.5541
3. Crude oil	0.3922	-0.0427	0.4738
6. Light manufacturing (import competing)	0.0981	-0.0666	0.2256
8. Petroleum refining	0.1467	-0.0873	0.3138
9. Heavy manufacturing	0.0776	-0.0782	0.2273

(a) In generating these elasticities the selection of $4g + 2h + r + 6$ exogenous variables comprises: $f_{11}^{(4)}(g); p_{12}^m(g); t_1(g); x_{11}^{(4)}; i=3,8-10, v_i=1,2,4-7, (g); k_j(h); n_j(h); f_{1,q}(r); q, \phi, f_1, m_n^d, w, f_R$.

(b) Values for all other exogenous variables are zero.

(c) Units are billions of Chilean pesos. at the 1977 exchange rate with the \$ US. These numbers must be multiplied by a conversion factor of 57.353 to convert them to millions of 1981 US dollars, the units in which the results are expressed throughout the paper. All other numbers in the Table are expressed in percentage changes.

References

- Behrman, J.R., "Sectoral Elasticities of Substitution Between Capital and Labour in a Developing Economy: Time Series Analysis in the Case of Postwar Chile", Econometrica, Vol. 40 (March 1972) No. 2, pp. 311-326.
- Corbo, V. and Meller, P., "La sustitución de trabajo, capital humano y capital físico en la industria manufacturera chilena", Estudios de Economía No. 14 segundo semestre 1979, pp. 17-43.
- Dick, H., Gerken, E., Mayer, T. and Vincent, D.P., "Stabilisation Strategies in Primary Commodity Exporting Countries: a Case Study of Chile", Working Paper No. 144, Kiel Institute of World Economics, June 1982.
- Dixon, P.B., Parmenter, B.R., Sutton, J. and Vincent, D.P., ORANI: A Multisectoral Model of the Australian Economy. North-Holland Publishing Company, Amsterdam 1982.
- Douglas, H.C., "The Chilean Experience in Trade Reform: A Progress Report on the Consequences and Implications". Paper presented to a Conference on the Free Trade Movement in Latin America, Hamburg, June 21-24, 1981.
- Fischer, B. and Mayer, Th., "On the Structuralist View of Inflation in Some Latin American Countries: A Reassessment", The Developing Economies, Vol. 19 (March 1981) No. 1, pp. 39-51.
- Johnson, H.G., "The Monetary Approach to the Balance of Payments", Journal of International Economics, 7, 1977, 251-268.
- Lasaga, M., The Copper Industry in the Chilean Economy. D.C.Heath and Co., Lexington 1981.
- Lluch, C., Powell, A.A., Williams, R.A., Patterns in Household Demand and Saving. Oxford University Press, Oxford 1977.
- Taborga, M., Estructura De Consumo y Grupo Social, Departamento de Economía, Universidad de Chile, Santiago de Chile 1978.