EXPLAINING THE TRADE BALANCE:  
A GENERAL EQUILIBRIUM APPROACH 

by 
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November 1985  

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Abstract

In this paper we develop a simple general equilibrium model of the current account net of factor services. The model takes explicitly into account the relation between the real exchange rate, the trade balance, output and expenditures. The model is then estimated for the Chilean economy using quarterly data. The model was then used to make some counterfactual simulations.
INTRODUCTION

Ongoing trade deficits have played a key role in the accumulation of external debt of most of the 10 most indebted countries. 1/ Moreover, the drastic reduction in the flow of external financing toward these countries has required severe adjustments in their trade balances. In many cases, these countries have had to generate large surpluses to pay for that portion of the interest payments that could not be financed from drawing down reserves and/or additional capital inflows. As an example, the trade balance of Latin America as a region had to be adjusted from a deficit of US$1.6 billion in 1981 to a surplus of US$31.4 billion in 1983. 2/

This dramatic turnaround in the trade balance in so short a period was accomplished through a combination of expenditure reductions and real devaluations. In the medium term, output in the tradable sector should expand as a result of the real devaluations, a trend that should in turn generate a moderate recovery in output and expenditures. Thus, a real devaluation to boost on output and the trade balance is at the heart of the adjustment programs that many highly indebted countries are attempting today.

This paper investigates the relationship between the trade balance, the real exchange rate and total expenditures. The popular Salter-Swan-Corden Australian model (Salter 1959; Swan 1960; Corden 1981; Dornbursch 1980) is usually used to analyze the relationship among those three factors. This model groups goods into tradables and non-tradables, with supply and demand specified for each good. A relationship between the real exchange rate (the

1/ The exceptions are Argentina and Venezuela, whose debt has resulted mostly from adjustments in the capital account of the balance of payments.
relative price between tradables and non-tradables) and total expenditures in units of non-tradables is derived from the market-clearing condition in the market for non-tradables. In this model, the value of total output in units of non-tradables is also a function of the real exchange rate. On the other hand, the current account deficit, including non-factor services, is the difference between expenditures and output.

Although the model is very useful in analysing the adjustment that results from a reduction in the level of the current account deficit, unfortunately implementing it is very difficult. In particular, the grouping of goods into tradables and non-tradables and the creation of the corresponding price and output figures, as well as the distribution of primary inputs into industries of both types, is very hard to do. In order to apply the model easily to many countries using existing data, the level of aggregation has to be simple enough to correspond closely to the data. Not surprisingly, there have been very few empirical implementations of the model.

In this paper we develop a simple model for analyzing the current account net of factor services; it can be implemented using readily available country statistics. We then apply the model to Chile, a country that has undertaken substantial adjustments in the last three years. Indeed, its trade balance went from a deficit of US$1.5 billion in 1981 to a surplus of US$0.7 billion in 1982 and US$1.3 billion in 1983.

The rest of this paper is divided into four sections. In the first, we develop the model of the trade balance, while in the second, we present the empirical results. The third section offers some counterfactual simulation experiments. Finally, we present our conclusions in the final section.
I. THE MODEL

The lack of empirical studies about the behavior of the trade balance in developing countries motivated us to build a small, simplified general equilibrium model of the trade balance 1/. The model finally specified and estimated has six equations and five identities, most of them derived from the optimization processes explained below.

I.1 Production and Supply (Static)

Chile produces three main types of goods: primary ones, restricted here to copper, which is taken as exogenous; ones that are sold abroad 2/ (exportables); and ones that are sold in the domestic market (domestic). Note that the domestic goods include so-called "import-competing goods" whose prices are determined domestically, since they are not identical to their foreign "homologous."

Our model is short run, and we assume not only that capital is fixed for each period, but also that investment decisions are exogenous. Additionally, there are no explicit adjustment costs or inventories. Hence, we can solve the static optimization problem and obtain the same results that

---

1/ This attempt was not our first. However, our efforts in the past started "small" and, after considering the "optimal" disaggregation, finished big, with large, complex models. Here, we stay with a small model that can be implemented easily and quickly for many countries. This approach required the utilization of basic information typically available to everyone in almost every country. We think that these type of models could greatly help to analyze the role of alternative policies. We are aware of the "Lucas' critique" problem, but we are also aware that usually the analysis of stabilization and adjustment programs is based in much weaker models and/or simple equation relationships. With respect to the latter type of models our approach represents a large improvement without much greater cost.

2/ Excluding copper.
an infinite horizon intertemporal optimization framework would show under these assumptions. 1/

With this context, we make the traditional assumption about aggregation and assume a Cobb-Douglas technology, homogenous of degree one, with labor, capital and intermediate inputs as factors of production. We get the following aggregate supply equations:

\[ q_x^S = a_x^0 - a_x(w - p_x) - b_x(\pi^x - p_x) + k_x \]  \hspace{1cm} (1)

\[ q_n^S = a_n^0 - a_n(w - p_n) - b_n(\pi^n - p_n) + k_n \]  \hspace{1cm} (2)

where \( q_x^S, q_n^S, w, p_x, p_n, \pi^x, \pi^n, k_x \) and \( k_n \) are, respectively, the logarithms of (endogenous) exports, domestic production, the nominal wage faced by firms, exportable prices, domestic good prices, intermediate input prices for the exportable sector, intermediate input prices for the domestic sector, capital in the export sector and capital in the domestic sector, and \( a_x^0, a_n^0, b_x, a_n, b_n \) are the parameters.

---

1/ As will be seen in section I.5, we include adjustment costs but in the traditional, ad hoc way. Thus their inclusion does not come explicitly from the optimization process. We use this approach in order to preserve a simple structure that is easily estimable.

2/ Note that we assume that exports and production of exportable goods are equivalent.
The empirical evidence suggests that there are significant lags between the time at which exports take place and the time at which exporters receive payment. \(^1\) Accordingly we can rewrite equation (1) as:

\[
q^s_x = a^0_x - a_x(w - p_x + \log(1+r)) - b_x(p^{\text{in}}_x - p_x + \log(1+r)) + k_x \quad (1')
\]

or

\[
q^s_x = a^0_x - a_x(w - p_x) - b_x(p^{\text{in}}_x - p_x) - (a_x + b_x)r + k_x \quad (1'')
\]

where \(r\) is some real interest rate that takes into account domestic and external financial considerations.

Finally, we make the assumption that in small countries, export and import prices in foreign currency are set abroad.

I.2 Expenditure and Demand Side

Although we do not formalize it explicitly, we assume a two-stage budgeting approach, with the first stage determining the level of expenditures for each period \(^2\) and the second stage assigning the expenditures to domestic and imported goods. \(^3\)

---

\(^1\) We could also specify this condition as a lag between payments for factors and export earnings. All these are variations of the "Cavallo effect."

\(^2\) Here we put private consumption government expenditures and investment together. Moreover, we take our total demand equations from here, so it will have to explain even the intermediate demands.

\(^3\) Hence, we have two goods on the expenditure side — the domestic ones and imports. The latter do not have perfect domestic substitutes, and their prices are set abroad.
I.2.1 Expenditure Function

Following Corbo (1985), we use an expenditure function of the form

$$E = c_0 + c_1 RW + c_2 RW_{-1} + c_3 RW_{-2} - c_4 r^d - c_5 r^f + c_6 Y + c_7 Y_{-1}^{1/2}$$  \hspace{1cm} (3)$$

where $E$, $RW$, $r^d$, $r^f$ and $Y$ are, respectively, real expenditures, real wealth, real interest rate of peso loans, real interest rate of dollar loans (in peso terms) and real GDP; $c_0$, $c_1$, $c_2$, $c_3$, $c_4$, $c_5$, $c_6$ and $c_7$ are the parameters; and subindexes $-1$ and $-2$ are one and two lags, respectively.

The parameters $c_1$, $c_2$ and $c_3$ capture the effect and dynamic that real wealth has on expenditures; an increase in real wealth, ceteris paribus, raises expenditures in order to satisfy the intertemporal budget constraint: 2/

$$\int_s^T E_t e^{-\int_s^t r^d \, dt} \, dt = RW_s.$$  \hspace{1cm} (2)$$

The dynamic comes from conditions such as liquidity constraints.

The parameters $c_4$ and $c_5$ are the interest rate effects. They capture the intertemporal substitution effect (Dornbusch 1983; Svensson and Razin 1983): because an increase in the interest rate makes it more expensive to consume today if intertemporal substitution exists, people will, ceteris

---

1/ The lagged output term is a modification of Corbo (1985).
2/ We assume strict monotonicity in the utility function, and we therefore have strict equality at the optimum.
paribus, reduce consumption today to consume more tomorrow, and the typical income effect. 1/

The parameters $c_6$ and $c_7$ capture the liquidity effects in the sense that under imperfect capital markets, an equivalent increase in future income (considering a discount factor) would have a smaller short-run effect on consumption. 2/

I.2.2 Final Demand

In the second stage, we are implicitly using a CES sub-utility function plus some additional assumptions about the definition of expenditures and prices to obtain an easy log-linear system:

$$q_n^d = d_0 + \frac{1}{1 - d_1}(p_c - p_n) + e$$

$$q_m^d = d_2 + \frac{1}{1 - d_1}(p_c - p_m) + e$$

where $\frac{1}{1 - d_1}$ is the elasticity of substitution; $p_c$, $p_m$ and $e$ are the logs of the consumer price index, of the prices of imported goods and of expenditures, respectively; and $d_0$, $d_1$ and $d_2$ are the parameters.

Even though we have a CES utility function behind our equation, we use a Cobb-Douglas price index to simplify the empirical estimation. 3/

---

1/ This relationship could also be taken into account by measuring wealth as the present value of net income. Our measure of wealth does not include human wealth (the present value of future income); hence interest rate changes include a wealth effect, with an increase in $r$ reducing human wealth (Summers 1981).

2/ Again, this relationship could also be included in our measure of wealth.

3/ This approach would be very limited only if $d_1$ were very different from zero; this condition is not the case (see the empirical section).
\[ p_c = \theta p_n + (1 - \theta) p_m. \tag{6} \]

I.3 Equilibrium in the Domestic Market

We impose equilibrium in the domestic market only as a long-run condition. I/ We postpone the distinction between desired and actual quantities and prices, and for the time being solve only for the long-run equilibrium in the domestic market where actual and desired prices and quantities are identical:

\[ q_s^d = q_n^d. \tag{7} \]

Replacing the terms in equation (7) with equations (2) and (4), we can solve for the domestic price:

\[
p_n = \frac{(d_0 - a_n^0)}{(a_n + b_n + (1/(1 - d_1)))} \cdot \frac{a_n}{(a_n + b_n + (1/(1 - d_1)))} \cdot \frac{b_n}{w} + \frac{(1/(1 - d_1))}{(a_n + b_n + (1/(1 - d_1)))} \cdot \frac{1}{p_c} + \frac{1}{(a_n + b_n + (1/[1 - d_1]))} \cdot (e - k_n). \tag{8} \]

or, simply,

\[
p_n = f_0 + f_1 w + f_2 p_n^{in} + (1 - f_1 - f_2) p_c + f_3 (e - k_n) \tag{8'} \]

I/ See the partial adjustment section for the dynamic and its assumption.
where \( f_0, f_1, f_2 \) and \( f_3 \) are the parameters, with \( f_1, f_2, f_3 \geq 0 \) and \( f_1 + f_2 \leq 1 \).

I.4 Identities, Definitions and the GDP Deflator

In this subsection we give the definitions and identities required to close the model.

I.4.1 GDP Deflator

In our first approximation, we specify the GDP deflator as a Cobb-Douglas function on the final prices. Although we really should specify it in terms of the value-added prices, this approach, again, would have complicated the model unnecessarily. In any event, value-added prices are a function of final goods prices. Thus, we have

\[
p = g_1 p_n + g_2 p_x + (1 - g_1 - g_2) p_{cu} \tag{9}
\]

where \( p \) and \( p_{cu} \) are the log of the GDP deflator and of the price of copper, respectively.

I.4.2 Input Prices and the Wage Equation

Input prices are defined as Cobb-Douglas combinations of the prices of domestic goods and imports:

\[
p_{x}^{in} = h_1 p_n + (1 - h_1) p_m \tag{10}
\]

\[
p_{n}^{in} = j_1 p_n + (1 - j_1) p_m \tag{11}
\]
We assume unemployment in the labor market, with indexation for wages:
\[ w = w_{-1} + \xi_1 Apc + \ln \] (12)
where \( w \) is the log of the wages faced by firms, \( \xi_1 \) is a positive parameter and \( \ln \) is the log of taxes and other labor costs. 1/

1.4.3 Balance of Trade and Non-Factor Services, and the GDP-Expenditure Identity

The balance of trade and non-factor services is defined in domestic currency as

\[ B = P_x X - P_m M + P_{cu} C_u \] (11)

where \( B \) is the balance of trade and non-factor services, and \( P_x, P_m \) and \( P_{cu} \) are the prices of exports, imports and copper, respectively. 2/

Finally, to close the model, we have the GDP-expenditure identity,

\[ Y = (E P_c + B)/P \] (14)

---

1/ Note that the indexation is related to the wage received by workers.

2/ We have that:

\[ p_x = \log (P_x); \quad p_m = \log (P_m); \quad q_x = \log (X) \]
\[ q_m = \log (M); \quad p_c = \log (P_c); \quad P_{cu} = \log (P_{cu}). \]
I.5 Adjustment Costs, Learning-by-Doing and Dynamics

In this section we depart from the optimization framework in order to give dynamics to the model, while at the same time preserving the simplicity of the log-linear specification we have in most of our equations. Introducing adjustment costs into the optimization program is theoretically easy but complicates the estimation excessively. In any event, the justifications for the partial adjustment mechanism we are using are the same as the modern ones: the increasing cost of changing the level of production, information problems, etc. 1/

The hypothesis of no adjustment cost in the imports equation was clearly not rejected. Therefore, we concentrate on dynamics in the equations for exports and prices.

I.5.1 Exports

For exports we use two different mechanisms to introduce the dynamics; the first one is a "learning-by-doing" variable that "captures" the learning process in the export sector, while the second one is a traditional partial adjustment process, justified on the basis of reasons given earlier in this section. The former variable can also be thought as simplified endogenous technological progress.

---

1/ For a discussion about dynamics and time lags, see Goldstein and Kahn (1985).
I.5.1.1 Learning-by-Doing

We assume not only that people learn over time, but also that this learning process depends on total past exports. This assumption can be written as

\[ \text{LBD}_t = \text{LBD}_{t-1} + (1 - \delta) \text{LBD}_{t-1} \]  \hspace{1cm} (15)

where LBD is the learning-by-doing variable, and \( \delta \) is the rate of depreciation of acquired knowledge. The final value of \( \delta \) is determined by iterating around the maximum of the likelihood function. For the maximum we chose 10 percent per quarter, that is, the know-how afforded by any particular shipment of exports is almost gone after 2.5 years. The other assumption involves \( \text{LBD}_0 \): we assume that it is equal to 1. Hence the learning process re-starts in the first quarter of 1975. Complementing equation (1'') with equation (16), we get:

\[ q_x^o = a_x^o - a_x (w - p_x) - b_x (p_x^i - p_x) - (a_x + b_x) r + k_x \]

\[ + c_x \cdot \log (\text{LBD}) \]  \hspace{1cm} (16)

We postpone for a while the discussion about the differences between short- and long-run responses.
I.5.1.2 Partial Adjustment Mechanism

As we know, this particular form of the Koyck model takes the form

\[ \Delta q_x = \theta_1 [q_x^* - q_{x-1}] \quad \text{(17)} \]

Substituting equation (16) in equation (17) and solving for actual exports, we have

\[ q_x = \theta_1 \left[ a_x^0 - a_x (w - p_x) - b_x (p_x^{in} - p_x) - (a_x + b_x) r + k_x \right. \\
+ c_x \cdot \log \left( \text{LBD} \right)] + (1 - \theta_1) q_{x-1} \quad \text{(18)} \]

I.5.1.3 Short- and Long-Run Elasticities

We illustrate the difference between short-run and long-run elasticities using the own-price elasticities as an example. The short-run elasticity is straightforward:

\[ \frac{\partial q_x}{\partial p_x} \bigg|_{sr} = \theta_1 (a_x + b_x) \quad \text{(19)} \]

The long-run elasticity is more complex, since there are two dynamic mechanisms. However, we can use lag operators and simplify the expression. Indeed, equation (15) can be expressed as

\[ \text{LBD} = \frac{X_{-1}}{(1 - [1 - \delta] L)} \quad \text{(15')} \]

The long-run elasticity is
\[
\frac{\partial q_x}{\partial p_x} \bigg|_{LR} = \left( \frac{\partial q_x}{\partial p_x} \bigg|_{SR} \right) \left( 1 - \frac{\partial q_x}{\partial p_x} \right) \]

and

\[
\frac{\partial q_x}{\partial q_x - 1} = (1 - \theta_1) + \frac{\partial q_x}{\partial \text{LBD}} \cdot \frac{\partial \text{LBD}}{\partial Q_{-1}} \cdot \frac{\partial Q_{-1}}{\partial q_x - 1} \]

\[
= (1 - \theta_1) + \frac{\theta_1 c_x}{\text{LBD}} \cdot \frac{1}{\delta} \cdot Q_{-1} \cdot 
\]

Substituting equation (15') in equation (21), we obtain

\[
\frac{\partial q_x}{\partial q_x - 1} = (1 - \theta_1) + \theta_1 c_x \]

(21')

and, finally,

\[
\frac{\partial q_x}{\partial p_x} \bigg|_{LR} = \frac{a_x + b_x}{(1 - c_x)} \]

(20')

I.5.2. Domestic Prices

Before specifying the dynamic of prices, it is convenient to write equation (8') in terms of first differences:

\[
\Delta p_n = f_1 \Delta \omega + f_2 \Delta p_n^{\text{in}} + (1 - f_1 - f_2) \Delta p_c 
\]

\[
+ f_3 \Delta (e - k_n) \]

(21)
It is also convenient to take first differences in equations (6) and (11) and to substitute in equation (22) in order to collect the terms with \( \Delta p_n \) on the left-hand side:

\[
\Delta p_n = \frac{f_1}{(1 - f_2 f_1 - \Theta [1 - f_1 - f_2])} \Delta w + \frac{(1 - f_2 f_1 - \Theta [1 - f_1 - f_2]) - f_1}{(1 - f_2 f_1 - \Theta [1 - f_1 - f_2])} \Delta p_m
\]

\[
+ \frac{f_3}{(1 - f_2 f_1 - \Theta [1 - f_1 - f_2])} \Delta (e - k_n), \tag{22}
\]

or

\[
\Delta p_n = m_1 \Delta w + (1 - m_1) \Delta p_m + m_2 \Delta (e - k_n) \tag{22'}
\]

where \( m_1 \) and \( m_2 \) are the parameters, with \( m_2 > 0 \) and \( 0 \leq m_1 \leq 1 \).

Now we can introduce the partial adjustment mechanism. In order to avoid problems with the second step in the budgeting process, it is important to assume that all the disequilibrium is covered by inventories: 

\[
\Delta (\Delta p_n) = \theta_2 [\Delta p_n^* - \Delta p_n - 1]. \tag{23}
\]

Substituting equation (22) in equation (23) and solving for the actual percentage change in prices, we have

\[
\Delta p_n = \theta_2 [m_1 \Delta w + (1 - m_1) \Delta p_m + m_2 \Delta (e - k_n)] + (1 - \theta_2) \Delta p_{n-1}. \tag{24}
\]

---

1/ Note that there is no particular reason to assume that firms held inventories. Future refinements of this work could treat inventories explicitly.
II. EMPIRICAL RESULTS

We start with a summary of the model to be estimated:

(a) Equations

\[ E = c_0 + c_1 RW + c_2 RW_{-1} + c_3 RW_{-2} - c_4 r^d - c_5 r^f + c_6 Y + c_7 Y_{-1} \]  

\[ q_m = q_m^d = d_2 + (1/[1 - d_1]) (p_c - p_m) + e \]  

\[ q_x = \theta_1 [a^o_x - a_x (w - p_x) - b_x (p_{x}^{in} - p_x) - (a_x + b_x) r \] 

\[ + k_x + c_x \cdot \log \text{LBD}] + (1 - \theta_1) q_{x} - 1 \]  

\[ p_n = p_{n-1} + \theta_2 [m_1 \Delta w + (1 - m_1) \Delta p_m + m_2 \Delta (e - k_n)] + (1 - \theta_2) \Delta p_{n-1} \]  

\[ \omega = \omega_{-1} - \theta_1 \Delta p_{c-1} + \Delta \text{lin} \]  

\[ p = g_1 p_n + g_2 p_x + (1 - g_1 - g_2) p_{cu} \]  

(b) Identities

\[ p_c = \theta p_n + (1 - \theta) p_m \quad \theta = 0.73 \]
\[ p_x^{\text{in}} = h_1 p_n + (1 - h_1) p_m \quad h_1 \equiv .88 \]  
(10)

\[ B = p_x X - p_m M + p_{cu} C_u \]  
(13)

\[ Y = (E p_c + B)/P \]  
(14)

\[ \text{LBD} = X_{-1} + (1 - \delta) \text{LBD}_{-1} \quad \delta \equiv 0.1 \]  
(15)

In addition, we use all the identities to transform logs in original series and vice-versa.

II.1 Expenditure Equation

From Corbo (1985) and using PDL to find the best specification, we have the following constraints:

(a) \[ c_0 = c_4 = 0 \quad 1/ \]

(b) \[ c_2 = 2 c_1 \]

(c) \[ c_3 = 3 c_1 \quad 2/ \]

(d) \[ c_7 = 0.5 c_6 \cdot \]

Hence

1/ We tested this hypothesis and did not reject it.
2/ Constraints (b) and (c) come from a PDL with near constraint and are restricted to a polynomial of degree 1.
\[ E = c_0 + c_1 RW + 2c_1 RW_{-1} + 3c_1 RW_{-2} - c_5 r^f + c_6 Y + 0.5 c_6 Y_{-1}. \]  \hspace{1cm} (3')

II.2  \textbf{Imports Equation}

As we said in section I.5, there is no evidence of a slow adjustment. Thus, we stay with equation (5), correcting it by auto-correlation.

All the results suggests that $d_1$ is not significantly different from zero. As such, our sub-utility function is not significantly different from a Cobb-Douglas function.

II.3  \textbf{Exports Equation}

The great variety of exports makes it difficult to estimate export equations. Estimating them is particularly difficult if we want to cover all exports (except copper), since there are goods such as traditional exports (mostly natural resource-based) that are very inelastic to price changes and that, in many situations, respond more to budget considerations than to prices, given that they are supplied by government-owned enterprise. 1/

However, those considerations were sacrificed to preserve the simplicity of the model and the data requirements.

Obviously our decision made the coefficients of prices and wages very imprecise, and more outside information was required. We, therefore, imposed an average relative cost share of wages and inputs set at $a_x = (0.21/0.79) b_x$, based on national accounts information.

1/ As copper is the extreme case, we took it out.
The relevant interest rate will depend on the weighted marginal rates, that is, it will be the sum of each interest rate weighted by the marginal borrowing source. Because that approach is complicated, we use a simple average.

Given these considerations, our final exports equation is a transformation of equation (1d), as follows:

$$q_x = \theta_1 [a_x^0 + n_1 p_x - n_1 (.21w + .79p^in_x)
\quad - (n_1/4) (r^d + r^f) + k_x + c_x \log (LBD)]
\quad + (1 - \theta_1) q_x - 1. \quad 1/$$

As we will show later, the simultaneous estimation gave us a very "flat" likelihood function around the maximum on the \((\theta_1, c_x)\) dimension. As our main purpose is to get a "good" import and export equation, we decided to give some "weight" to those results that gave smaller sum of square residuals (SSR) for the export and import equations. To do so, we compared SSR for the unconstrained version and for the version with \((\theta_1, c_x)\) fixed at the values they have in the non-simultaneous estimation. 2/ As we expected, the SSR for the export and import equations was smaller in the constrained case.

---

1/ The coefficient of the interest rate is divided by 4, first because it is the average, and second, because we are transforming annual rates into 6-months rates.

2/ This alternative is reasonable, since at least for the isolated case, it gives the minimum SSR for export and import equations.
Given this outcome, we did a likelihood function test for the constrained model; the null hypothesis of constraints validity was not rejected.

II.4 Domestic Prices, Wages and Deflator Equations

We estimated final versions of the domestic price and wage equations, from equations (24′) and (12′).

In the wage equation case, we tried different hypotheses, including Phillip curves and dummy variables for the third and fourth quarters of 1982, when indexation was eliminated. In the end, the simplest version, equation (12′), proved good enough.

The deflator equation presented a huge autocorrelation. However, estimating it in first difference solved the problem.

II.5 Seasonal Adjustment

Given that agricultural goods play an important role in Chilean trade, we used exports and imports seasonally adjusted by a moving average method. 1/ To be consistent with this step, we have to redefine identities (13) and (14), as follows:

\[ BSA = P_{XSA}^x - P_{MSA}^m + P_{CU} \cdot CU \]  

(13SA)

and

\[ \text{...} \]

YSA = (E \times p_c + BSA)/P \quad (14^{SA})

where SA following the variable means seasonally adjusted. 1/ Of course, we also replaced YSA in equation (3).

II.6 The Results

In the first part of this subsection, we present the results equation by equation. In the second, we show the results from the simultaneous equation model and some tests that support the version finally adopted.

II.6.1 Equation by Equation

This discussion has no purpose other than to give some reference point for comparing the general results. Each individual equation has been estimated using non-linear least square, but without taking into account the simultaneity problem. For each equation we show the values of the coefficients, the student statistics, 2/ the sum of square residuals (SSR), R², Durbin-Watson statistics (DW), 3/ and the logarithm of the likelihood function (LLF). 4/

The results are shown in Tables II.1 - II.6.

1/ Remember that only X and M were seasonally adjusted; BSA and YSA are only modified to preserve the validity of these identities.

2/ This information must be used cautiously since the student test is not the best one in cases where the equations are non-linear in their parameters.

3/ Again, there are some equations where DW is not the proper test, for example, in those equations with lagged endogenous variables and in those without constant.

4/ The residuals are assumed to be normally distributed.
Table II.1: EXPENDITURES

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>$c_1$</td>
<td>0.00227</td>
<td>11.55</td>
</tr>
<tr>
<td>$c_5$</td>
<td>5452.06</td>
<td>3.734</td>
</tr>
<tr>
<td>$c_6$</td>
<td>0.60300</td>
<td>49.83</td>
</tr>
<tr>
<td>DE$_2$ a/</td>
<td>9440.55</td>
<td>4.485</td>
</tr>
<tr>
<td>DE$_3$ a/</td>
<td>3098.04</td>
<td>1.542</td>
</tr>
</tbody>
</table>

SSR = 0.18 E+09
$R^2$ = 0.985
$DW$ = 1.736
LLF = -277.02

a/ DE$_2$ and DE$_3$ are the coefficient for dummy variables.

DE$_2$ showed an upward shift in the second and third quarters of 1981; meanwhile, DE$_3$ takes into account a demand shift in the second and third quarters of 1979. The main purpose of these dummy variables is to help the dynamic simulation where big errors in one period would affect all following predictions. Both involve periods where factors not considered in our equation may have had big effects: in the second and third quarters of 1979, the exchange rate regime in Chile was changed into a fixed exchange rate system (Corbo 1985), while in the second and third quarters of 1981 people started to question more seriously the sustainability of the exchange rate regime.
Table II.2: IMPORTS

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$</td>
<td>0.7493</td>
<td>5.907</td>
</tr>
<tr>
<td>$d_2$</td>
<td>-1.370</td>
<td>-16.02</td>
</tr>
<tr>
<td>$d_1$</td>
<td>-0.501</td>
<td>-0.85</td>
</tr>
</tbody>
</table>

SSR = 0.310609  
$R^2$ = 0.935585  
DW = 1.5304  
LLF = 25.9881

Table II.3: EXPORTS

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_0$</td>
<td>-5.6264</td>
<td>-10.026</td>
</tr>
<tr>
<td>$n_1$</td>
<td>0.1864</td>
<td>1.783</td>
</tr>
<tr>
<td>$c_0$</td>
<td>0.3159</td>
<td>6.273</td>
</tr>
<tr>
<td>$\theta_1$</td>
<td>0.5671</td>
<td>3.114</td>
</tr>
</tbody>
</table>

SSR = 0.164  
$R^2$ = 0.942  
DW = 2.363  
LLF = 35.54

Table II.4: DOMESTIC PRICES

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_2$</td>
<td>0.5745</td>
<td>4.197</td>
</tr>
<tr>
<td>$m_1$</td>
<td>0.8352</td>
<td>5.552</td>
</tr>
<tr>
<td>$m_2$</td>
<td>0.1712</td>
<td>0.957</td>
</tr>
</tbody>
</table>

SSR = 0.065  
$R^2$ = 0.997  
DW = 1.966  
LLF = 49.43
Table II.5: WAGES

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ell_1 )</td>
<td>0.9478</td>
<td>16.50</td>
</tr>
</tbody>
</table>

SSR = 0.092  
R\(^2\) = 0.997  
DW = 2.403  
LLF = 44.29

Table II.6: GDP DEFLATOR

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \delta_1 )</td>
<td>0.7516</td>
<td>15.99</td>
</tr>
<tr>
<td>( \delta_2 )</td>
<td>0.0709</td>
<td>1.571</td>
</tr>
</tbody>
</table>

SSR = 0.026  
R\(^2\) = 0.999  
DW = 1.877  
LLF = 63.12

II.6.2. Simultaneous Model

II.6.2.1. General Results

In this subsection we present the results from the estimation of the full model by full information maximum likelihood (Table II.7). In the first two columns we present the results for the unconstrained model, in the second two columns the results with the restriction \( \theta_1 = 0.5671 \) and \( c_x = 0.3159 \), which were the values obtained from the single-equation estimation of the export equation.
Table II.7: ESTIMATION RESULTS FOR FULL MODEL

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Unconstrained Value</th>
<th>Student</th>
<th>Constrained Value</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$</td>
<td>0.6801</td>
<td>2.743</td>
<td>0.7246</td>
<td>3.151</td>
</tr>
<tr>
<td>$d_2$</td>
<td>-1.3520</td>
<td>-9.708</td>
<td>-1.3552</td>
<td>-10.90</td>
</tr>
<tr>
<td>$d_1$</td>
<td>-0.3210</td>
<td>-0.351</td>
<td>-0.3642</td>
<td>-0.4734</td>
</tr>
<tr>
<td>$c^o_x$</td>
<td>-3.3775</td>
<td>-1.394</td>
<td>-5.6319</td>
<td>-218.3</td>
</tr>
<tr>
<td>$n_1$</td>
<td>0.0607</td>
<td>0.237</td>
<td>0.2216</td>
<td>2.318</td>
</tr>
<tr>
<td>$c^x$</td>
<td>0.1161</td>
<td>0.5385</td>
<td>0.3159</td>
<td>-</td>
</tr>
<tr>
<td>$\theta_1$</td>
<td>0.3237</td>
<td>1.556</td>
<td>0.5671</td>
<td>-</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.5631</td>
<td>2.800</td>
<td>0.5570</td>
<td>3.135</td>
</tr>
<tr>
<td>$m_1$</td>
<td>0.6832</td>
<td>1.697</td>
<td>0.7190</td>
<td>2.030</td>
</tr>
<tr>
<td>$m_2$</td>
<td>0.3264</td>
<td>1.157</td>
<td>0.3130</td>
<td>1.165</td>
</tr>
<tr>
<td>$g_1$</td>
<td>0.9393</td>
<td>7.636</td>
<td>0.9432</td>
<td>9.713</td>
</tr>
<tr>
<td>$g_1'$</td>
<td>0.7434</td>
<td>16.73</td>
<td>0.7390</td>
<td>17.69</td>
</tr>
<tr>
<td>$g_2$</td>
<td>0.1051</td>
<td>2.749</td>
<td>0.1027</td>
<td>2.414</td>
</tr>
<tr>
<td>$c_1$</td>
<td>0.0024</td>
<td>7.392</td>
<td>0.0024</td>
<td>9.197</td>
</tr>
<tr>
<td>$c_5$</td>
<td>7743.8</td>
<td>2.274</td>
<td>7521.5</td>
<td>2.930</td>
</tr>
<tr>
<td>$c_6$</td>
<td>0.5945</td>
<td>32.15</td>
<td>0.5972</td>
<td>37.35</td>
</tr>
<tr>
<td>$DE_2$</td>
<td>10618</td>
<td>2.234</td>
<td>10560</td>
<td>3.097</td>
</tr>
<tr>
<td>$DE_3$</td>
<td>5239.6</td>
<td>3.178</td>
<td>5476.5</td>
<td>3.208</td>
</tr>
<tr>
<td>LLF</td>
<td>-347.76</td>
<td></td>
<td>-349.56</td>
<td></td>
</tr>
</tbody>
</table>
The null hypothesis that the constraints are valid is tested using a likelihood ratio test procedure:

\[ X = 2[\text{LLF}_{\text{unrestricted}} - \text{LLF}_{\text{restricted}}] - \chi^2_2 \text{ under } H_0 . \]

The critical value for \( \chi^2 \) at the 5 percent level and with 2 degrees of freedom is 5.99; the value of \( \chi^2 \) is 3.59. Hence, we cannot reject \( H_0 \).

II. 6.2.2 Individual Equation Statistics in the Simultaneous Estimation

Table II.8: INDIVIDUAL EQUATION STATISTICS

<table>
<thead>
<tr>
<th>Equation:</th>
<th>Imports</th>
<th>Exports</th>
<th>Domestic Price</th>
<th>Wage</th>
<th>Deflator</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constrained SRR</td>
<td>0.312</td>
<td>0.166</td>
<td>0.068</td>
<td>0.092</td>
<td>0.027</td>
<td>0.21 E+09</td>
</tr>
<tr>
<td>SRR DW</td>
<td>1.506</td>
<td>2.361</td>
<td>2.080</td>
<td>2.399</td>
<td>1.932</td>
<td>1.853</td>
</tr>
<tr>
<td>Unconstrained SRR</td>
<td>0.315</td>
<td>0.202</td>
<td>0.070</td>
<td>0.092</td>
<td>0.027</td>
<td>0.22 E+09</td>
</tr>
<tr>
<td>SRR DW</td>
<td>1.433</td>
<td>2.377</td>
<td>2.079</td>
<td>2.395</td>
<td>1.931</td>
<td>1.851</td>
</tr>
</tbody>
</table>

II.6.3 Some Elasticities

In the next section we present some simulation exercises using the complete model; here we give only some partial effects. For this purpose, we use the elasticity values (Table II.9). Let us denote the percentage change in variable i attributable to a 1 percent change in variable j as \( ij(\cdot) \), with \( (\cdot) \) equal to SR -- short-run -- or LR -- long-run.
Table II.9: SHORT- AND LONG-RUN ELASTICITIES

<table>
<thead>
<tr>
<th>Elasticities</th>
<th>Value</th>
<th>Elasticities</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X.PX(SR)</td>
<td>0.1257</td>
<td>M.PM</td>
<td>-0.7330</td>
</tr>
<tr>
<td>X.PX(LR)</td>
<td>0.3239</td>
<td>M*PM</td>
<td>-0.5351</td>
</tr>
<tr>
<td>X.W(SR)</td>
<td>-0.0264</td>
<td>M*PN</td>
<td>0.5351</td>
</tr>
<tr>
<td>X.W(LR) in</td>
<td>-0.0680</td>
<td>P.N.W(SR)</td>
<td>0.4010</td>
</tr>
<tr>
<td>in X.Px(SR)</td>
<td>-0.0993</td>
<td>P.N.W(LR)</td>
<td>0.7190</td>
</tr>
<tr>
<td>in X.Px(LR)</td>
<td>-0.2559</td>
<td>P.N.PM(SR)</td>
<td>0.1567</td>
</tr>
<tr>
<td>X.r(SR)</td>
<td>-0.0629</td>
<td>P.N.E(SR)</td>
<td>0.1746</td>
</tr>
<tr>
<td>X.r(LR)</td>
<td>-0.1620</td>
<td>P.N.E(LR)</td>
<td>0.3130</td>
</tr>
<tr>
<td>X.Kx(SR)</td>
<td>0.5671</td>
<td>P.N.K* (SR)</td>
<td>-0.1746</td>
</tr>
<tr>
<td>X.Kx(LR)</td>
<td>1.4618</td>
<td>P.N.K* (LR)</td>
<td>-0.3130</td>
</tr>
</tbody>
</table>

*: Considering the direct effect on the price index.

**: Rate of change.
II.6.4 Model Solution

In this section we present figures showing the static solution of the model. Dynamic simulations are also presented. However, note that this model has many dynamic elements, a condition that makes it very difficult to simulate (dynamically) for many periods, since errors are transmitted and accumulated in the endogenous variables. Nevertheless, the results are quite good except for an excessive expansion of expenditures during the boom years and an excessively low level of expenditures in the early periods. This extreme variation (albeit with the correct sign) affects all other variables through the different channels of the model.
Figure 2
LOG OF IMPORTS, STATIC SIMULATION

LAG PLOTTED WITH *
LAGGED PLOTTED WITH * (SIMULATION)
Figure 3
LOG OF DOMESTIC GOODS PRICES, STATIC SIMULATION

LPN PLOTTED WITH *
LPNSD PLOTTED WITH + (SIMULATION)
Figure 4

LOG OF UNIT LABOR COST, STATIC SIMULATION

LW PLOTTED WITH *
LWSD PLOTTED WITH + (SIMULATION)
Figure 5

GDP, STATIC SIMULATION

PGD PLANTED WITH *
PGSD PLANTED WITH + (SIMULATION)
Figure 6

EXPENDITURE, STATIC SIMULATION

EXP G PLOTTED WITH *
EXP GSD PLOTTED WITH + (SIMULATION)
Figure 7

BALANCE OF TRADE AND NONFINANCIAL SERVICES, STATIC SIMULATION

BEING PLOTTED WITH *
BEING SD PLOTTED WITH + (SIMULATION)
Figure 9

LOG OF IMPORTS, DYNAMIC SIMULATION

LAG PLOTTED WITH *  
LEVELS PLOTTED WITH + (SIMULATION)
Figure 10

LOG OF DOMESTIC GOODS PRICES, DYNAMIC SIMULATION

LPN PLOTTED WITH *
LPNDD PLOTTED WITH + (SIMULATION)
Figure 12
GDP, DYNAMIC SIMULATION

PG8 PLOTTED WITH *
PG8DD PLOTTED WITH + (SIMULATION)
Figure 13
EXPG PLOTTED WITH * EXPDD PLOTTED WITH + (SIMULATION)
III. SOME SIMULATION EXPERIMENTS

In this section we use the complete model to perform some simulation experiments. The shock and its effects over time on the main variables is shown, as is the difference in percentages between the control and the new path following the shock. 1/

III.1 Devaluation

Here we analyze the effects of an exchange rate that is 50 percent higher from 1979 on. We distinguish two cases. The first uses the wage

Table III.1: DEVALUATION WITH ACTUAL INDEXATION

<table>
<thead>
<tr>
<th>Variable</th>
<th>Quarter after the Shock (% difference)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>X (without cu)</td>
<td>4.02</td>
</tr>
<tr>
<td>M</td>
<td>-9.99</td>
</tr>
<tr>
<td>*B (in mil of US$)</td>
<td>163.89</td>
</tr>
<tr>
<td>E</td>
<td>7.41</td>
</tr>
<tr>
<td>PGB</td>
<td>12.88</td>
</tr>
<tr>
<td>PN</td>
<td>7.95</td>
</tr>
<tr>
<td>W</td>
<td>0</td>
</tr>
<tr>
<td>PX/PN</td>
<td>42.05</td>
</tr>
<tr>
<td>PM/PN</td>
<td>42.05</td>
</tr>
<tr>
<td>W/PN</td>
<td>-7.95</td>
</tr>
</tbody>
</table>

1/ The difference in the balance of trade and services (except interest payments) is shown in millions of dollars (not in percentages).
indexation process that really existed at that time (Table III.1) which the second assumes that indexation was only 70 percent of past changes in the CPI (Table III.2). 1/ For both devaluations we assume that the wealth effect is offset by a compensatory policy (e.g., an increase in money supply, etc.).

Table III.2: DEVALUATION WITH PARTIAL INDEXATION

<table>
<thead>
<tr>
<th>Variable</th>
<th>Quarter after the Shock (% difference)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>X (without cu)</td>
<td>3.99</td>
</tr>
<tr>
<td>M</td>
<td>-8.01</td>
</tr>
<tr>
<td>*B (in mil of US$)</td>
<td>149.23</td>
</tr>
<tr>
<td>E</td>
<td>9.57</td>
</tr>
<tr>
<td>PGB</td>
<td>15.67</td>
</tr>
<tr>
<td>PN</td>
<td>8.33</td>
</tr>
<tr>
<td>W</td>
<td>0</td>
</tr>
<tr>
<td>P_x/P_n</td>
<td>41.67</td>
</tr>
<tr>
<td>P_m/P_n</td>
<td>41.67</td>
</tr>
<tr>
<td>W/PN</td>
<td>-8.33</td>
</tr>
</tbody>
</table>

1/ Of course, this new assumption is used in both the control (i.e. without devaluation) and the simulated path.
The impact of the devaluation is a rise in exports and a decrease in imports because of the increase in the real exchange rate. As a result, the balance of trade and non-factor services improves dramatically.

After the shock, as $P_N$ starts eating up the devaluation, the economy slowly reverts to the old equilibrium (in a dynamic sense). However, this process, contrary to what was thought at that time, is quite slow; even with full indexation, we can see that a small effect still remains three years later. It is also interesting to note that here we have offset the "monetary effect." Otherwise, the effect on relative prices would have been even longer and deeper.

III.2 Partial Wage Disindexation

Here we analyze the evolution of our main variables under the partial indexation process already used in the second experiment in subsection III.1 (Table III.3). As before, we compare the control, i.e., the case with full indexation, against the case with 70 percent indexation.

In this case, the general results are pretty obvious: a lower indexation (assuming that it is sustainable) with inflation greater than zero will cause real wages to deteriorate, a situation that will in turn reduce labor costs in all sectors. The latter trend will increase the production of exports and domestic goods and, through this channel, real expenditures. The only question that remains is whether imports increase or decrease, in other words, whether the expenditures effect dominates the price effect, or vice-versa.
Table III.3: CHANGE IN THE INDEXATION RULE

<table>
<thead>
<tr>
<th>Variable</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>X (without cu)</td>
<td>0.76</td>
<td>3.49</td>
<td>6.88</td>
<td>13.46</td>
<td>33.22</td>
<td>35.20</td>
</tr>
<tr>
<td>M</td>
<td>-1.62</td>
<td>-1.91</td>
<td>-1.69</td>
<td>-2.15</td>
<td>-29.24</td>
<td>-11.56</td>
</tr>
<tr>
<td>B* (in mil of US$)</td>
<td>8.37</td>
<td>19.48</td>
<td>43.91</td>
<td>63.26</td>
<td>1466.63</td>
<td>502.23</td>
</tr>
<tr>
<td>E</td>
<td>0.98</td>
<td>7.69</td>
<td>15.40</td>
<td>27.70</td>
<td>21.31</td>
<td>50.36</td>
</tr>
<tr>
<td>PGB</td>
<td>1.73</td>
<td>9.99</td>
<td>19.08</td>
<td>32.52</td>
<td>28.02</td>
<td>63.01</td>
</tr>
<tr>
<td>PN</td>
<td>-4.75</td>
<td>-15.95</td>
<td>-25.80</td>
<td>-39.09</td>
<td>-63.34</td>
<td>-62.76</td>
</tr>
<tr>
<td>W</td>
<td>-11.88</td>
<td>-28.96</td>
<td>-42.21</td>
<td>-56.90</td>
<td>-77.91</td>
<td>-78.35</td>
</tr>
<tr>
<td>PX/PN</td>
<td>4.75</td>
<td>15.95</td>
<td>25.80</td>
<td>39.09</td>
<td>63.34</td>
<td>62.76</td>
</tr>
<tr>
<td>PM/PN</td>
<td>4.75</td>
<td>15.95</td>
<td>25.80</td>
<td>39.09</td>
<td>63.24</td>
<td>62.76</td>
</tr>
<tr>
<td>W/PN</td>
<td>-7.08</td>
<td>-13.01</td>
<td>-16.41</td>
<td>-17.81</td>
<td>-14.57</td>
<td>-15.59</td>
</tr>
</tbody>
</table>

The results are quite strong; the price effect is much bigger, and so imports go down, while the balance of trade improves dramatically.

III. 3 Flatter Wealth

As said in Corbo (1985), wealth rose mainly because of a "bubble" that appreciated the value of real assets excessively. The following experiment assumes that once Tobin's q reaches its long-run value (1), it stays at that level. Tobin's q in fact crossed the unitary value in the third quarter of 1977, which is therefore considered as the shock period. The results are shown in Table III.4.
Table III.4: TOBIN'S q = 1 FROM 77.III ON

<table>
<thead>
<tr>
<th>Variable</th>
<th>0</th>
<th>0.16</th>
<th>0.63</th>
<th>1.83</th>
<th>6.01</th>
<th>6.89</th>
</tr>
</thead>
<tbody>
<tr>
<td>X (without cu)</td>
<td>-0.80</td>
<td>-6.61</td>
<td>-16.87</td>
<td>-22.10</td>
<td>-43.42</td>
<td>-48.32</td>
</tr>
<tr>
<td>M</td>
<td>4.78</td>
<td>46.18</td>
<td>153.56</td>
<td>293.27</td>
<td>1773.35</td>
<td>939.99</td>
</tr>
<tr>
<td>B* (in mil. of US$)</td>
<td>-0.73</td>
<td>-5.90</td>
<td>-14.70</td>
<td>-17.84</td>
<td>-34.38</td>
<td>-39.85</td>
</tr>
<tr>
<td>E</td>
<td>-0.51</td>
<td>-4.04</td>
<td>-10.26</td>
<td>-10.21</td>
<td>-29.33</td>
<td>-26.61</td>
</tr>
<tr>
<td>PGB</td>
<td>-0.13</td>
<td>-1.41</td>
<td>-4.68</td>
<td>-9.45</td>
<td>-24.12</td>
<td>-25.78</td>
</tr>
<tr>
<td>PN</td>
<td>0</td>
<td>-0.33</td>
<td>-1.91</td>
<td>-6.03</td>
<td>-17.63</td>
<td>-18.28</td>
</tr>
<tr>
<td>P_x/P_n</td>
<td>0.13</td>
<td>1.41</td>
<td>4.68</td>
<td>9.45</td>
<td>24.12</td>
<td>25.78</td>
</tr>
<tr>
<td>P_m/P_n</td>
<td>0.13</td>
<td>1.41</td>
<td>4.68</td>
<td>9.45</td>
<td>24.12</td>
<td>25.73</td>
</tr>
<tr>
<td>W/PN</td>
<td>0.13</td>
<td>1.08</td>
<td>2.77</td>
<td>3.42</td>
<td>6.49</td>
<td>7.50</td>
</tr>
</tbody>
</table>

Wealth enters our model through the expenditure equation. "Flatter wealth," as defined in our experiment, means lower wealth for the otherwise "boom" periods. A decrease in expenditures depresses the domestic sector and reduces imports; on the other hand, exports increase because of a higher real exchange rate. Thus the balance of trade is much better than in the control case.

It should also be noted that the increase in production in the exportable sector is not enough to compensate for the fall in domestic sector production. Hence PGB goes down.
III.4 Terms of Trade Improvement

The next experiment involves a 50 percent (permanent) increase in the prices of Chilean exports (excluding copper). It is assumed that this change takes place in the third quarter of 1974, in order that (Table III.5) can be compared with the path where the devaluation was 50 percent.

An increase in the prices of exports causes exports to grow, a trend that in turn leads output to rise. Through this channel expenditure increase. The expansion in expenditures "pulls" domestic goods production. As seen, the general results are: an increase in expenditures and output in the domestic and export sectors and an improvement in the balance of trade.

Table III.5: TERMS OF TRADE IMPROVEMENT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Quarter after the Shock (% difference)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>X (excluding cu)</td>
<td>5.12</td>
</tr>
<tr>
<td>M</td>
<td>6.92</td>
</tr>
<tr>
<td>B* (in mil of US$)</td>
<td>481.43</td>
</tr>
<tr>
<td>E</td>
<td>6.31</td>
</tr>
<tr>
<td>PGB</td>
<td>10.96</td>
</tr>
<tr>
<td>PN</td>
<td>1.08</td>
</tr>
<tr>
<td>W</td>
<td>0</td>
</tr>
<tr>
<td>PX/PN</td>
<td>48.92</td>
</tr>
<tr>
<td>PM/PN</td>
<td>-1.03</td>
</tr>
<tr>
<td>W/PN</td>
<td>-1.08</td>
</tr>
</tbody>
</table>
III.5 Increase in the Foreign Interest Rate

Here, we analyze the effect of a foreign interest rate that is 20 percentage points higher (i.e., $r^f_{\text{new}} = r^f_{\text{old}} + .2$) for the whole period. However, this experiment is only "partial," as we assume that capital inflows and the "bubble" are not affected by this change. Unfortunately, we do not have a model that includes the indirect effects. For this exercise, the shock period (the one in which the foreign interest rate starts rising) is the third quarter of 1975. The results appear in Table III.6.

Table III.6: INCREASE IN FOREIGN INTEREST RATE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Quarter after the Shock (% difference)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>X (excluding cu)</td>
<td>-0.54</td>
</tr>
<tr>
<td>M</td>
<td>-5.68</td>
</tr>
<tr>
<td>B* (in mil of US$)</td>
<td>21.89</td>
</tr>
<tr>
<td>E</td>
<td>-5.20</td>
</tr>
<tr>
<td>PGB</td>
<td>-3.44</td>
</tr>
<tr>
<td>PN</td>
<td>-0.93</td>
</tr>
<tr>
<td>W</td>
<td>0</td>
</tr>
<tr>
<td>$P_X/P_N$</td>
<td>0.93</td>
</tr>
<tr>
<td>$P_M/P_N$</td>
<td>0.93</td>
</tr>
<tr>
<td>W/PN</td>
<td>0.93</td>
</tr>
</tbody>
</table>
The "partial" experiment gives the foreign interest rate two channels to work through: first, it depresses expenditures, second it reduces the production of exports. The expenditure effect reduces imports and the production of domestic goods. However, the reduction in imports is actually a combination of two effects — price and expenditure — and it is bigger than the fall in exports. Hence, there is an improvement in the balance of trade.

IV. CONCLUSIONS

The main purpose of this paper was to investigate the effects of a real devaluation on expenditure, output and the trade balance, inclusive of non-interest services. For this purpose we formulated and estimated a small general equilibrium model that includes both wealth effects and relative prices. The advantage of using this type of model instead of the traditional simple equation net trade balance one is that it takes into account the effect of a devaluation on output and expenditures as well as the price effects in non-tradables and wages. One additional advantage of this type of model is that it incorporates explicitly the real effects of policies which are usually excluded in the analysis of adjustment programs.

The model was estimated for the Chilean economy using quarterly data. The model was then used to perform some counterfactual simulations. Two simulations in particular are of great interest: first, the 50 percent one-shot devaluation with existing wage indexation, second, the 50 percent one-shot devaluation with partial wage indexation. Based on the results of these simulations, even in the first case a devaluation improves the trade balance, and even after two and a half years. Of course, the improvement is even more pronounced in an economy with only partial wage indexation.
REFERENCES


