Cuadernos de Economía, Año 33, N° 98, pp. 109-131 (abril 1996)

RECENT EVOLUTION OF THE CHILEAN REAL EXCHANGE RATE

LARRY A. SJAASTAD*

INTRODUCTION

This paper concerns the evolution of the Chilean real exchange rate over the past decade. In particular, it focuses on the determinants of the "true" real exchange rate (TCRV), the difference between that real rate and the purchasing power parity (PPP) real exchange rate (TCR) as computed by the Banco Central de Chile, and the effect of real exchange rates on real interest rates.

Since the demise of the Breton Woods international monetary system in the early 1970s, both nominal and PPP real exchange rates among the major currencies have become highly volatile and, more significantly, shocks to those exchange rates have become persistent (although PPP real rates are mean reverting)[1]. The prolonged deviations in PPP real exchange rates have come to be identified with failure of the purchasing power parity doctrine. Indeed, Jones and Purvis (1983) described the "prevailing conventional wisdom" concerning PPP as:

(1) PPP does not hold in the short run.
(2) "There are strong tendencies towards PPP so that it does hold in the long run" [page 34].

The erratic short-run behavior of major-currency PPP real exchange rates has drastically reduced their analytical usefulness in a macroeconomic framework for both major

* Professor of Economics, University of Chicago, 1126 East 59th Street, Chicago, IL 60637, and Adjunct Professor at the University of Western Australia. Visiting Professor at the Instituto de Economía, Pontificia Universidad Católica de Chile. The author wishes to thank Veronica Gil and Aldo Lema for valuable assistance with the data in the preparation of this study, Alvaro Donoso and an anonymous referee for valuable comments.

1 See Frenkel (1981) for an early study of the departures from PPP in the 1970s.

and minor currency countries[2]. It will be argued, nonetheless, that the true real exchange rate has been largely immune to the factors that have introduced such high volatility into the PPP real exchange rates.

The first section to follow deals with the basic attributes of true and PPP real exchange rates. Section II is concerned with econometric tests of the behavior of the Chilean nominal exchange rate, and section III investigates the behavior of the real exchange rate as calculated by the Banco Central. In section IV, the true real exchange rate is defined and its behavior since 1986 is investigated. The final section is concerned with the determinants of real interest rates in Chile, and the effect on them of changes in real exchange rates.

I. Some Key Aspects of Real Exchange Rates

In the following notation, upper case letters indicate natural logarithms, and an "F" is appended to a variable name if it is measured in foreign currency:

TC = the domestic-currecty price of foreign exchange,
TCR = PPP real exchange rate, to be defined below,
TCRV = "true" real exchange, to be defined below,
P = w • PNT + (1-w) • PT, a price index for the country in question,
PT = a domestic-currency price index of internationally-traded goods,
PNT = a domestic-currency price index of nontraded goods,
EXP = a domestic-currency price index of exports,
IMP = a domestic-currency price index of imports,
WN = a domestic-currency index of nominal wages,
TT = EXPF - IMPF, the external terms of trade,
TB = the trade balance (exports-imports)/GDP.

The final effect on variable Y of a permanent shock to variable X (a final-form multiplier) is indicated by $\delta(Y)/\delta(X)$, and first differencing by Δ[3].

The true real exchange rate for Chile, which is merely the relative price of goods that are traded internationally, is defined as $PT_{CH} - PNT_{CH}$ and does not explicitly involve the nominal exchange rate. A more convenient version can be expressed in terms of more readily observable variables:

$$(1) \qquad TCRV_{CH} \equiv PT_{CH} - P_{CH}$$

$$= w_{CH} \cdot (PT_{CH} - PNT_{CH}),$$

which differs from the real thing only by a factor of proportionality, w_{CH}, the weight of nontraded goods in the Chilean price level.

2 In his classic paper, Mussa (1979) claimed that "the natural logarithm of the spot exchange rate follows approximately a random walk" and in Mussa (1986) he argued that "short-term changes in nominal exchange rates and in real exchange rates show substantial persistence during subperiods when the nominal exchange rate is floating".

3 Final-form multipliers were first defined by Theil and Boot (1962).

The empirical counterpart of the true real exchange rate is some variant of the PPP real exchange rate which explicitly involves the nominal rate[4]. In natural logarithms, that real rate between Chile and reference country Y would usually be written as:

$$(2) \qquad TCR^{Y}_{CH} \equiv TC^{Y}_{CH} + P_Y - P_{CH}$$

where TC^{Y}_{CH} is the price of currency Y in terms of Chilean pesos. By subtracting equation 1 from 2 and rearranging, the PPP real exchange rate can be written in terms of the true real exchange rate:

$$(3) \qquad TCR^{Y}_{CH} = TCRV_{CH} + P_Y - PTF_{CH}$$

where PTF_{CH} is PT_{CH} expressed in the currency of country Y. Apart form sheer chance, the correlation between the two real exchange rates will be perfect only when P_Y - PTF_{CH} is constant; that is, when expressed in a common currency, the price index for Chile's traded goods is perfectly correlated with the price level of country Y. But as the goods actually traded by Chile are but a small subset of goods and services produced and consumed in country Y, PTF_{CH} will deviate from P_Y whenever relative prices change[5].

In a world of M open economies, prices of traded goods are directly influenced by national price levels and/or exchange rates; the manner in which this takes place is described in the Appedix. Equation A-5 of that appendix poses a simple relationship between national price levels and a foreign currency price index for goods traded internationally by any country such as Chile:

$$(4) \qquad PTF_{CH} = \sum_{j}^{M} \theta^{CH}_{j} \bullet PF_j + G(Z_{CH}),$$

where the θ^{CH}_{j} are non-negative weights that measure the relative price-making power of country j over Chile's traded goods. As $\sum_{j}^{M} \theta^{CH}_{j} = 1$, PTF_{CH} is a weighted average of the price levels (expressed in a single currency) of all countries, including Chile. The term $G(Z_{CH})$ captures all other relevant variables (the "fundamentals"), which is neglected in much of what follows.

Equations 3 and 4 can be rearranged to take the form of a linear combination of all relevant PPP real exchange rates, which reveals the fact that true real exchange rates are multilateral in nature:

$$(5) \qquad TCRV_{CH} = \sum_{j \neq CH}^{M} \theta^{CH}_{j} \bullet TCR^{j}_{CH} + G(Z_{CH}),$$

4 Edwards (1989), for example, defines the real exchange rate as the ratio of the foreign-currency price of traded goods to the domestic-currency price of nontraded goods. But in his empirical analysis, the real exchange rate becomes the PPP version, with the obligatory apology "unfortunately, it is not possible to find an exact empirical counterpart to the [true] analytical construct" [page 87].

5 In this context, Saidi and Swoboda (1983) observed that "... different weighs (in national price indices) for different commodity groups, whether traded or non traded, induce deviations from PPP when relative prices change; these variations will be persistent as long as relative prices changes persist" [page 13]. See also Mussa (1986) on this point.

the sum of the coefficients being $(1-\theta_{CH}^{CH})$. Neglecting $G(Z_{CH})$, equation 5 can be further rearranged to exhibit the key defect of PPP real exchange rates:

$$(5') \qquad TCR_{CH}^{Y} = TCRV_{CH} + \sum_{j \neq CH}^{M} \theta_j^{CH} \bullet TCR_j^{Y}$$

that is, the PPP real exchange rate between Chile and any reference country Y (e.g., the U.S.) deviates from the Chilean true real exchange rate by a linear combination of the PPP real exchange rates between the reference country Y and all third countries. Even neglecting $G(Z_{CH})$, the two real exchange rates are certain to be perfectly correlated only when $\sum_{j \neq CH}^{M} \theta_j^{CH} \bullet TCR_j^{Y}$ is constant; since $TCR_Y^Y \equiv 0$, that requires $\theta_j^{CH} = 0$ for all $j \neq CH, Y$. Thus the Chilean PPP real exchange rate is a good proxy for true real only when no third country can significantly influence the prices of Chilean traded goods. As that condition is unlikely to be met in the real world, the term $\sum_{j \neq CH}^{M} \theta_j^{CH} \bullet TCR_j^{Y}$ introduces measurement error into TCR_{CH}^{Y}.

One must hasten to point out, however, that even if TCR_{CH}^{Y} and $TCRV_{CH}$ are poorly correlated in the short run, the actual long run response of TCR_{CH}^{Y} to a permanent shock to, say, P_Y depends on the degree to which purchasing power parity holds. If PPP holds in the long run between country Y and all third countries (i.e., if PPP real exchange rates are mean reverting), a permanent shock to, say, P_Y will eventually cause an equivalent adjustment in all TC_y^k so the long run effect of that shock on TCR_{CH}^{Y} is nil. In the short run, however, TCR_{CH}^{Y} can exhibit large and persistent deviations that have no counterpart whatsoever in the true real exchange rate.

The Banco Central of Chile calculates a multi-lateral version of the PPP real exchange rate; that rate may or may not be an improvement over the simple version of the PPP real exchange rate as it is a weighted average of several PPP real exchange rates:

$$(6) \qquad TCR_{BC} = \sum_j \upsilon_j \bullet TCR_{CH}^{j},$$

where the υ_j weights (wich sum to unity) are based on trade volumes. It is readily shown that the Banco Central PPP real exchange rate is subject to measurement error; neglecting $G(Z_{CH})$, equation 6 can be rearranged as follows:

$$(6') \qquad TCR_{BC} = TCRV_{CH} + \sum_j (\upsilon_j - \theta_j^{CH}) \bullet PF_j.$$

Even though $\sum_j (\upsilon_j - \theta_j^{CH}) = 0$, there is no reason to assume that all $(\upsilon_j - \theta_j^{CH}) = 0$ and hence if the $(\upsilon_j - \theta_j^{CH})$ are positively (negatively) correlated with the PF_j, TCR_{BC} will exhibit a positive (negative) drift away from $TCRV_{CH}$ over time. Although the Banco Central's real exchange rate is similar in form to the true real exchange rate, the two differ in that (i) TCR_{BC} omits the $G(Z_{CH})$ term, (ii) a weighted average is appropriate only if $\theta_{CH}^{CH} = 0$, and (iii) the θ_j^{CH} weights in equation 4 bear no logical relationship to the υ_s in equation 6. Indeed, the θ_j^{CH} ensure that the measurement errors in the TCR_{CH}^j that appear in equation 5 exactly cancel out, which will occur only by chance in TCR_{BC} as defined by equation 6.

II. Tests of the Nominal Exchange Rate

The first issue taken up concerns the stability of the Chilean exchange rate regime over the 1984-94 period. Using monthly data, an quation was estimated that involved the Chilean peso-U.S. dollar exchange rate, the IPC price index, the dollar-DM and dollar-yen exchange rates, and an index of the dollar price of copper; all variables were in natural logarithms. Using the property of any polynomial $\alpha(L)$ of degree N that $\alpha(L) = (1-L) \bullet \tilde{\alpha}(L) + L^N \bullet \alpha(1)$, where $\tilde{\alpha}_k = \sum_{i=0}^{k} \alpha_i$ and L is the lag operator, the equation was parameterized as:

$$(7) \qquad \tilde{\alpha}(L) \bullet \Delta TC_t = \tilde{\beta}(L) \bullet \Delta IPC_t + \tilde{\gamma}(L) \bullet \Delta MARK_t + \tilde{\lambda}(L) \bullet \Delta YEN_t + \tilde{\rho}(L) \bullet COBRE_t$$

$$+\alpha(1) \bullet TC_{t-N} + \beta(1) \bullet IPC_{t-N} + \gamma(1) \bullet MARK_{t-N} + \lambda(1) \bullet YEN_{t-N} + \rho(1) \bullet COBRE_{t-N}$$

Equation 7 was estimated by nonlinear least squares (NLLS) using White's (1980) robust method for standard errors, lags were added until the estimates of $\alpha(1)$, $\beta(1)$, $\gamma(1)$ and $\rho(1)$ stabilized. A test of the joint restriction that of $\alpha(1)$, $\beta(1)$, $\gamma(1)$ and $\rho(1)$ do not differ significantly from zero was not rejected at the 10 per cent level, so the variables in level form were dropped. With the final-form multipliers embedded, equation 7 was re-estimated with nonlinear least squares (NLLS); the results are reported in Table 1.

TABLE 1

FINAL-FORM MULTIPLIERS OF THE NOMINAL EXCHANGE RATE: 1984:1-1994:12

Variable	Coefficient	Std. Err.	t Statistic	P-Value
IPC	0.9994	0.3871	2.5817	0.0098
MARK	0.1474	0.1435	1.0270	0.3044
YEN	0.0001	0.0009	0.0745	0.9406
COBRE	-0.0551	0.0493	-1.1185	0.2634

FINAL-FORM MULTIPLIERS OF THE NOMINAL EXCHANGE RATE: 1984:1-1989:12

Variable	Coefficient	Std. Err.	t Statistic	P-Value
IPC	1.5018	0.6308	2.3806	0.0173
MARK	0.1483	0.1738	0.8532	0.3935
YEN	0.0001	0.0013	0.1084	0.9136
COBRE	-0.1003	0.0434	-2.3106	0.0209

FINAL-FORM MULTIPLIERS OF THE NOMINAL EXCHANGE RATE: 1990:1-1994:12

Variable	Coefficient	Std. Err.	t Statistic	P-Value
IPC	0.3280	0.3227	1.0165	0.3094
MARK	-0.0255	0.0805	-0.3172	0.7511
YEN	-0.0011	0.0010	-1.0448	0.2961
COBRE	-0.1047	0.0828	-1.2648	0.2059

The upper panel of Table 1 contains the results for the entire period. Note that a permanent shock to the IPC of one per cent ultimately results in a highly significant depreciation of the peso by one percent, which suggests that, on average, the regime was a crawling peg and hence without an anchor. Note that no other variables were significant; movements in the exchange rates among the major currencies had no lasting effect on the peso-dollar rate.

The results for political subperiods, however, are quite different. The middle panel of Table 1 reports the final-form multipliers for the 1984-89 period. The final-form multiplier for the IPC is 1.50 (but not significantly different from unity) which is consistent with the frequently heard argument that exchange rate policy was motivated by a desire to drive up the real exchange rate. There is also evidence that the exchange rate responded negatively to increases in the price of copper. For the final period, 1990-94, none of three multipliers are significant, which is consistent with an exchange-rate policy motivated by the desire to reduce the rate of inflation. It is notable that there is no response to changes in the dollar-DM and dollar-yen exchange rate despite the claim that the exchange rate is based on a basket of currencies.

An alternative explanation for the difference in the results for the two subperiods is that, during the second period, the direction of causality became reversed so that the exchange rate was driving the price level, rather than *vice versa*[6]. Assuming that, for the second subperiod, the deterministic component of the price level is defined by $\Delta IPC_t = \tilde{\eta}(L) \bullet \Delta TC_t$, equation 7 becomes:

$$(7') \quad \left[\tilde{\alpha}(L) - \tilde{\beta}(L) \bullet \tilde{\eta}(L)\right] \bullet \Delta TC_t = \tilde{\gamma}(L) \bullet \Delta MARK_t + \tilde{\lambda}(L) \bullet \Delta YEN_t + \tilde{\rho}(L) \bullet COBRE_t$$

$$+\alpha(1) \bullet TC_{t-N} + \beta(1) \bullet IPC_{t-N} + \gamma(1) \bullet MARK_{t-N} + \lambda(1) \bullet YEN_{t-N} + \rho(1) \bullet COBRE_{t-N}$$

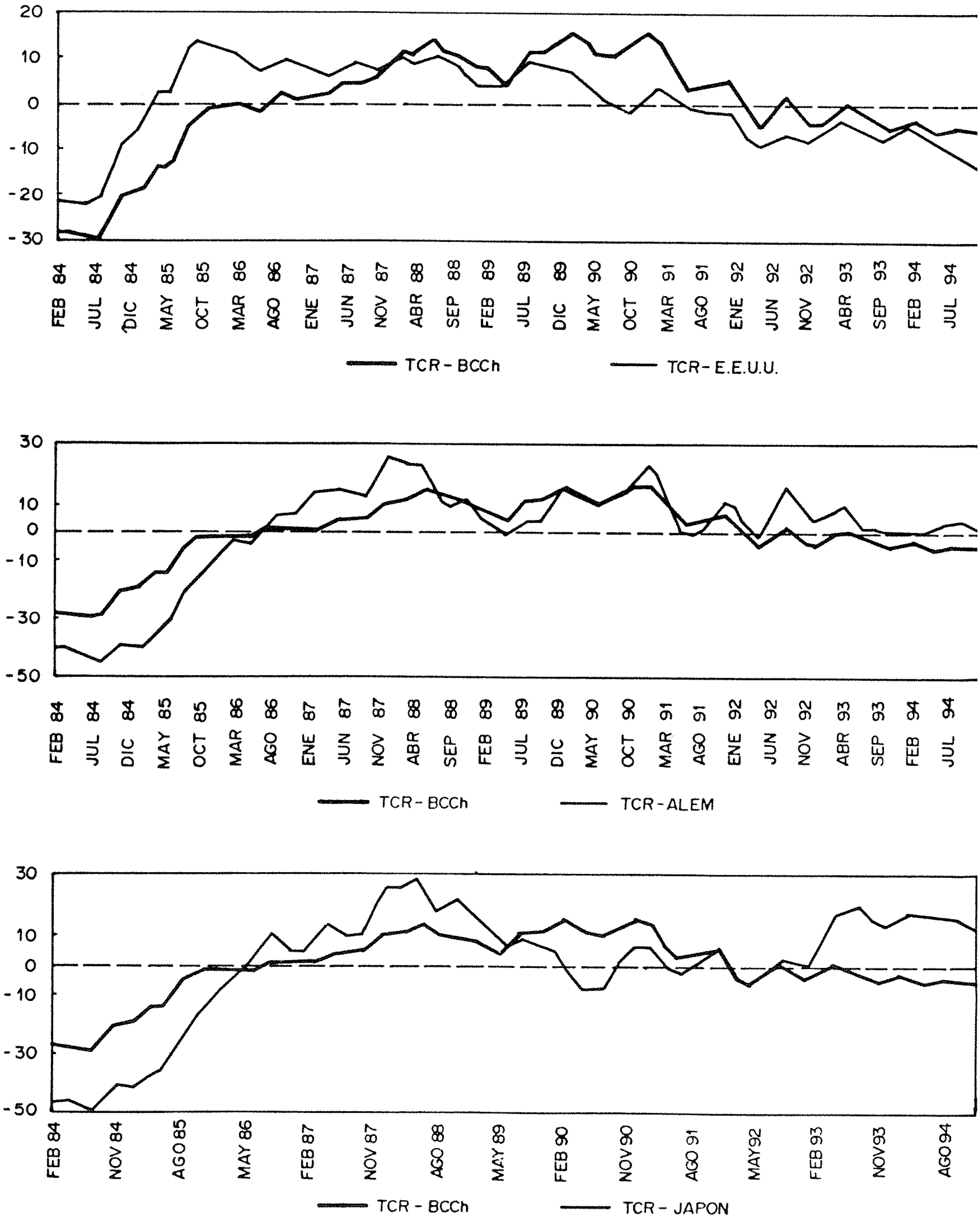
In that case, the final-form multiplier of ΔTC with respect to ΔIPC should not be significant, which is precisely the case. Under either interpretation, it is clear that Chilean exchange rate policy changed significantly with the change in government in 1990. Reducing the rate of inflation received higher priority, with less effort to manipulate the real exchange rate.

III. Alternative Formulations of PPP Real Exchange Rates

Figure 1 presents comparisons of the Banco Central real exchange rate with the Chilean PPP real exchange rate vis á vis the U.S., Germany and Japan for the period 1984-1994. The four real exchange rates exhibit broadly similar patterns, rising to a peak in 1990 and then declining, but the real exchange rates defined on the DM and the yen exhibit substantially greater variance in the early part of the period than does the rate defined on the dollar; in all cases, however, there is a dramatic increase in the real exchange rates in 1984 and 1985 when the economy was recovering from severe recession. Finally, the peso-DM and peso-yen real exchange rates tend to exceed the Banco Central real rate in the second half of the period, and the peso-dollar real rate has consistently been below the Banco Central rate since mid-1989 (which reflects the progressive weakness of the U.S. dollar in recent years).

6 The author is indebted to an anonymous referee for suggesting this possibility.

FIGURE 1
ALTERNATIVE REAL EXCHANGE RATE MEASURES



On the assumption that the Banco Central real exchange rate captures the true real exchange rate, equation 5 was estimated using TCR_{BC} as the dependent variable and the PPP real exchange rates vis á vis the dollar, the DM (for the European Union) and the yen (for the yen bloc) as independent variables; the equation was parameterized in the same way as was equation 7. The restriction that the coefficients of the variables in level form do not differ significantly from zero could not be rejected (albeit at the four per cent level), so those variables were dropped. The final form multipliers are reported in Table 2.

The implied estimates of the "theta" coefficients are highly significant for the dollar and DM blocs, but not so for the yen. The sum of the coefficients is close to-but significantly different from- unity; the t statistics and P-value in the last line of the upper panel of Table 2 are against a unit sum. These results indicate that, insofar as the Banco Central real exchange rate is concerned, the peso-dollar PPP real exchange rate has roughly double the weight of the peso-DM rate and that, if the Banco Central real exchange rate is a reasonable facsimile of Chile's true real exchange rate, the dollar and DM blocs are dominant in determining world prices of Chilean traded goods. The exercise was repeated with Japan excluded, and the results are reported in the lower panel of Table 2; that exclusion clearly has only very minor effects.

TABLE 2
FINAL-FORM MULTIPLIERS FOR THE BANCO CENTRAL REAL EXCHANGE RATE:
1984:1-1994:12

THREE COUNTRIES: U.S., GERMANY, JAPAN

Variable	Coefficient	Std. Err.	t Statistic	P-Value
TCR=$	0.5792	0.0724	7.9980	0.0000
TCR-DM	0.2602	0.0581	4.4760	0.0000
TCR-YEN	-0.0074	0.0712	-0.1039	0.9173
SUM	0.8320	0.0591	2.8432*	0.0045*

TWO COUNTRIES: U.S. AND GERMANY

Variable	Coefficient	Std. Err.	t Statistic	P-Value
TCR=$	0.5649	0.0609	9.2764	0.0000
TCR-DM	0.2716	0.0406	6.6926	0.0000
SUM	0.8364	0.0552	2.9606*	0.0031*

*t statistics are against unity.

IV. The Determinants of the Chilean True Real Exchange Rate

A true real exchange rate for Chile was constructed using unit-value data based on nominal and real volumes of imports and exports[7]. The unit-value data for imports and exports are available on a quarterly basis only since 1986. In developing a price series for traded goods, the first difficulty was discovering the appropriate weights to be given to imports and exports. All other things held constant, it follows from the homogeneity postulate that an increase in the domestic price of traded goods must ultimately increase the price of nontraded godds by the same percentage, and hence the proper weight of export prices in PT (and PTF) must be $\delta PT/\delta EXP = (\delta PNT/\delta EXP)_s$, where the subscript s indicates substitution-effect only[8]. Holding the exchange rate and the external terms of trade constant, there clearly exists a change in commercial policy such that $\Delta IMP = \varepsilon_I$, $\Delta EXP = \varepsilon_E$, and $(\delta PNT/\delta IMP)_s \bullet \varepsilon_I + (\delta PNT/\delta EXP)_s \bullet \varepsilon_E = 0$. Since $(\delta PNT/\delta IMP)_s + (\delta PNT/\delta EXP)_s = 1$, it follows that $(\delta PNT/\delta EXP)_s = \varepsilon_I /(\varepsilon_I - \varepsilon_E) \equiv \Omega$ is the proper weight of EXP in PT, and that of IMP is $1-\Omega$:

$$(8) \qquad PT = (1-\Omega) \bullet EXP + \Omega \bullet IMP$$

$$IMP + (1-\Omega) \bullet TT,$$

and $PTF = IMPF + (1-\Omega) \bullet TT$. As Ω is a free parameter, there is no specification error and hence the homogeneity postulate is not violated.

The Ω parameter was estimated on the basis of an equation set up exactly as was equation 7 but in which IPC price index was the dependent variable and foreign-currency import unit values, the terms of trade, nominal wages, and the exchange rate were the independent variables[9]:

$$(9) \qquad \tilde{\alpha}(L) \bullet \Delta IPC_t = \tilde{\beta}(L) \bullet [\Delta IMPF_t + (1-\Omega_{IPC}) \bullet \Delta TT_t] + \tilde{\gamma}(L) \bullet \Delta WN_t + \tilde{\lambda}(L) \bullet \Delta TC_t$$

$$+ \alpha(1) \bullet IPC_{t-N} + \beta(1) \bullet [IMPF_{t-N} + (1-\Omega_{IPC}) \bullet TT_{t-N}] + \gamma(1) \bullet WN_{t-N} + \lambda(1) \bullet TC_{t-N}.$$

Equation 9 has the property that it is homogenous of the degree one in nominal wages (a proxy for the price of nontraded goods) and the exchange rate.

An identical equation was specified for the IPM price index, and the two equations were estimated simultaneously by ESTIMA RATS nonlinear system using Hansen's (1982) generalized method of moments (NLSYSTEM-GMM). The estimates of both Ω_{IPC} and Ω_{IPM} were 0.72, with t statistics (against zero) of 8.30 and 6.86, respectively. Moreover, since the restriction that equation 8 is homogeneous of degree one in nominal wages and the exchange rate, and that $\Omega_{IPC} = \Omega_{IPM}$ could not be rejected at the 30 per level of significance, those restrictions were imposed and the restricted estimate of $\Omega_{IPC} = \Omega_{IPM} = \Omega$ was 0.74 with a t statistic against zero of 8.18.

Equation 9 is very similar to the "omega" equation, $PNT-EXP = \omega \bullet (IMP-EXP)$, introduced by Sjaastad (1980) to quantify the "incidence" of protection. The incidence

7 Details concerning the exact manner in which the unit-value data were constructed are available from the Instituto de Economía, Universidad Católica de Chile.

8 Since $\delta PT/\delta EXP = (\delta PNT/\delta EXP)_S,/(\delta PNT/\delta PT)_S$, and as $(\delta PNT/\delta PT)_S = 1$ if follows from the homogeneity postulate that $\delta PT/\delta EXP = (\delta PNT/\delta EXP)_S$.

9 The fact that the polynomials in equation (9) are the same as those in equation (7) is of no significance.

parameter, $\delta PNT/\delta IMP = \omega$, summarizes the substitution effect noted by Dornbusch (1974). It follows from the definition of the price level that:

$$\delta P/\delta IMP = w \bullet (\delta PNT/\delta IMP) + (1\text{-}w) \bullet (\delta PT/\delta IMP)$$

$$= w \bullet \omega + (1\text{-}w) \bullet \Omega ,$$

but since it follows from equation 8 that $\delta P/\delta IMP = \Omega$, it also follows that $\Omega = \omega$. The restricted estimate of Ω is quite consistent with estimates of ω obtained for Chile (and other countries as well) using other methods.

The restricted estimate of Ω was used to construct a foreign-currency price index for traded goods (PTF) according to equation 8, which was then used to create an index of the true real exchange rate (TCRV) as defined by equation 1. Figure 2 presents comparisons of the Banco Central real exchange rate with the Chilean true real exchange rate defined first on the IPM and next on the IPC using quarterly data for the period 1986-1994. For purposes of comparison, the final panel of that Figure presents a real exchange rate defined as the natural logarithm of the ratio of the import unit-value index (in pesos) to the IPC. As can be seen, the overall behavior of all real exchange rates is quite similar; they tend to be relatively stable in the first part of the period, and then tend to fall by about thirty percent during the 1990s.

Preliminary examination of the true real exchange rates suggested that they were strongly affected by changes in the trade surplus (the well-known Salter (1959) effect) but that the effect was much stronger in the second half of the period than in the first. This difference suggests that the degree of the Salter effect may depend upon the level of economic activity; when unemployment is high, an increase in expenditure (i.e., a decline in the trade surplus) is reflected mainly in an increase in production of nontraded goods, whereas when the unemployment rate is low, the effect is mainly on the prices of nontraded goods. Accordingly, the following equation was specified:

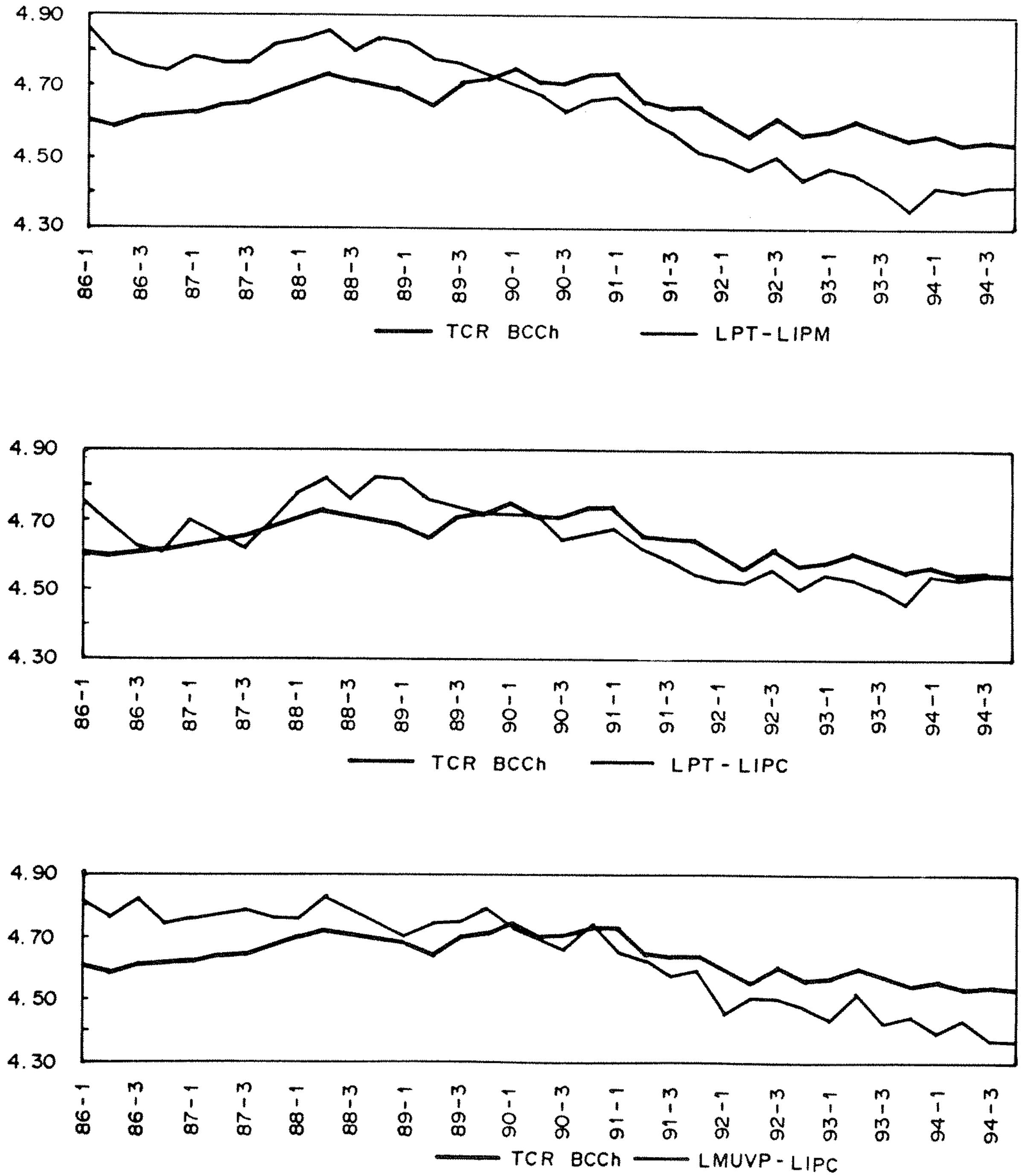
$$(10) \quad \tilde{\alpha}(L) \bullet \Delta TCRV_t = \left[\exp(U^*) - \exp(U)\right] \bullet \tilde{\beta}(L) \bullet \Delta TB_t + \tilde{\gamma}(L) \bullet \Delta TT_t + \alpha(1) \bullet TCRV_{t-N}$$

$$+ \left[\exp(U^*) - \exp(U)\right] \bullet \beta(1) \bullet TB_{t-N} + \gamma(1) \bullet TT_{t-N},$$

where U is the unemployment rate and U* is the level of unemployment at which the Salter effect vanishes[10]. The external terms of trade are included because the real income effect of a change in those terms of trade may affect the demand for nontraded goods and hence the true real exchange rate. The final-form multiplier of TCRV with respect to TB is defined as $\left[\exp(U^*) - \exp(\overline{U})\right] \bullet \beta(1) / \alpha(1)$, where $\overline{U}$ is the average unemployment rate for the entire period. As exports minus imports are equal to Y minus Y^e, where Y is output and Y^e is expenditure, it follows that $TB = 1\text{-}(Y^e/Y)$, so $Y/Y^e = 1/(1\text{-}TB)$. As TB usually is very small (less than ten percent in the Chilean case), 1/(1-TB) is approximately 1+TB and hence TB is a very good approximation for $\ln(Y/Y^e)$. The final-form multiplier, then, is the elasticity of TCRV with respect to the ratio of income to expenditure.

10 Again the fact that the polynomials in equation (10) are the same as those in equation (7) is of no significance.

FIGURE 2
ALTERNATIVE TRUE REAL EXCHANGE RATE MEASURES



All parameters of equation 10, including U^e, were estimated by nonlinear least squares (NLLS) using quarterly data for the period 1986-1994, and the results for two subperiods and the entire 1987-94 period are summarized in the upper panel of Table 3. The estimates of the final-form elasticity of the real exchange rate with respect to the income-expenditure ratio are highly significant and are substantially larger for the second half of the period (1991-94). Moreover, that elasticity is larger when the real exchange rate is defined on consumer prices than wholesale prices, which arises from the fact that the wholesale price index includes far more traded goods than does the consumer price index. Neither of the estimates of the final-form multiplier of the real exchange rate with respect to the terms of trade, TT, are significantly different from zero, but the estimates of U* are both highly significant and very similar to the average level of unemployment during 1987.

Equation 10 also was estimated using the multi-lateral PPP real exchange rate calculated by the Banco Central; the results appear in the lower panel of Table 3. Again the estimates of the final-form elasticity of the real exchange rate with respect to the income-expenditure ratio are highly significant and are substantially larger for the second half of the period (1991-94), but the estimates are considerably smaller than those obtained using the true real exchange rate. This result suggests that the nominal exchange rate is the mechanism by which the true real exchange rate is adjusted.

Finally, by combining equations 1 and 8, one obtains:

$$\text{EXP} - \text{P} = \text{TCRV} + \Omega \bullet \text{TT}, \tag{11}$$

and hence equation 10 can be re-written as follows:

$$\tilde{\alpha}(L) \bullet \Delta(\text{EXP} - \text{P})_t = [\exp(U^*) - \exp(U)] \bullet \tilde{\beta}(L) \bullet \Delta \text{TB}_t + [\tilde{\gamma}(L) + \Omega] \bullet \Delta \text{TT}_t$$
$$+ \alpha(1) \bullet (\text{EXP} - \text{P})_{t-N} + [\exp(U^*) - \exp(U)] \bullet \beta(1) \bullet \text{TB}_{t-N} + [\gamma(1) + \Omega] \bullet \text{TT}_{t-N}. \tag{12}$$

As estimates of $\gamma(1)$ based on equation 10 (and reported in Table 3) were not significantly different from zero, equation 12 offers an alternative estimate of Ω. That equation was estimated in the same manner as was equation 10, and the results are reported in Table 4. As only the estimate of the final-form elasticity of the true real exchange rate with respect to TT is affected by this transformation of equation 10, only the results for the entire period are reported. The estimates of that final-form elasticity, 0.79 and 0.68 for wholesale consumer prices, respectively, are both highly significant and very similar to the estimates of Ω based on equation 9 and reported earlier. That very similar estimates of Ω can be obtained by quite different methods and utilizing quite different data sets strongly reinforces one's confidence in those estimates.

TABLE 3
ESTIMATED FINAL-FORM MULTIPLIERS OF THE CHILEAN REAL EXCHANGE RATES BASED ON EQUATION 10

REAL EXCHANGE RATE DEFINED ON THE IPM PRICE INDEX:

Period	Variable	Coefficient	Std. Err.	t Statistic	P-Value
1987:1-1994:4	TB	1.6849	0.1406	11.9812	0.0000
	TT	0.0534	0.0930	0.5739	0.5740
	U*	0.0750	0.0010	76.1984	0.0000
1987:1-1990:4	TB	0.3920	0.0327	11.9812	0.0000
1991:1-1994:4	TB	2.9777	0.2485	11.9812	0.000

REAL EXCHANGE RATE DEFINED ON THE IPC PRICE INDEX:

Period	Variable	Coefficient	Std. Err.	t Statistic	P-Value
1987:1-1994:4	TB	3.4124	0.4424	7.7126	0.0000
	TT	-0.0597	0.1822	-0.3277	0.7474
	U*	0.0860	0.0042	21.2214	0.0000
1987:1-1990:4	TB	2.0577	0.2668	7.7126	0.0000
1991:1-1994:4	TB	4.7670	0.6181	7.7126	0.000

REAL EXCHANGE RATE DEFINED BY THE BANCO CENTRAL DE CHILE:

Period	Variable	Coefficient	Std. Err.	t Statistic	P-Value
1987:1-1994:4	TB	1.3963	0.2280	6.1233	0.0000
	TT	-0.1895	0.1143	-1.6574	0.1169
	U*	0.0808	0.0026	31.9377	0.0000
1987:1-1990:4	TB	0.6775	0.1106	6.1233	0.0000
1991:1-1994:4	TB	2.1152	0.3454	6.1233	0.000

TABLE 4
ESTIMATED FINAL-FORM MULTIPLIERS OF THE CHILEAN REAL EXCHANGE RATES BASED ON EQUATION 12

REAL EXCHANGE RATE DEFINED ON THE IPM PRICE INDEX:

Period	Variable	Coefficient	Std. Err.	t Statistic	P-Value
1987:1-1994:4	TB	1.6849	0.1406	11.9812	0.0000
	TT	0.7901	0.0930	8.4961	0.0000
	U*	0.0750	0.0010	76.1984	0.0000

REAL EXCHANGE RATE DEFINED ON THE IPC PRICE INDEX:

Period	Variable	Coefficient	Std. Err.	t Statistic	P-Value
1987:1-1994:4	TB	3.4124	0.4424	7.7126	0.0000
	TT	0.6771	0.1822	3.7170	0.7474
	U*	0.0860	0.0042	21.2214	0.0000

Concluding Comments to Section IV

The dramatic decline in the real exchange rate of Chile since 1990 -by about thirty per cent- appears to be explained by the twin factors of (i) a sustained increase in expenditure relative to income which, via the Salter effect, has a strong impact on the internal relative price structure, and (ii) the substantial decline in unemployment, which has reinforced the strength of the Salter effect. Viewed in that light, the Chilean peso does not -as of the end of 1994- appear to be overvalued. Moreover, while the behavior of the true real exchange rate and the Banco Central multi-lateral PPP real rate are broadly similar, there are important differences between the two. In particular, the Banco Central real rate is far less sensitive to changes in the trade balance than is the true real exchange rate.

V. Determinants of the Real Interest Rate in Chile

In this section we develop a framework for examining the behavior of the real rate of interest in Chile, and how it depends upon the exchange rate mechanism. In particular, it indicates the manner in which Chilean real interest rates might systematically differ from external real rates. As the entire section is quite tentative, it should be viewed as an outline for future research.

Although the evidence from Section II is not conclusive, it is claimed that the Chilean exchange rate is defined against a basket currency, the weights of which reflect volumes of trade. The main advantage of a currency basket is that it allows two degrees of freedom -the composition of the basket and the rule itself- and, as will be seen, the additional degree of freedom permits targeting the real rate of interest, which involves two nominal variables. An exchange rate rule defined on a single currency (a special case of a currency basket), expends one degree of freedom inefficiently as all of the weight is given to one currency, whereas defining that rule on a basket of currencies offers a richer choice of weights. Although in practice the number of relevant currencies is likely to be small, the basket will be defined on all major currencies.

The Definition of the Basket

The basket rule will be developed in terms of its exchange rate with a reference currency 1. The basket is labelled "B" and its value in terms of currency 1 is designated tc_1^B ($\ln tc_1^B = TC_1^B$):

$$(13) \qquad tc_1^B = \sum_{j=1}^{M} tc_1^j \cdot n_j ,$$

where the n_j, the number of units of each major currency in the basket, define its composition. The price of the basket in terms of any currency X is:

$$(14) \qquad tc_x^B = tc_x^1 \cdot tc_1^B = tc_x^1 \cdot \sum_{j=1}^{M} tc_1^j \cdot n_j ,$$

which also defines the exchange rate rule. It is straightforward to show that:

$$(15) \qquad dTC_x^1 = dTC_x^B - \sum_{j=2}^{M} \gamma_j \cdot dTC_1^j ,$$

where $\gamma_j \equiv (tc_1^j \cdot n_j) / tc_1^B$ is the weight of the j^{th} currency in that basket and dTC is rate of change of the natural logarithm of a nominal exchange rate.

The Real Rate of Interest with a Basket-Based Exchange Rate Rule

The Chilean real interest rate is given by $r_{CH} = i_{CH} - \Pi_{CH}$, which requires an expression for the Chilean inflation rate. Equation 4 can be manipulated into de following form:

$$PT_{CH} = TC_{CH}^k + P_k + \sum_{j}^{M} \theta_j^{CH} \cdot TCR_k^j ,$$

where P_k is the (natural logarithm of) price level of country k in its own currency, $TCR_k^j = P_j + TC_k^j - P_k$ is the PPP real exchange rate between countries k and j, and the term $G(Z_{CH})$ has been suppressed. In terms of rates of inflation, the above equation can be written as:

$$(4') \qquad \Pi^{T}_{CH} = dTC^{k}_{CH} + \Pi_{k} + \sum_{j}^{M} \theta^{CH}_{j} \bullet dTCR^{j}_{k} ,$$

where the notation is obvious.

Assume now, for simplicity of exposition, that the true real exchange rate is constant, so that $\Pi_{CH} = \Pi^{T}_{CH}$[11]. As equation 15 defines an implicit exchange rate rule on the reference currency (i.e., currency 1), we can replace dTC^{k}_{CH} in equation 4' with equation 15 to obtain a general expression for the Chilean inflation rate:

$$(16) \qquad \Pi^{b}_{CH} = \Pi^{CH}_{W} + dTC^{B}_{CH} + \sum_{j=2}^{M} \left(\Theta^{CH}_{j} - \gamma_{j}\right) \bullet dTC^{j}_{1} ,$$

where the new "thetas" are defined as $\Theta^{CH}_{j} \equiv \theta^{CH}_{j} / (1-\theta^{CH}_{CH})$; as $\sum_{j \neq CH}^{M} \Theta^{CH}_{j} = 1$, they measure country j's share of power in the world market for Chilean tradeables, excluding Chile itself. The term $\Pi^{CH}_{W} = \sum_{j \neq CH}^{M} \Theta^{CH}_{j} \bullet \Pi_{j}$ is the "world" rate of inflation from the point of view of Chile: a weighted average of external inflation rates using the Chilean thetas as weights. By choosing the weights of the basket such that $\gamma_{j} = \Theta^{CH}_{j}$, equation 16 becomes:

$$(16') \qquad \Pi^{b}_{CH} = \Pi^{CH}_{W} + dTC^{B}_{CH}.$$

Obviously, the exchange rate rule *vis á vis* the currency basket (i.e., dTC^{B}_{CH}) can be chosen to create whatever rate of inflation Chileans may desire[12].

An exchange rate rule defined on a currency basket also provides greater scope for reducing the variance in real interest rates. Asume now a credible exchange rate rule defined on a basket of M currencies; with the peso freely convertible into a fixed package of those M currencies, the Chilean nominal interest rate, i_{CH}, will be a weighted average of the interest rates, i_j, on the currencies included in the basket plus the rule itself (and a spread):

$$(17) \qquad i^{b}_{CH} = \sum_{j}^{M} \gamma_{j} \bullet i_{j} + dTC^{B}_{CH} + \text{spread},$$

where the b superscript on i^{b}_{CH} indicates a basket exchange rate rule. By substituting equations 16 and 17 for the inflation and the nominal interest rates into the expression for the real interest rate, we obtain an expression for the real of interest, r^{b}_{CH}:

11 On this context, a movement in the true real exchange rate merely creates a differential between the real rates of interest in the traded and nontraded goods sectors.

12 It is often proposed that the weights of a currency basket should reflect trade patterns; while such exchange rates may have some value as descriptive devices, it is evident from the foregoing analysis that they have no deep theoretical significance.

$$(18) \quad r^b_{CH} \equiv i^b_{CH} - \Pi^b_{CH} = r^b_w - \sum_{j=2}^{M} (\Theta^{CH}_j - \gamma_j) \bullet dTC^j_1 ,$$

where $r^b_w \equiv \sum_{j=2}^{M} \gamma_j \bullet r_j$ is the "world" real rate of interest (and the "spread" has been dropped). The last term on the right side of equation 18 is eliminated if the composition of the basket is such that the γ_j weights are equal to the θ^{CH}_j coefficients.

In principle, by a prudent choice of weights, a basket-based exchange rate rule would permit Chile to *completely* insulate her domestic real interest rate from fluctuations in third-currency exchange rates such that its own real rate of interest is equal to the "world" real rate. Just how the Chilean real rate of interest behaves clearly depends upon the weights chosen by the Banco Central for its currency basket (the γ_j). If those weights differ significantly from the θ^{CH}_j, the Chilean real rate of interest (even if the true real exchange rate were constant) will depart in an erratic fashion from real rates in the rest of the world.

Borrowing Abroad Versus Borrowing in Chile

For a Chilean financial institution that borrows in, say, the United States and lends in Chile, the *ex post* real rate of interest on the loan is given by:

$$(19) \quad r^{US}_{CH} = i_{US} + dTC^{US}_{CH} - \Pi_{CH},$$

and were the borrowing to take place in Chile, the real rate would be $r_{CH} = i_{CH} - \Pi_{CH}$. Again assuming that Chile is pursuing a well-defined basket-based exchange rate rule, equation 17 and 19 can be combined into an expression for the difference between r_{CH} and r^{US}_{CH}:

$$r_{CH} - r^{US}_{CH} = \sum_{j}^{M} \gamma_j \bullet i_j - i_{US} + \left(dTC^{B}_{CH} - dTC^{US}_{CH}\right),$$

where the "spread" has been neglected. Since $dTC^{B}_{CH} - dTC^{US}_{CH} = dTC^{B}_{US} = \sum_{j}^{M} \gamma_j \bullet dTC^{j}_{US}$ and $dTC^{j}_{US} = -dTC^{US}_{j}$, the real interest rate differential can be written as:

$$(20) \quad r_{CH} - r^{US}_{CH} = \sum_{j}^{M} \gamma_j \bullet (i_j - i_{US} - dTC^{US}_j),$$

where $i_j - i_{US} - dTC^{US}_j$ is the departure from uncovered interest rate parity between the U.S. and country j.

The real interest rate differential, r_{CH} - r^{US}_{CH}, can be expressed more conveniently in terms of PPP real exchange rates between the U.S. and country j; it follows from the very definition of PPP real exchange rates that:

$$dTC^{US}_j = \Pi_j - \Pi_{US} + dTCR^{US}_j,$$

and hence, after some manipulation, equation 20 can be written as:

$$(21) \qquad r_{CH} - r_{CH}^{US} = (r_W^b - r_{US}) + \sum_j^M \gamma_j \bullet dTCR_j^{US}$$

where $r_{US} = i_{US} - \Pi_{US}$. The real interest rate differential between borrowing in Chile and borrowing in the U.S., then, has two components. The first consists of a systematic component: the real interest differential between the U.S. and the rest of the world, $r_W^b - r_{US}$, which can be estimated. The second component is more stochastic in nature: it is a weighted average of departure from PPP between the U.S. and all other countries (except Chile).

Equation 21 has a rather straight-forward interpretation. As it is assumed that Chile pursues a basket-based exchange rate rule, a *real* appreciation of the U.S. dollar against other major currencies ($dTCR_j^{US} < 0$) leads to an automatic *real* depreciation of the Chilean peso against the dollar, which raises the *ex post* cost to a Chilean institution that has borrowed in the U.S., and hence r_{CH}^{US} tends to rise relative to r_{CH}. Opportunities for arbitrage, then, depend on the ability to predict the term $\sum_j^M \gamma_j \bullet dTCR_j^{US}$, which is not easy. It is true, however, that PPP real exchange rates tend to be mean-reverting and hence when the TCR_j^{US} are "high", they are more likely to decline than to increase[13]. The timing of the movements in PPP real exchange rates are, however, very difficulty to predict.

One of the main topics for further research in this immediate context concerns the true nature of the Chilean exchange rate policy; it is claimed that that policy is based on a basket of currencies the weights of which are based on volumes of trade, but the evidence cited in section III above does not strongly support that claim. A second topic concerns the mean-reverting nature of the PPP real exchange rates between the U.S. and the other major-currency countries; research in that area might provide a basis for predicting the all important $\sum_j^M \gamma_j \bullet dTCR_j^{US}$ component of equation 21.

13 Huizinga (1987) and others find evidence of mean reversion in PPP real exchange rates during the post-Bretton Woods period, and Diebold *et al.* (1991) also find mean reversion during the gold standard era. Evans and Lothian (1993) find both temporary and permanent influences on real exchange rates during the post-Bretton Woods period, and Lothian and Taylor (1995) find strong evidence of mean reversion in both the U.S. dollar/sterling and French franc/sterling real exchange rates during the past two centuries.

APPENDIX: EXCHANGE RATES AND PRICES OF TRADED GOODS

Ignoring transport costs, tariffs and other barriers to trade, the "law of one price" for an internationally-traded good q states that:

$$\text{(A-1)} \qquad P^i_q = P^j_q + EX^j_i,$$

where P^i_q is the (natural logarithm of the) price of good q in currency i, and EX^j_i is the (natural logarithm of the) price of currency j in terms of currency i[14]. With no loss of generality, set i = X; i.e., the currency of country X will be the *reference* currency[15]. The *excess* demand for good q in country j, $D^{j,q}$, is a function of its *real* price and a vector, Z^j_q, of all other relevant variables (i.e., the market "fundamentals" in country j):

$$\text{(A-2)} \qquad D^{q,j} = D^{q,j}\left[(P^j_q - P_j),\ Z^j_q\right]$$

$$= D^{q,j}\left[(P^x_q - EX^j_x - P_j),\ Z^j_q\right],$$

where P_j is the (natural logarithm of the) price level in country j: As:

$$P^x_q - EX^j_x - P_j = (P^x_q - P_x) - (EX^j_x + P_j - P_x)$$
$$\equiv P^{X,R}_q - TCR^j_x,$$

the excess demand for good q in country j can be written as a function of the natural logarithm of the ratio of its *real* price in country X to the PPP *real* exchange rate between countries X and j:

$$D^{q,j} = D^{q,j}\left[(P^{X,R}_q - TCR^j_x),\ Z^j_q\right].$$

In a world of M countries, there are M such excess demand equations which must sum to zero:

$$\sum_j^M D^{q,j} = \left[(P^{X,R}_q - TCR^j_x),\ Z^j_q\right] = 0,$$

and hence in principle there is a solution for $P^{X,R}_q$ in terms of the TCR^j_x and the Z^j_q. By differentiating the summation totally and rearranging:

14 This approach apparently was first employed by Ridler and Yandle (1972) in a study of the effect of exchange rates on commodity prices. The model presented in this appendix first appeared in Sjaastad (1985). A somewhat similar approach has been developed by Dornbusch (1987).

15 As the interest is in currency *blocs* rather than countries, there is no one-to-one correspondence between countries and currencies.

$$dP_q^{X,R} = \sum_j^M \left(D_1^{q,j} / D_1^q\right) \bullet d\left(TCR_x^j\right) - \left(D_2^{q,j} / D_1^q\right) \bullet dZ_q^j,$$

where $D_1^{q,j} \equiv \partial(D_{q,j}) / \partial\left(P_{X,R} - TCR_x^j\right) < 0$, $D_2^{q,j} = \partial(D_{q,j}) / \partial Z_q^j$, and $D_1^q \equiv \sum_j^M D_1^{q,j}$; a linear approximation is obtained by integration:

$$\text{(A-3)} \qquad P_q^{X,R} = \sum_j^M \vartheta_j^q \bullet TCR_X^j + F(Z_q),$$

where $\vartheta_j^q \equiv D_1^{q,j} / D_1^q \geq 0$ and $F(Z_q)$ is the integral of - $\sum_j^M \left(D_2^{q,j} / D_1^q\right) \bullet dZ_q^j$. The ϑ_j^q are non-negative fractions that sum to unity and $F(Z_q)$ captures the Z_q^j vectors (the fundamentals) which are assumed to be orthogonal to the TCR_x^j.

The ϑ_j^q coefficients measure the relative market power possessed by each country and, as such, have no logical relation to international trade patterns. In the limiting case when $\vartheta_j^q = 0$, country j is a price taker in the world market for good q as its real exchange rate vis á vis country X has no effect on the real price of good q in currency X. At the other extreme, if $\vartheta_j^q = 1$ country j is a price maker; any change in its real exchange rate will cause an equi-proportionate change in the real price of good q country X.

Equation A-3 can be generalized to a real price index for any subset of traded goods; that index is defined as $PT_X^R \equiv \sum_q^N w_q \bullet P_q^{X,R}$, where the w_q are non-negative weights that sum to unity. Combining the index with equation A-3:

$$\text{(A-4)} \qquad PT_X^R \equiv \sum_q^N w_q \bullet \left[\sum_j^M \vartheta_j^q \bullet TCR_x^j + F(Z_q)\right]$$
$$= \sum_j^M \theta_x^j \bullet TCR_x^j + G(Z_x),$$

where the $\theta_x^j \equiv \sum_q^N w_q \bullet \vartheta_q^j$, which sum to unity, have the same interpretation as the ϑ_j^q; they measure the relative market power possessed by country j over the prices of the subset of goods traded internationally by country X. The term $G(Z_x) \equiv \sum_q^N w_q \bullet F(Z_q)$ captures the global fundamentals for those goods.

Equation A-4 also can be defined on nominal prices by adding P_x to both sides of equation A-4:

$$PT_x = \sum_j^M \theta_x^j \bullet (EX_x^j + P_j) + G(Z_x),$$

and expressed in the currency of, say, country Y by using the identity $EX_x^j - EX_x^Y \equiv EX_Y^j$ and the property that $\sum_j^M \theta_x^j = 1$:

$$\text{A-5)} \quad PTF_x = \sum_j^M \theta_x^j \cdot PF_j + G(Z_x),$$

where PTF_x and PF_j are expressed in terms of currency Y. It is this expression that appears as equation 4 in the text.

REFERENCES

Diebold, Francis X., Steven Husted and Mark Rush (1991), "Real Exchange Rates Under the Gold Standard", *Journal of Political Economy*, Vol. 99, N° 6; pp. 1252-71.

Dornbusch, R. (1974), "Tariffs and Nontraded Goods", *Journal of International Economics*, Vol. 4: pp. 177-85.

Edwards, S. (1989), *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries*. Cambridge: The MIT Press.

Evans, M. D.D. and J. R. Lothian (1993), "The Response of Exchange Rates to Permanent and Transitory Shocks Under Floating Exchange Rates", *Journal of International Money and Finance*, Vol. 12, pp. 563-86.

Frenkel, J. (1981), "The Collapse of Purchasing Power Parity During the 1970s", *European Economic Review*, Vol 16; pp. 145-65.

Hansen, L. P. (1982), "Large Sample Properties of Generalized Method of Moments Estimators", *Econometrica*, Vol. 50; pp. 1029-54.

Huizinga, J. (1987), "An Empirical Investigation of the Long Run Behavior of Real Exchange Rates", in Karl Brunner and Allan Meltzer (eds.), *Empirical Studies of Velocity, Real Exchange Rates, Unemployment and Productivity*. Carnegie-Rochester Conference Series on Public Policy, Vol. 27. Amsterdam: North-Holland Publishing Company.

Jones, R. W. and Douglas D. Purvis (1983), "International Differences in Response to Common External Shocks: The Role of Purchasing Power Parity", in Emil Claassen and Pascal Salin (eds.), *Recent Issues in the Theory of Flexible Exchange Rates*. Amsterdam: North-Holland Publishing Company; pp. 33-55.

Lothian, J. R. and M. P. Taylor (1995), "Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries", *Journal of Political Economy* (forthcoming).

Mussa, M. (1979), "Empirical Regularities in the Behavior of Exchange Rates and Theories of the Foreign Exchange Market", in Karl Brunner and Allan Meltzer (eds.), *Policies for Employment, Prices, and Exchange Rates*. Carnegie-Rochester Conference Series on Public Policy, Vol. 11. Amsterdam: North-Holland Publishing Company; pp. 9-57.

Mussa, M. (1986), "Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates: Evidence and Implications", in Karl Brunner and Allan Meltzer (eds.), *Real Business Cycles, Real Exchange Rates and Actual Policies*. Carnegie-Rochester Conference Series on Public Policy, Vol. 25. Amsterdam: North-Holland Publishing Company; pp. 117-213.

Ridler, D. and C.A. Yandle (1972), "A Simplified Method for Analyzing the Effects of Exchange Rate Changes on Exports of a Primary Commodity", *IMF Staff Papers*, Vol. 19.

Saidi, Nasser and Alexander Swoboda (1983), "Nominal and Real Exchange Rates: Issues and Some Evidence", in Emil Claassen and Pascal Salin (eds.), *Recent Issues in the Theory of Flexible Exchange Rates*. Amsterdam: North-Holland publishing Company; pp. 3-27.

Salter, W. E.G. (1959), "Internal and External Balance: The Role of Price and Expenditure Effects", *Economic Record*, Vol 35, N° 71 (August).

Sjaastad, L. A. (1980), "Commercial Policy, 'True Tariffs' and Relative Prices", in John Black and Brian Hindley (eds.), *Current Issues in Commercial Policy and Diplomacy*. London: Macmilan.

Sjaastad, L. A. (1985), "Exchange Rate Regimes and the Real Rate of Interest", in Michael Connolly and John Mc Dermott (eds.). *The Economics of the Caribbean Basin*. New York: Praeger Publishers.

Sjaastad, L. A. (1995), "On Exchange Rates, Nominal and Real", (mimeo).

Theil, H. and J.C.G. Boot. (1962), "The Final Form of Econometric Equation Systems", *Review of the International Statistical Institute*; pp. 136-52.

White, H. (1980), "A Heterocedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heterocedasticity", *Econometrica*, Vol. 48.