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Exchange Rate-Based Disinflation, Wage Rigidity, and Capital Inflows: Tradeoffs for Chile, 1977-81

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Chile's exchange rate-based stabilization program might have produced better results if capital inflows had been kept lower and if wage indexing had been more flexible.

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Real exchange rate appreciation usually accompanies stabilization programs based on the exchange rate. One thing that causes the real exchange rate to appreciate is the capital inflows that follow liberalization of the capital account and the financial market.

Capital inflows cause the exchange rate to appreciate in part because of the resulting increase in expenditures. This appreciation is exacerbated if there is some price rigidity — as, for instance, when wages are indexed — and if control of the money supply is only partial. All these conditions existed during Chile's experiment with exchange rate-based disinflation between 1978 and 1981.

Simulating what might have been (using an econometric model), the authors study how exchange rate-based disinflation affects expenditure switching and reduction when wages are partially indexed in some segments of the labor market.

An alternative policy restricting capital inflows to a lower level would have led to a proportionately larger decline in absorption than in income — and the decline in absorption would have fallen disproportionately more on consumption than on investment.

The authors also show the extent to which a more flexible rule on wage indexing would have offset the adverse impact of lower capital flows on protected sector employment.

This paper is forthcoming in the *Journal of Development Economics*.

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I. Introduction

The use of exchange rate-based disinflation gained much support in the late 1970s and early 1980s especially among semi-industrial countries wishing to avoid the usual contractionary effects of orthodox stabilization policies. The theoretical literature on this topic is vast, ranging from intuitive reasoning (Dornbusch 1982, 1985) to more formal analysis (Helpman and Razin, 1987). This paper adds to the less extensive body of empirical work examining one aspect of exchange rate-based disinflation; namely, how it affects the composition of expenditure switching and expenditure reduction adjustment in the presence of partial wage indexation in some segments of the labor markets. The analysis is carried out for Chile where exchange rate-based disinflation policy was actively pursued for four years.

In February 1978 Chile adopted the policy of pre-announcement of the exchange rate (the active crawling peg) to reduce inflation. At the same time, restrictions on medium and long-term capital flows were relaxed. The authorities devalued, at a decreasing pace, until June 1979 when the value of the peso was fixed. Also at that time legislation was introduced stating that wage indexation for workers subject to collective bargaining (essentially all workers outside of agriculture and some services) would begin to have as a floor the previous twelve months' rate of inflation (backward wage indexation, based on a maximum of 100 percent of the previous year's inflation, had been in place since November 1974). Capital inflows increased after the establishment of the active crawling peg system and further accelerated after the fixing of the exchange rate in June 1979. The current account deficit rose steadily to reach a staggering 15% of GDP in 1981. 1/

The paper re-examines two of the remaining controversies about Chile's policies during this period. The first relates to the extent the loss of competitiveness that resulted from Chile's exchange rate policy would have been tempered had Chile followed a more restrictive external borrowing policy by not liberalizing the capital account of the balance of payments. The second relates to the high unemployment levels that persisted during Chile's economic boom. Productivity increases that accompanied the tariff dismantling are partly responsible for the high unemployment, but the issue of how sensitive employment was to wages remains. The first issue is analyzed in the context of a model where the domestic savings rate is linked to the level of external borrowing. The second issue is treated in the context of a Phillips curve and a portfolio model which links the money supply to capital inflows. These augmented linkages more realistically portray the response of employment to more "reasonable" levels of capital inflows. The empirical analysis is carried out with a five-sector simulation model that emphasizes the implications of adjustments in domestic savings behavior to lower capital inflows and the implications of partial wage rigidity on employment and macroeconomic equilibrium. 2/

From a more general perspective, the paper shows how certain macroeconomic phenomena can be approximately incorporated into an otherwise microeconomic general equilibrium analysis. The approximation is ad hoc but it fits the Chilean stylized facts relatively well and suggests other applications. Section II introduces a one-sector model that includes the major features of the more detailed model from which are derived the simulations reported in section III. The simulations from the five sector model show that the loss in GDP growth would have been small, even for

large cuts in foreign capital inflows. Macro-micro linkages via the determination of the price level and the labor-market specification are explored, again in a one sector model, in section IV. The simulation results from the resulting expanded five sector model show a favorable employment-inflation tradeoff to lower capital inflows in 1980 and 1981. Conclusions follow in section V.

II. Capital Inflows, the Real Exchange Rate and Investment: A One-Sector Analysis

Consider an economy which has to adjust to a reduction in capital inflows. The standard Salter-Swan analysis indicates that if there is full wage and non-tradable price flexibility, a real exchange rate depreciation will be necessary provided that nontradable and tradables are gross substitutes in consumption (the usual case). If, on the other hand, there is some degree of price inflexibility then, as shown by Jones and Corden (1976) for the case of fixed nominal wages, there is an indeterminancy because the new equilibrium will lie inside the (full-employment all markets cleared) production possibility curve.

In the standard analysis no distinction is made between the various components of absorption. This precludes taking into consideration contributions to the analysis of the current account which have emphasized the usefulness of modelling adjustments in savings and investment behavior (e.g. Sachs 1981, and Svensson and Razin 1983). Implications for the current account of real exchange rates temporarily in disequilibrium have also focused on savings and investment behavior (Dornbusch 1985).

We introduce now a one-sector simplified version of the more complex multi-sector model used in section III. The key features of the

model are: (1) a fixed real wage to reflect wage indexation; and (2) private savings depend negatively on capital inflows. The model is useful to show the implications of the postulated private savings behavior on investment (and hence on medium-term growth) when there is a reduction in capital flows. To save on notation, time subscripts are omitted. The model consists of equations (1)-(12) below.

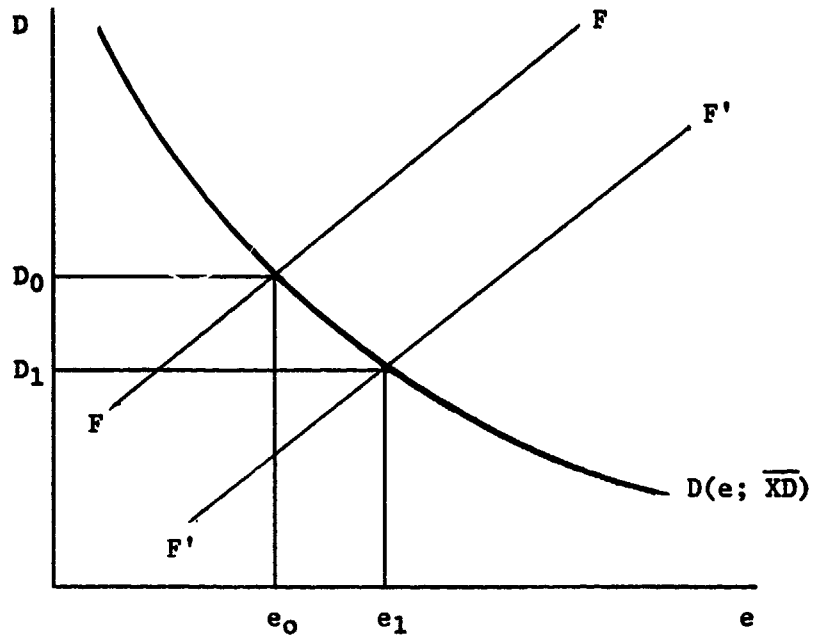
(1)	$XD = f(L; \bar{K})$	Production function
(2)	$\bar{W} = \partial f/\partial L$	Labor demand
(3)	$E/D = g(e \cdot \bar{PE}/PD)$	Export supply
(4)	$M/D = h(e \cdot \bar{PM}/PD)$	Import demand
(5)	$\bar{F} = \bar{PM} \cdot M - \bar{PE} \cdot E$	External balance
(6)	$XD = k(D, E)$	Composite output
(7)	$X = l(D,M)$	Composite expenditure
(8)	$PS \cdot XD = PD \cdot D + e\bar{PE} \cdot E$	Income
(9)	$P \cdot X = PD \cdot D + e\bar{PM} \cdot M$	Absorption
(10)	$P \cdot C = PS \cdot XD - S$	Consumption
(11)	$P \cdot I = S + e\bar{F}$	Investment
(12)	$S = S(PS \cdot XD, e\bar{F})$	Savings function

where XD = output; L = employment; $\bar{W}$ = fixed real product wage (i.e. $\bar{W} = W\bar{PS}$); K = (putty clay) capital; D, E = output for domestic and export markets respectively; M = imports; e = the price of foreign exchange in domestic currency units; $\bar{F}$ = exogenous transfer of purchasing power (i.e. net capital inflows) measured in foreign currency units; $\overline{PM}$, $\overline{PE}$ = 1 exogenous world prices of imports and exports (reflecting the small country assumption); k and 1 are respectively the CET and CES aggregator functions for composite output and composite expenditure; PS, P = prices of the composites; C, I = consumption and investment. The first distinctive feature of the model is the assumption of product differentiation for exports (via the constant elasticity of transformation -- i.e. CET -- function in equation 6) and imports (via the CES aggregation function in equation 7). This assumption is supported by detailed microeconometric evidence (Morande, 1985) and is largely responsible for why the multi-sector model tracks the large structural shifts observed in Chile during 1977-81 relatively well (see Condon, Corbo, de Melo, 1985). The second distinctive feature is the assumption, embodied in equation 12, that domestic savings is negatively related to foreign capital inflows (i.e. $s_2 < 0$). Econometric evidence supporting this formulation is provided below. The model is homogeneous of degree zero in prices so that only relative prices are determined, and PD serves as numéraire. In this formulation changes in e approximate changes in the real exchange rate.

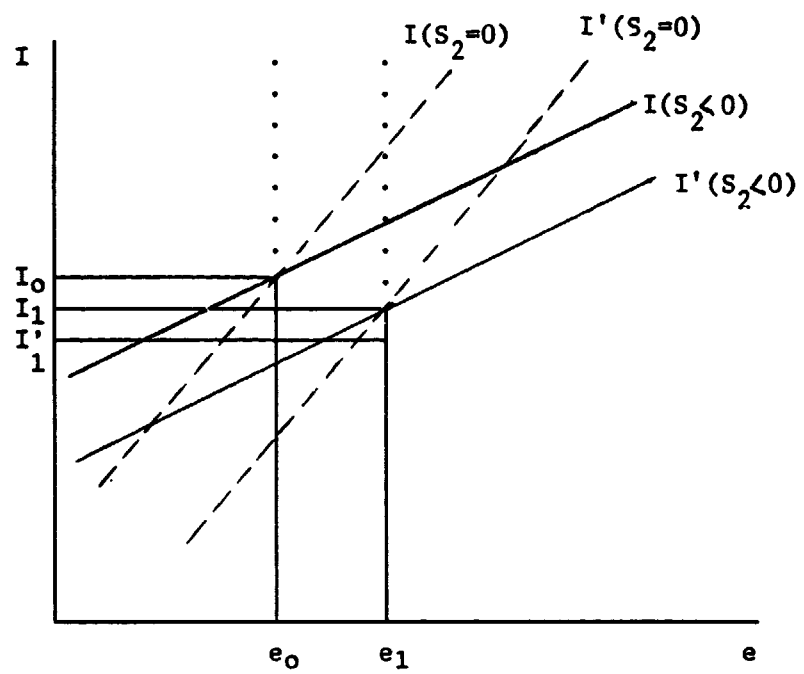
Fixing the real product wage dichotomizes the system: equations (1) and (2) determine employment and output. For a given output level, $\overline{XD}$, equations (3) - (6) co-determine equilibrium imports, exports, domestic use of output and the real exchange rate. Equilibrium is depicted in figure 1a as the intersection of the external balance equation FF) and the allocation

Figure 1:
Investment and Real Exchange Rate Adjustment to Capital Inflows

1a



1b



schedule for domestic sales, $D(e; \overline{XD})$. The FF curve slopes upward because, at a given real exchange rate, a diversion of sales from the export market to the domestic market creates excess demand for foreign exchange, which is eliminated by a real exchange rate depreciation. The slope of D(e; XD) reflects the fact that the allocation of output to the domestic market is negatively related to the real exchange rate. A reduction in the capital flows shifts FF rightward and a decrease in the real wage shifts $D(e; \overline{XD})$ rightward.

Figure 1b shows the implications of the assumption about domestic savings behavior for investment taking output as fixed. If domestic savings is independent of capital inflows, real investment is positively related to a change in e by virtue of the revaluation (in domestic currency units) of the net foreign transfer. (The revaluation effect was first noted by Hirschman, 1948). This effect is mitigated by the assumption that domestic savings is negatively related to the size of the transfer ($s_2<0$). Note that from equation (11) a decrease in the foreign transfer, $\overline{F}$, shifts the investment line downward and the shift is greater when there is no offsetting change in domestic savings (i.e. $s_2 = 0$).

We can now depict the effect of a reduction in foreign transfers. As shown in the top quadrant, the FF schedule shifts rightward resulting in a real exchange rate depreciation. The medium term implications are found by tracing the new real exchange rate, e_1, to the lower figure and seeing where it intersects the new investment line, $I'(s_2 < 0)$. This new lower investment level, I_1, is, however, greater than it would be in the absence of the assumption that the domestic savings rate rises to offset reductions in foreign savings. (In figure 1b, I_1' is the investment level that would result in the case where $s_2 = 0$).

There are two other channels through which a reduction in foreign capital inflows affects macroeconomic equilibrium. First, the multisector model captures the effect of a change in the relative price between tradables and nontradables on the cost of a unit of composite capital equipment installed in each sector, and hence on the volume of real investment. This allows us to capture the construction boom that occurred (Corbo, 1986). Second, as explained below, the real consumption wage rather than the real product wage is fixed, which complicates the outcome because output is no longer fixed because the real product wage is t fixed. It remains that the main determinants of how the economy will adjust to lower foreign transfers are the extent of short-run price rigidity and the domestic savings response to variations in the net foreign transfer. Hence we shall focus on the empirical characterization of these two channels.

III. Capital Inflows and the Real Exchange Rate: A Multisector Analysis

During the boom years of 1977-81, high unemployment rates (above 10%) coexisted with rising real wages. The consensus (see Edwards 1986, Riveros 1986) is that the high unemployment levels of the late seventies are not explained by changes in labor participation rates, but rather by the extreme real wage rigidity that resulted from automatic wage indexation. The stylized representation of the labor market which most closely fits the facts is the segmented labor market hypothesis (see e.g. Stiglitz, 1982). Edwards (1986) gives evidence that labor market adjustment during the period is consistent with the hypothesis that unemployment is involuntary with respect to the protected segment of the market covered by wage indexation, but voluntary with respect to the

remaining (free) segment. In the model the free segment is approximated by agriculture and social, personal and domestic services, with the rest of the economy in the protected segment. Wages in the primary sector and other services sectors clear the market. Wages in the protected sector are fixed in terms of the cost of living index. 3/ For the protected sector, the average wage in period t, WA_t is given by:

$$(13) \qquad WA_t/WA_{t-1} = 1 + \gamma \left[(\bar{P}_t/\bar{P}_{t-1})^{-1} \right]$$

where $\gamma = 1$, and $\bar{P}_t$ is the CPI index defined below.

Gross investment is set equal to total national savings:

$$(14) \qquad TINV = S_p + S_G + CA \cdot ER$$

where (S_G) is government saving, CA is the current account deficit and ER is the price of foreign exchange. Real gross private saving, $S_p/\bar{P}$, is a function of real disposable income Y, and foreign capital inflows denominated in pesos, $\bar{F}_2 \cdot ER$. After correcting for heteroskedasticity, the estimated equation over the period 1960-81 gives the following results:

$$(15) \qquad \underset{}{S_p/\bar{P}} = \underset{(.15)}{1.7} + \underset{(4.55)}{.16\ Y} - \underset{(3.50)}{.39}\ (\bar{F}_2 \cdot ER) / \bar{P}$$

where t-statistics are reported in parentheses. This equation is a proxy for several adjustment channels not directly captured in the model. 4/ One is that capital inflows lowered the real interest rate, thus raising

expenditure. Second, insofar as the real exchange rate appreciation caused by the capital inflow was viewed as temporary, consumers would have substituted present for future expenditure in durables, which in Chile are imported or import-competing.

Although the sustained current account deficit corresponded to changes in private savings and investment, the model includes a government sector. Government savings is derived by subtracting exogenous real government spending on goods and services from total government revenue. Foreign savings is equal to the current account deficit. The model has five sectors, and is calibrated to 1977, the base year. The key elasticities are the elasticities of substitution in the production functions, the trade substitution elasticities, and the export transformation elasticities (see table 1). All elasticities are best guesses but sensitivity analyses from earlier work suggest they are reasonable values. Equilibrium is defined as a set of relative prices for goods and factors such that excess demand in all markets is zero. 5/

In the multisector model the real exchange rate, e, is defined as:

$$(16) \qquad e = \frac{(\sum_i W_i^m \overline{PM}_i + \sum_i W_i^e \overline{PE}_i)\, ER}{\sum_i W_i^x PD_i},$$

where the i subscript refers to sectors, superscripts m, e, x denote imports, exports and domestic production respectively, the W's are variable quantity weights (summing to unity), and all variable mnemonics are as defined in section II. Finally, the numeraire, which is set to the observed CPI index, is given by:

Table 1: PARAMETERS AND STRUCTURE OF THE CHILEAN ECONOMY IN 1977

	Primary	Copper	Manufacturing	Construction	Services
Sectoral shares in total output (percent)	11.1	5.9	37.2	4.3	41.5
Ratio of imports to domestic goods (percent)	27.2	3.8	37.6	0.0	3.9
Value-added ratio	.54	.55	.30	.49	.64
Ratio of imported intermediates to total intermediate inputs (percent)	14.6	17.4	17.5	24.0	14.9
Depreciation rates	3.5	3.5	3.5	3.0	3.5
Ratio of exports total output (percent)	10.5	93.6	7.0	0.0	4.6
Capital-labor ratio	0.4	1.2	0.2	0.7	0.4
Capital labor elasticity of substitution	0.9	0.9	1.2	1.5	1.5
Trade substitution elasticity a/	3.0	3.0	3 0	0.5	0.5
Export transformation elasticity b/	3.0	2.0	3.0	2.0	2.0

a/ The trade substitution elasticity is the compensated price elasticity of demand for imports.

b/ The export transformation elasticity is the compensated price elasticity of supply of exports.

Note: The trade substitution and export transformation elasticities are not independent. For their relation see de Melo and Robinson (forthcoming).

$$(17) \qquad \bar{P} = \sum_i \Omega_i P_i$$

where the Ω_i are fixed quantity weights. The model endogenously determines the equilibrium real exchange rate consistent with different levels of capital inflows. The model-predicted relation between capital inflows and the real exchange rate is shown in Table 2. The real exchange rate appreciation predicted by the model is close to other estimates (see e.g. Corbo, 1985). Note the acceleration that occurred in 1980 -- the first full year when the rate of crawl of the nominal exchange rate was zero and total capital inflows began rising dramatically.

Table 2: CAPITAL INFLOWS AND THE REAL EXCHANGE RATE IN THE BASE RUN

	1977	1978	1979	1980	1981	Cumulative 1977-81
Exogenous total capital inflow 1/	530	1,150	1,590	3,140	5,320	11,730
Endogenous real exchange rate index 2/	100	97	96	90	82	--

1/ Millions of dollars.
2/ 1977 = 100.

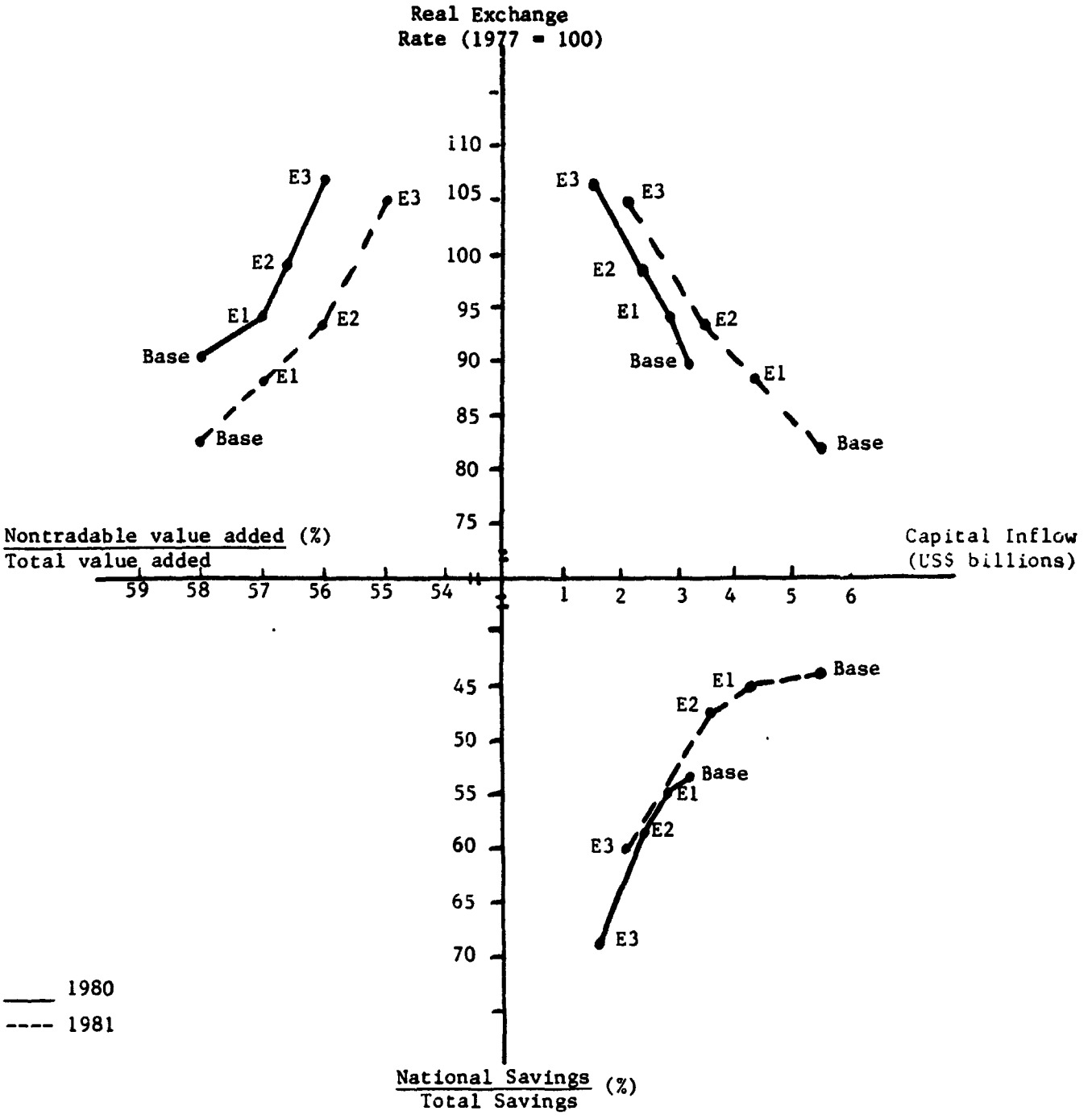
To simulate the response of the economy to lower levels of capital inflows, the total capital inflow in table 2 for 1980 and 1981 is reduced by 10%, 25%, and 50% (experiments E-1, E-2, and E-3 respectively). At the initial exchange rate there is excess demand for traded goods. The extent of relative price adjustment depends on the importance of capital inflows in total absorption and on the relative import intensity of consumption and investment expenditures. In 1980, capital inflows represented about 10% of absorption in Chile.

Adjustment occurs mainly through expenditure reduction. Expenditure is reduced by (1) the fall in capital inflows, and (2) an increase in unemployment because of real wage rigidity. Real wage rigidity thus implies that external balance comes at the expense of an increase in unemployment. It also implies that compositional shifts in demand are minimal (see figure 2, quadrant 2). The shift from consumption toward investment demand in 1980, however, raises the 1981 GDP level beyond what it would have been in the absence of the link between domestic savings and capital inflows.

Table 3 reports the consequences for GDP, absorption and nonprimary employment of the different capital inflow levels and figure 2 traces the trade-offs for the real exchange rate (and hence the distribution of production between tradables and nontradables), and the composition of savings at different capital inflow levels. The fall in absorption is much larger than the fall in income. One reason for this is the shift from consumption toward investment demand, which raises employment because investment goods are labor intensive relative to the consumption bundle. Still, as noted below, the employment consequences of the reduction in capital inflows with a fixed real wage are negative

Figure 2:

Model Predicted Tradeoffs from Lower Capital Inflows



overall. Table 3 also shows that the cost of adjustment to lower capital inflows rises more than proportionately with the decline in capital inflows. 6/ This is because producers who use imported intermediates as inputs find it increasingly difficult to substitute domestic intermediates and have to pay a higher price for imported intermediates. As a result, the economywide value added to gross output ratio falls.

Table 3: GDP, ABSORPTION, AND NONPRIMARY EMPLOYMENT LEVELS WITH LOWER CAPITAL INFLOWS IN 1980 AND 1981
(percentage deviation from base run)

	1980				1981			
	Capital inflows a/	GDP	Absorption	Nonprimary employment	Capital inflows a/	GDP	Absorption	Nonprimary employment
E-1	1.1	--	-2.3	-0.4	1.5	-.5	-3.3	-0.9
E-2	2.8	-0.6	-5.8	-1.1	3.8	-1.2	-8.5	-2.0
E-3	5.4	-1.5	-11.9	-2.3	7.6	-2.9	-17.5	-4.3

a/ Decline in capital inflows expressed as a proportion of base run GDP.

IV. Capital Inflows, Disinflation and Employment

The active crawling peg disinflation policy was partly thwarted by the inflationary pressures created by the capital inflows since full sterilization of these inflows could not be achieved by the monetary authorities and part of the increased demand fell on nontraded goods. It is also likely that wages were affected by the expenditure boom, adding a cost-push element to inflationary forces. We now turn to an examination of the linkages between capital inflows, inflation, wages, and employment by

adding macroeconomic elements to the microeconomic model. It is obvious that the macroeconomic issues raised here are best studied on their own but a multisector model is eventually needed if one wishes to study employment implications.

As in section II we present the main features with a one-sector macro model which abstracts from the determination of internal-external balance already covered in section II. The equations of the macro model are given by (18)-(21).

$$(18) \qquad M^S = g(\bar{F}) \qquad ; g' > 0$$

$$(19) \qquad M^D = kPy$$

$$(20) \qquad y = f\left(\frac{w}{p}\right) \qquad ; f' < 0$$

$$(21) \qquad w = h(\tilde{y}_{-1}, \tilde{p}) \qquad ; h_{\tilde{y}} > 0; \; h_{\tilde{p}} > 0$$

Following econometric evidence in Corbo (1986), we assume that the money supply (18) is partly under the control of monetary authorities, i.e., that there is less than perfect capital mobility. 7/ Money demand is given by the Cambridge equation (19). As before, real GDP is a decreasing function of the real wage in the sector under wage legislation (20). Finally wage contracts are given by a Phillips curve, where $\tilde{y}_{-1}$ is the deviation of GDP from trend last period and $\tilde{p}$ is expected inflation formed last period. 8/ Neglecting lags, or equivalently considering the effect of a change in $\bar{F}$ last period, we drop the tildes in (21) and derive the aggregate demand and supply schedules by equating (19) and (20) and by

substituting (21) into (20). The resulting equilibrium is shown in figure 3. The aggregate demand schedule is downward sloping, and it can be shown that the aggregate supply is upward sloping unless the effects of changes in output have a strong effect on wages. 9/ From the demand side, a reduction in capital inflows reduces GDP as in the simulations presented above. In addition, on the supply side, lower inflation translates into lower nominal wages through (21). For the estimated Phillips curve coefficients reported below in (22), the real wage falls, which implies a downward shift of the aggregate supply curve in figure 3.

Before turning to the simulation experiments, we report the econometric evidence supporting the Phillips curve determination of manufacturing wages proposed in (21). After performing model specification tests 10/ to choose between perfect foresight, full backward wage indexation and alternatives, we settled on the following estimates (corrected for first-order autocorrelation) derived from quarterly data over the period 1976(1) - 1982(4):

$$(22) \qquad \hat{WA}_t = \underset{(-0.99)}{-0.007} + \underset{(3.17)}{0.23}\,(y_{t-1} - y^*_{t-1}) + \underset{(24.78)}{1.22}\,({}_{t-1}\hat{P}_t)$$

$$\bar{R}^2 = 0.92, \quad DW = 2.01$$

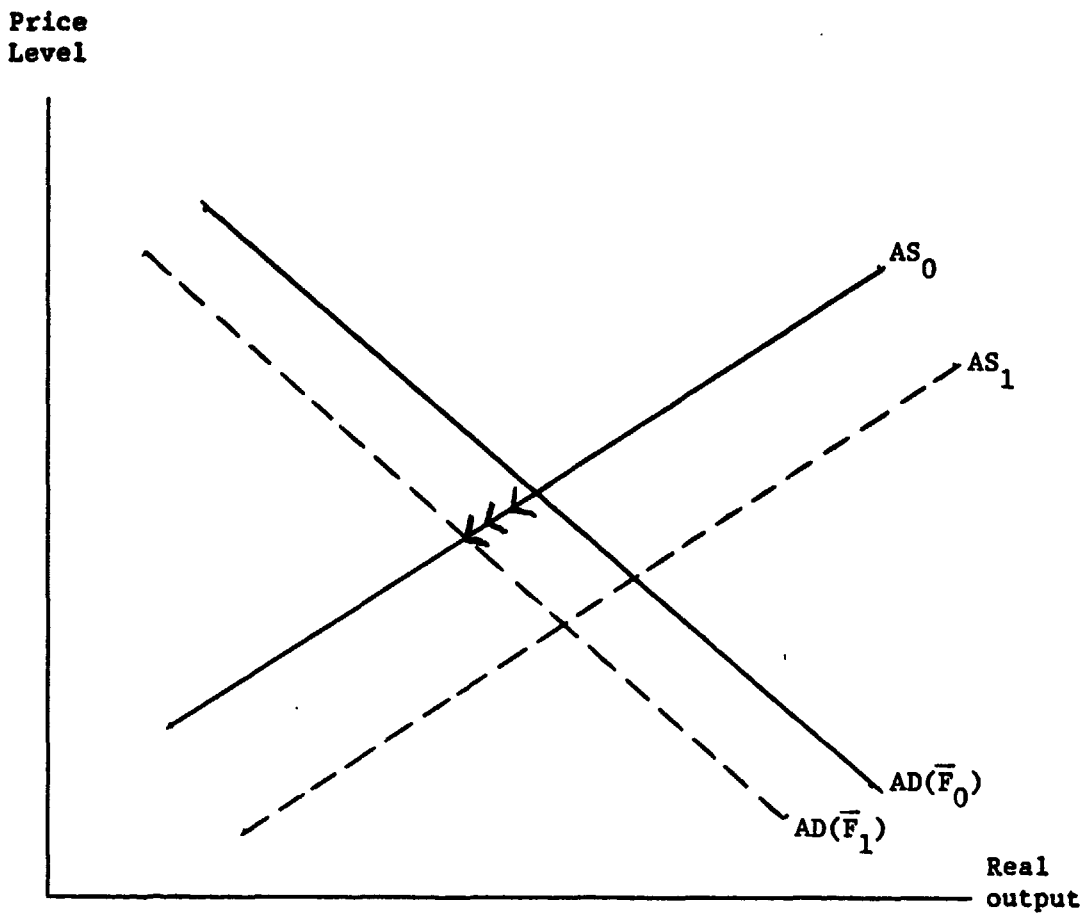
where ^ denotes a percentage change between t and t-1, y_t is GDP, y^*_t is trend GDP, and

$$(23) \qquad {}_{t-1}\hat{P}_t = 0.5\,\hat{P}_{t-1} + 0.5\,\hat{P}_t$$

This formulation encompasses the formulation in (13) as a special case. 11/

Figure 3:

Effects of a Reduction in Capital Inflows on Output and the Price Level



Note: $\bar{F}_1 < \bar{F}_0$ (capital inflows)

To carry out the simulations, we use the estimated offset coefficient from Corbo (1986, p. 122). His estimate, using quarterly data from 1975 to 1982 derived from a three asset portfolio model similar to Kouri and Porter (1974) indicates that a 10 peso increase in domestic credit is offset by a 6.8 peso loss in reserves. This implies a 3.2 peso increase in the money supply. Equation (19) then determines the new price level associated with the lower level of capital inflows. Because the estimated value of the offset coefficient would have likely changed in a regime with greater capital controls like the one implicit in our experiments, we only report simulations for 10% and 25% cuts in capital inflows.

To isolate the effect of a lower level of capital inflows on wages and on protected sector employment, the base run simulation was recalibrated with protected sector wages determined by equation (22) rather than by equation (13) and with the price level determined by equations (18)-(21). The calibration results in a new base simulation where the equilibrium real wage increase is the same as the one incorporated exogenously in the base run reported in section III. Then we performed again the simulations consisting of 10% and 25% cuts in capital inflows during 1980-1. The results of the new simulations are reported in table 4 in the form of ratios to the equilibrium levels of the same variables in the earlier set of simulation experiments (e.g. the value of 97 in the upper left-hand corner of table 4 means that the real wage is now 3 percent lower in 1980 than it was in the corresponding previous simulation).

Table 4: REAL WAGES AND REAL GDP WITH PHILLIPS CURVE WAGE DETERMINATION 1/

	1980		1981	
	Real Wage 2/	GDP	Real Wage 2/	GDP
EXP1	97	101	93	102
EXP2	92	102	82	105

1/ Ratio to corresponding values in table 3 and figure 2.

2/ Protected sector.

The results indicate that the alternative to full backward wage indexation represented by equation (22) would have resulted in lower real wages in the protected sector. Thus, for example, for a 25% decline in capital inflows, real wages in 1981 are 18% below the level reached in the earlier experiment. As a result, GDP is 5% higher. The reason for the lower real wages lies in the replacement of full backward wage indexation by a process linking wage growth to current inflation and to deviations from trend growth. As a result, there is an element of expenditure switching in the economy's response to deflation that was not previously accounted for. This evidence supports earlier conjectures (Corbo, 1986, Edwards and Edwards, 1987) which blame the policy of full backward wage indexation for exacerbating the output loss resulting from the sharp fall in capital inflows that eventually occurred in Chile in 1982.

V. Conclusions

A real exchange rate appreciation usually accompanies exchange rate-based stabilization programs. One mechanism that leads to real exchange rate appreciation is capital inflows that may follow capital account and financial market liberalizations. Capital inflows lead to a real exchange rate appreciation because part of the resulting increase in expenditures falls on domestically produced goods. The real exchange rate appreciation is exacerbated if there is some price rigidity, as for instance, when there is wage indexation, and if money supply control is partial. All these features were present in the Chilean experiment with exchange rate-based disinflation between 1978 and 1981.

This paper has studied two effects that accompanied the real exchange rate appreciation in Chile during 1979-81. First, we give econometric and simulation evidence that an alternative policy restricting capital inflows to a lower level would have led to a proportionately larger fall in absorption than in income, and the decline in absorption would have fallen disproportionately more on consumption than on investment. Second, we give econometric and simulation evidence of the extent to which a more flexible wage indexation rule would have offset the adverse impact on protected sector employment of lower capital inflows.

Footnotes

1/ During 1977-81 capital inflows more than financed the current account deficits, so that the Central Bank was accumulating international reserves. The inflows materialized for two reasons. First, on the supply side, there was the gradual liberalization of the economy to capital flows -- starting in September 1977 when commercial banks were allowed for the first time to borrow externally. Second, on the demand side, there was a portfolio shift toward dollar-denominated loans in response to the increase in the difference between the peso-denominated and the dollar-denominated real interest rate that resulted from fixing the exchange rate (Corbo, 1986). It is likely that capital inflows influenced the general revaluation of assets (the stock market price index rose sevenfold between January 1977 and December 1980). These inflows, by relaxing the capital market disequilibrium, probably resulted in a perceived increase in permanent wealth, which in turn led to a reduction in domestic savings.

2/ The level of disaggregation (5 sectors), and assumptions about foreign trade elasticities are the same as those used in our earlier analysis of reform-induced productivity gains (Condon, Corbo, and de Melo, 1985). External closure, labor market specifications (and supporting evidence) depart from our previous analysis.

3/ Commerce, transportation, utilities, government and other services comprise the aggregate services sector. Output in the services sector is a Cobb-Douglas aggregation of fixed-wage labor and flex-wage labor, with shares derived from the data in Edwards (1986, appendix).

4/ The parameter estimates are in line with those reported in Weisskopf (1972). We emphasize that our equation is an attempt to capture various intertemporal effects that the static nature of the model would otherwise ignore (see also Grinols and Bhagwati 1976). The formulation in equation (14) is close in spirit to the Laursen-Metzler (1950) effect. The small country assumption in our model implies that changes in purchasing power via terms-of-trade changes must come exogenously, whereas in the Laursen-Metzler analysis, a devaluation implies a terms-of-trade change. This is in line with Dornbusch (1985) who gives forceful arguments why capital inflows are (often correctly) perceived by private agents as transfers rather than loans.

5/ The five sectors are: Primary, Mining, Manufacturing, Construction, Services. The solution strategy and algorithms used are described in Dervis, de Melo, and Robinson (1982, appendix 3). The complete set of model equations is available upon request.

6/ A variant of experiment E-3 in which the coefficient of $(F_2\ ER/P)$ in equation 15 is set to zero results in a 3.4 percent drop in nonprimary employment in 1980 compared with a drop of 2.3 percent in E-3.

7/ Quarterly estimates (over the period 1975-1982) of a portfolio model similar to Kouri and Porter (1974) gave strong empirical support for the model with the offset coefficient on domestic internal credit estimated at -0.32.

8/ During the period of analysis, wage contracts in Chile were typically negotiated once a year. Evidence supporting a Phillips curve approach to wage determination is given in Corbo (1985) and below.

9/ This is most unlikely, especially in view of the fact that only approximately two thirds of the labor market was under wage indexation. The condition for AS to be upward sloping in figure 3 is $(1-hy) > 0$.

10/ The selection of weights in determining price expectations formation in (23) was based on the model selection procedure suggested by Davidson and MacKinnon (1981). We were able to reject both perfect foresight and full backward wage indexation when tested against the "half and half" alternative adopted in (23) as a special case.

11/ In (13) the coefficient on deviation from trend output is assumed to be zero, the coefficient on expected inflation one and the coefficients on $\hat{P}_{t-1}$ and $\hat{P}_t$ in (23) one and zero respectively.

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APPENDIX

A. Model Equations

This appendix sets out the model equations in block form. A bar on a variable indicates that the variable is exogenous. In general, i and j subscripts refer to sectors (5), and k susbcripts refer to labor categories (2). Equations appear in Table A1 and corresponding variables are defined in Table A2.

The simulations reported in section 3 involve equations (A1)-(A26) with the coefficients reported in the text in equation (15) in the text substituted into equation (A19). In addition, the real wage for protected sector labor is not determined by (A11) but is fixed as in equation (13) in the text.

The simulations reported in section 4 require the following additional changes: equation (13) of the text is replaced by equation (22) of the text; and the overall price level is endogenously determined (along with the money supply) according to text equations (18)-(19).

B. Data

The primary data source is the 1977 input-output table, Matriz de Insumo-Producto de la Economía Chilena: 1977, ODEPLAN. The model contains a five sector aggregation of the twelve sector data in the publication. Data on employment, wage bills, and balance of payments statistics came from Indicadores Economicos y Sociales: 1960-82 and Cuentas Nacionales de Chile: 1960-82, both published by the Banco Central de Chile. The capital stock data and capital-composition matrix were compiled by the researchers at the Universidad Catolica based on 1977 data. World price indexes for

Chile's exports and imports were computed as Divisia indexes. The import price index is the trade-weighted wholesale price index of Chile's main trading partners. The export price index is the quantity weighted index of Chile's export prices. Values for both indexes are taken from Corbo (1985).

Table A1: Model Equations

1. Prices

(A1) $PM_i = \overline{PW}_i (1 + tm_i)(1 + tmv_i)(1 + trp_i)\, ER$

(A2) $PE_i = \overline{PWE}_i (1 + te_i)\, ER$

(A3) $PS_i = (D_i/X_i)[PD_i + PE_i (E_i/X_i)]$

(A4) $P_i = (D_i/X_i)[PD_i + PM_i (M_i/D_i)]$

(A5) $PN_i = PS_i - \sum_j P_j a_{ji} - td_i\, PD_i$

(A6) $\sum_i A_i P_i = \overline{P}$

2. Production and Employment

(A7) $X_i^S = g_i(L; \overline{K}_i)$

(A8) $L_i = \lambda_i (L_{i1}, \ldots, L_{ik})$

(A9) $L_k^D = \sum_i L_{ik}$

(A10) $PN_i \left(\frac{\partial x_i}{\partial L_i} \frac{\partial L_i}{\partial L_{ik}}\right) = W_k$

(A11) $L_k^D = L_k^S$

3. Foreign Trade

(A12) $X_i^S = h_i(E_i, D_i)$

(A13) $Q_i = f_i(M_i, D_i)$

(A14) $\sum_i \overline{PW}_i M_i - \sum_i \overline{PWE}_i E_i - \overline{F}_1 = F + \overline{F}_2$

4. Savings and Investment

(A15) $R_L = \sum_k \sum_i W_k L_{ki} (1 - tl_k)$

(A16) $R_K = \sum_i (PN_i X_i - \sum_k W_k L_{ki} - \delta_i K_{-1})(1 - tk_i) + \overline{F}_1 ER$

(A17) $R_G = \sum_k \sum_i W_k L_{ki}\, tl_k + \sum_i tk_i (PN_i X_i - \sum_k W_k L_{ki})$
$+ \sum_i tm_i \overline{PW}_i ER M_i + \sum_i tmv_i \overline{PW}_i ER M_i (1 + tm_i)$
$- \sum_i te_i \overline{PWE}_i ER E_i + \sum_i td_i X_i PD_i$

(A18) $TINV = S_p + (R_G - \sum_i P_i G_i) + (\sum_i \overline{PW}_i ER M_i - \sum_i \overline{PWE}_i ER E_i - ER\overline{F}_1)$

(A19) $S_p = \alpha_0 \overline{P} + \alpha_1 (R_L + R_K) - \alpha_2 \overline{F}_2 ER + \sum_i \delta_i K_{-1}$

(A20) $Y_i = \theta_i\, TINV / \sum_j v_{ji} P_j$

(A21) $Z_i = \sum_j b_{ij} Y_j$

5. Demand and Market Equilibrium

(A22) $C_i = \overline{g}_i (R_L + R_K - S_p)/P_i + \overline{g}_{zi}\, \overline{G}$

(A23) $V_i = \sum_j a_{ij} X_j^S$

(A24) $D_i = d_i (Z_i + C_i + V_i)$

(A25) $d_i = 1/f_i(M_i/D_i, 1)$

(A26) $D_i - [1/h_i(E_i/D_i, 1)]\, X_i^S = 0$

Table A2: Definition of Variables

C_i	=	consumption demand, sector i	g_i	=	CES production function
g_i	=	fixed private expenditure shares	$\overline{K}_i$	=	sectoral capital stock (fixed within a period)
g_{zi}	=	fixed government expenditure shares	L_i	=	aggregate labor in sector i
V_i	=	intermediate input demands	L_{ki}	=	labor of type k in sector i
d_i	=	domestic demand ratio	L_k^D	=	demand for category k labor
PM_i	=	domestic price of imports	L_k^s	=	supply of category k labor
$\overline{PW}_i$	=	exogenous world price of imports	W_k	=	nominal wage of labor category k
ER_i	=	exchange rate	R_L	=	after-tax labor income
tm_i	=	tariff rate	tl_k	=	tax rate on labor income of category k
tmv_i	=	import value added tax rate	tk_i	=	tax rate on nonwage income of sector i
trp_i	=	trade margin rate	R_K	=	after-tax capital income
PE_i	=	domestic price of exports	R_G	=	government revenue
$\overline{PWE}_i$	=	exogenous world export price	G_i	=	sectoral real government consumption
te_i	=	export subsidy rate			(note that $\Sigma_i G_i = \overline{G}$ is fixed exogenously.)
PS_i	=	average sales price	TINV	=	total investment (equal to domestic plus
PD_i	=	domestic good price			foreign saving)
P_i	=	composite good price	Y_i	=	investment by sector of destination
PN_i	=	value added or net sales price	Θ_i	=	sectoral investment allocation shares
td_i	=	indirect tax rate	b_{ij}	=	capital composition coefficients
a_{ij}	=	input-output coefficient	Z_i	=	investment by sector of origin
δ_i	=	price index weights equal to base year shares of	δ_i	=	capital stock depreciation rate
		composite good output	Q_i	=	composite good supply
$\overline{P}$	=	the price index, equal to of the GDP deflator	$\overline{F}_1$	=	net nonfactor service receipts payments
D_i	=	output for domestic use	$\overline{F}_2$	=	net foreign capital inflows
E_i	=	exports	F	=	endogenous reserve loss (equals zero if the
M_i	=	imports			exchange rate is endogenous)
S_i	=	gross domestic output of sector i	λ	=	labor aggregation function

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