COMMENT ON "TIPO DE CAMBIO REAL Y GASTO PUBLICO: UN MODELO ECONOMETRICO PARA CHILE"

LARRY A. SJAASTAD

In a recent paper published in Cuadernos de Economía**, Arellano and Larraín (1996) present estimates of the impact of government spending both on the Chilean real exchange rate and the Salter (1959) effect—the semi-elasticity of the real exchange rate with respect to the ratio of income to expenditure. Arellano and Larraín claim that in Chile during the 1982-93 period (i) an increase in the share of public-sector spending of one percentage point of gross national product (GDP), holding output and total spending constant, will reduce the real exchange rate by nearly three per cent, and (ii) an increase in total spending by one per cent, with its composition and GDP held constant, will reduce the real exchange rate by 1.7 per cent (see their Table 8B). These findings, particularly those with respect to the effect of government expenditure on the real exchange rate which have been publicized to an extraordinary degree, have been met with a high degree of skepticism among professional economists. It is the purpose of this comment to show why that skepticism has not been misplaced.

There are two problems with these results; first, the Arellano and Larraín estimate of government spending effect on the Chilean real exchange rate is so implausibly large that it borders on the bizarre. Secondly, that estimate and their estimate of the Salter effect are grossly inconsistent.

Arellano and Larraín attribute the strong effect of government expenditure on the real exchange rate to a high marginal propensity to spend on nontraded goods and services on the part of the government. While the bulk of government spending in Chile is on services and transfers (during the period in question, about half of government outlays in Chile were on transfers and only twelve per cent were on capital investment), it is naive to think that either the relative level or pattern of government expenditure can significantly affect the overall composition of total spending. Outlays by the Chilean government on transfers and nontraded goods merely transfer purchasing power from the pockets of one set of Chileans to another.

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** Cuadernos de Economía, Vol. 33, No. 98, abril 1966.
set - a Chilean Peter is paid by robbing a Chilean Paul. What is relevant is the difference between \( m_n^g \), the marginal propensity to spend on nontraded goods by those who sell goods and services to the government and/or benefit from transfer payments, and \( m_n^1 \), that propensity for those whose taxes go to finance government expenditure. As both groups are predominantly Chilean and the two groups are very heavily overlapping, that difference cannot be very large. In other words, while Peter and Paul may not be identical twins, they are close relatives with similar spending habits

To formally develop the point, let \( y_n^c \) be total expenditure, \( y_n^c \) be expenditure on nontraded goods, \( a_n = y_n^c / y_n^c \) be the overall average propensity to spend on nontraded goods, \( g \) be government expenditure, \( g_y = g / y_n^c \), and \( \ln P_n \) (\( P_T \)) be the natural logarithm of a price index for nontraded (traded) goods. With \( \ln P_n \), \( P_T \), and \( y_n^c \) constant, it is obvious that \( \partial y_n^c / \partial g = (m_n^g - m_n^1) \equiv \delta \) is the change in the demand for nontraded goods induced by a one peso increase in government expenditure. When expressed in terms of \( Y_n^c = \ln y_n^c \) and \( g_y \), that result is \( \partial Y_n^c / \partial g_y = \left( (\partial y_n^c / \partial g) / (\partial g_y / \partial g) \right) / y_n^c = \delta / a_n \). The Arellano-Larraín argument implies that \( \delta \) is so large relative to \( a_n \) that a small transfer of purchasing power between two broad sets of Chileans has a quantitatively important effect on the structure of demand. It is the same argument that was the basis for an early Keynesian view on fiscal policy that lead to the formulation of the once celebrated but now long discredited balanced-budget multiplier.

The results in the Arellano-Larraín paper, however, refer to the real exchange rate as defined by the Banco Central, which is a multilateral version of the purchasing-power-parity real exchange rate that can be expressed, in natural logarithms, as \( \Delta LTCR = \Delta \ln P^* - \Delta \ln IPC \), where \( \Delta \ln P^* \) refers to a weighted average of external price levels (expressed in pesos) and \( \Delta \ln IPC \) to the Chilean IPC. Writing the latter as \( \Delta \ln IPC = a_n \cdot P_n + (1 - a_n) \cdot P_T \), the Banco Central’s real exchange rate becomes \( \Delta LTCR = (\Delta \ln P^* - \Delta P_T) + a_n \cdot (\Delta P_T - P_n) \); with \( P_T \) held constant, \( \partial \Delta LTCR / \partial P_n = -a_n \). Moreover, elementary price theory indicates that \( \partial P_n / \partial Y_n^c = 1 / (\varepsilon_n - \eta_n) \), where \( \varepsilon_n \geq 0 \) and \( \eta_n \leq 0 \) are the own-price elasticities of supply of an demand for nontraded goods, so \( \partial P_n / \partial g_y = (\partial P_n / \partial Y_n^c) \cdot (\partial Y_n^c / \partial g_y) = (\delta / a_n) / (\varepsilon_n - \eta_n) \) and the effect of government expenditure on that real exchange rate is:

\[
\partial \Delta LTCR / \partial g_y = -a_n \cdot (\partial P_n / \partial g_y) \\
= -\delta / (\varepsilon_n - \eta_n)
\]

The Arellano and Larraín estimate of \( \delta / (\varepsilon_n - \eta_n) \) is nearly 3.0, which requires either that \( \delta \) be very large, or that the elasticity term \( (\varepsilon_n - \eta_n) \) be much

\[1\] While Arellano and Larraín differentiate their study from earlier ones with the argument that their measure of government expenditure includes transfer payments, they present no evidence whatsoever that the tastes and preferences of Chilean recipients of transfer payments differ so dramatically from those of others who are eating at the public trough.
smaller than one would expect in a highly open economy such as that of Chile.

The second problem arises from the fact that the government expenditure and Salter effects are closely related, but the Arellano-Larraín estimates of the two cannot be reconciled. Their estimate of the Salter effect uses the variable TSD = (y – ye) / y, where y is GDP.

Since \( Y^e - Y = \ln(y^e / y) = \ln\left[1 - (y - y^e) / y\right] \) is a close approximation of -TSD, the Salter effect also is closely approximated by:

\[
\frac{\partial \text{LTCR}}{\partial \text{TSD}} = - \frac{\partial \text{LTCR}}{\partial y^e}
\]

\[
= - \left( \frac{\partial \text{LTCR}}{\partial P_n} \right) \left( \frac{\partial P_n}{\partial Y^e_n} \right) \left( \frac{\partial Y^e_n}{\partial y^e} \right)
\]

\[
= \left[ a_n / (\varepsilon_n - \eta_n) \right] \cdot \left( m_n / a_n \right)
\]

\[
= m_n / (\varepsilon_n - \eta_n),
\]

where \( m_n = \partial y^e_n / \partial y^e \) is the overall marginal propensity to spend on non traded goods. When combined, equations (1) and (2) imply a very simple relationship between the government expenditure and Salter effects:

\[
\frac{\partial \text{LTCR}}{\partial g_y} = - \left( \frac{\delta}{m_n} \right) \cdot \left( \frac{\partial \text{LTCR}}{\partial \text{TSD}} \right)
\]

Without a Salter effect, there is no government expenditure effect; even with a Salter effect, the government expenditure effect is nil if \( \delta = (m^g_n - m^b_n) = 0 \).

Since all Chileans pay taxes of one form or another, and as the Chilean tax system is not highly progressive, the marginal propensity to spend on non traded goods by Chilean taxpayer, \( m^b_n \), must be very similar to the overall propensity, \( m_n \). As a first approximation, then, \( \delta / m_n = (m^g_n - m_n) / m_n = m^g_n / m_n - 1 \), and:

\[
\frac{m^g_n}{m_n} = 1 - \left( \frac{\partial \text{LTCR}}{\partial g_y} \right) / \left( \frac{\partial \text{LTCR}}{\partial \text{TSD}} \right)
\]

Using the current government expenditure variable, GC3D, Arellano-Larraín estimate \( \partial \text{LTCR} / \partial g_y \) and \( \partial \text{LTCR} / \partial \text{TSD} \) (reported in their Table 8B) to be -2.96 and 1.72, respectively, indicating that \( m^g_n / m_n = 1 + 2.96 / 1.72 = 2.72 \), whose standard error is 0.32. The sheer implausibility of this result is made evident by the observation that value added in Chilean agriculture, industry, and manufacturing is about two-thirds of GDP so even if those sectors produced mainly traded goods, the average propensity to spend on non traded goods, \( a_n \), cannot be less than about 0.4. Moreover, in view of the high income elasticity of demand for services, the marginal propensity to spend on non traded goods, \( m_n \), is unlikely to be less than the average.

\[2 \] The standard error was obtained by a Taylor expansion.
Taken at face value, then, the Arellano and Larraín results, imply that $m_n^g$ exceeds unity; in other words, their estimates imply that for a very broad group of Chileans - those who derive income as employees, pensioners, and suppliers of goods to the public sector - traded goods are inferior! As the patent absurdity of this implication destroys the credibility of their estimates, which of the two is correct? As will be shown, the answer is probably neither.

The source of this inconsistency may be estimation bias caused by strong trends in both the government expenditure and the real exchange rate during the early years of their sample period. The strength of these trends is evident in Graph 1 of the Arellano-Larraín paper; indeed, the trend in the real exchange rate during those early years is so pronounced that they found that variable to be integrated of order 1 (see their Table 7B). A unit root based on such a short time series, however, is inconclusive as that finding may result merely from a strong but short-term trend rather than a random walk, particular when, by its very nature, the variable in question should be stationary. Even though short samples of real exchange rate data often fail unit-root tests, there is considerable evidence that real exchange rates are mean reverting and hence cannot be random walks. Moreover, finding a unit root for a real exchange rate in such a short time series is a warning (one the authors acknowledged but apparently ignored) that the data have unusual characteristics which may render them unsuitable for estimation by standard econometric techniques.

Several tests were made to determine if the strong trends in the government expenditure and real exchange rate variables during the early years of their sample period so biased the Arellano-Larraín estimates as to generate the inconsistency in their results. The most obvious test involves merely eliminating the early years from the sample. An ordinary least squares (OLS) estimate of the equation which Arellano and Larraín report in their Table 8B - and made with their data set - is summarized in panel A of Table 1. The only difference with their results is that the standard errors were estimated using White's (1980) "robust errors" method. Arellano and Larraín apparently overlooked a strong second-quarter seasonal effect in the TSD variable; with that effect eliminated, the standard error of estimate (SEE) declined from 9.08 to 8.35 per cent and the coefficient of TSD increased sharply, but the other estimates changed only slightly; those results appear at the top of panel B, Table 1.

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3 The Banco Central real exchange rate is a proxy for the relative price of traded goods, and relative prices should be stationary. Indeed, if that real exchange rate is a random walk, we must be prepared for the day when the Chilean price level (or exchange rate) falls to zero (or rises to infinity).

4 Huijinga (1987) found evidence of mean reversion in the real exchange rates among floating currencies during the post-Bretton Woods period, and Diebold et al. (1991) also find mean reversion during the gold standard era. Lothian and Taylor (1996) find evidence of mean reversion in both the U.S. dollar/sterling and French franc/sterling real exchange rates over the past two centuries.

5 For this, and all subsequent estimates, only the results for current expenditure will be reported since those for total expenditure were very similar.
Eliminating the early observations which are dominated by common trends resulted in a dramatic decline in the magnitude and significance levels of the estimated effect of government expenditure on the real exchange rate. As shown in panel B of Table 1, when the sample is restricted to 1985:1-93:4, the estimated effect of government expenditure on the real exchange rate falls to -1.08 and is only marginally significant. With the 1985 observations also eliminated, that estimate falls to -0.31 and is grossly insignificant; while the estimate of the Salter effect is less than unity, it remains highly significant. These results are consistent with the hypothesis that the strong (negative) correlation in the time trends of the real exchange rate and government expenditure during the first few years of their sample—which were quite abnormal years in Chile—have severely biased the Arellano and Larraín estimates.

### Table 1
ESTIMATES OF THE EFFECT OF CURRENT GOVERNMENT EXPENDITURE ON THE CHILEAN REAL EXCHANGE RATE, AND OF THE SALTER EFFECT: QUARTERLY DATA, VARIOUS PERIODS

#### A. Original Data, Dependent Variable: LTCR

<table>
<thead>
<tr>
<th>Period</th>
<th>Variable</th>
<th>Coefficient</th>
<th>t Statistic</th>
<th>P-Value</th>
<th>See (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982:1-93:4</td>
<td>GC3D</td>
<td>-2.9595</td>
<td>-19.0272</td>
<td>0.0000</td>
<td>9.08</td>
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<td></td>
<td>TSD</td>
<td>1.7160</td>
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<td>0.0000</td>
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<tr>
<td></td>
<td>LTTIMA</td>
<td>-0.3357</td>
<td>-1.2845</td>
<td>0.1990</td>
<td></td>
</tr>
</tbody>
</table>

#### B. Original Data But With TSD Deseasonalized, Dependent Variable: LTCR

<table>
<thead>
<tr>
<th>Period</th>
<th>Variable</th>
<th>Coefficient</th>
<th>t Statistic</th>
<th>P-Value</th>
<th>See (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982:1-93:4</td>
<td>GC3D</td>
<td>-2.9312</td>
<td>-18.7282</td>
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<td>8.35</td>
</tr>
<tr>
<td></td>
<td>TSD</td>
<td>2.1350</td>
<td>6.0583</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LTTIMA</td>
<td>-0.3870</td>
<td>-1.4818</td>
<td>0.1384</td>
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</tr>
<tr>
<td>1985:1-93:4</td>
<td>GC3D</td>
<td>-1.0832</td>
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<td>0.0679</td>
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<td></td>
<td>TSD</td>
<td>1.0742</td>
<td>5.1453</td>
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<tr>
<td></td>
<td>LTTIMA</td>
<td>0.2448</td>
<td>2.1589</td>
<td>0.0309</td>
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</tr>
<tr>
<td>1986:1-93:4</td>
<td>GC3D</td>
<td>-0.3074</td>
<td>-0.5793</td>
<td>0.5624</td>
<td>4.24</td>
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<tr>
<td></td>
<td>TSD</td>
<td>0.8563</td>
<td>5.1460</td>
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</tr>
<tr>
<td></td>
<td>LTTIMA</td>
<td>0.2908</td>
<td>3.8840</td>
<td>0.0001</td>
<td></td>
</tr>
</tbody>
</table>

#### C. First Differences with TSD Deseasonalized, Dependent Variable: ΔLTCR

<table>
<thead>
<tr>
<th>Period</th>
<th>Variable</th>
<th>Coefficient</th>
<th>t Statistic</th>
<th>P-Value</th>
<th>See (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982:1-93:4</td>
<td>ΔGC3D</td>
<td>-0.3383</td>
<td>-2.8763</td>
<td>0.0040</td>
<td>4.73</td>
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<td></td>
<td>ΔTSD</td>
<td>0.4575</td>
<td>1.2622</td>
<td>0.2069</td>
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</tr>
<tr>
<td></td>
<td>ΔLTTIMA</td>
<td>-0.5917</td>
<td>-1.2540</td>
<td>0.2099</td>
<td></td>
</tr>
</tbody>
</table>

With the first four years eliminated, a unit root for the real exchange rate was rejected at the five per cent significance level. Quite inexplicably, the terms-of-trade coefficient is significant but of the wrong sign.
The results of the second test in which all variables were first differenced are reported in panel C of Table 1. As time trends are of extremely low frequency and first differencing eliminates low frequencies from the data, it should have an effect similar to that of deleting the early observations\(^7\). Indeed, the estimated coefficient for current government expenditure, -0.34, is nearly identical with that obtained from the 1986:1-93:4 subsample.

These tests provide strong evidence that trends in the real exchange rate and government expenditure variables contributed to the implausibly large magnitude of the Arellano-Larraín estimate of the effect of government spending on the real exchange rate. Assessing the economic significance, if any, of trends in time-series data over such a short period is, however, inherently difficult; while common trends may contain relevant information, there is no end to examples of purely fortuitous relationships among them. The objective of the final test, which involved several distinct steps, was to isolate the trends in the data from the remaining variance and quantity their effect on the estimates.

In the first step, GC3D was replaced by its quadratic time trend, TGC3D, which was estimated by OLS; those results appear in panel A of Table 2. That trend variable was highly significant and, remarkably enough, the SEE declined from 8.35 to 5.98 per cent; paradoxically, the quadratic time trend in GC3D apparently contains more information relevant to the real exchange rate than does GC3D itself! In the second step, GC3D was disaggregated into its trend, TGC3D, and deviations from that trend, RGC3D = GC3D - TGC3D:

\[
\text{LTCR} = \text{Constant} + A_0 \cdot \text{TGC3D} + A_1 \cdot \text{RGC3D} + B_0 \cdot \text{TSD} + C_0 \cdot \text{LTT1MA} + \text{u}
\]

\(u\) being the residual. If an orthogonal partitioning of the variance in GC3D is innocuous, the coefficients \(A_0\) and \(A_1\) should not differ significantly.

An OLS estimate of equation (4) is summarized in the upper half of panel B, Table 2; compared with the results in panel A, adding RGC3D makes a very modest contribution as the SEE declined only slightly. While the coefficients \(A_0\) and \(A_1\) were expected to be of similar magnitude, the trend coefficient is five times that of \(A_1\), and they differ significantly at the 0.00 per cent level. In view of the high serial correlation in the residuals, equation (4) was re-estimated with Hansen's (1982) generalized method of moments (OLS-GMM)\(^8\). As is evident from the results, which are reported in panel B of Table 2, the significance of both RGC3D and LTT1MA vanish.

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\(^7\) With four lags, a unit root for the first-differenced real exchange rate could be rejected at the two per cent level of significance.

\(^8\) The instruments were TGC3D, RGC3D, and TSD (all with lags one and two), LTT1MA with lags zero to two, and a constant. As the lags eliminated the first two observations which reduced the variance of LTCR, the SEE declined.
### TABLE 2
GOVERNMENT EXPENDITURE AND SALTER EFFECTS: QUARTERLY DATA, 1982:1-93:4

**A. GC3D Replaced With Its Quadratic Time Trend, Dependent Variable: LTCR**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t Statistic</th>
<th>P-Value</th>
<th>Std (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGC3D</td>
<td>-3.4384</td>
<td>-16.2522</td>
<td>0.0000</td>
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<tr>
<td>TSD</td>
<td>1.3673</td>
<td>4.1322</td>
<td>0.0000</td>
<td>5.98</td>
</tr>
<tr>
<td>LTT1MA</td>
<td>-0.3648</td>
<td>-1.7267</td>
<td>0.0842</td>
<td></td>
</tr>
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**B. OLS and OLS-GMM Estimates of Equation (4), Dependent Variable: LTCR***

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Estimate</th>
<th>t Statistic</th>
<th>P-Value</th>
<th>Std (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A_0$</td>
<td>-3.4214</td>
<td>-16.5788</td>
<td>0.0000</td>
<td>5.81</td>
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<tr>
<td>$A_1$</td>
<td>-0.6837</td>
<td>-3.5997</td>
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<tr>
<td>$B_0$</td>
<td>1.5145</td>
<td>4.8700</td>
<td>0.0000</td>
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<tr>
<td>$C_0$</td>
<td>-0.3708</td>
<td>-1.7194</td>
<td>0.0855</td>
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<tr>
<td>$A_0 / B_0$</td>
<td>-2.2591</td>
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<td>$A_1 / B_0$</td>
<td>-0.4515</td>
<td>-3.1336</td>
<td>0.0031</td>
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**C. Simultaneous Estimates of Equations (5) and (6)**

***NLSYSTEM Estimates***

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Estimate</th>
<th>t Statistic</th>
<th>P-Value</th>
<th>Std (%)</th>
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<tbody>
<tr>
<td>$A_T$</td>
<td>-2.9104</td>
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<td>$B_T$</td>
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<tr>
<td>$C_T$</td>
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<tr>
<td>$A_T / B_T$</td>
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<tr>
<td>$A_R$</td>
<td>-0.0207</td>
<td>-0.1900</td>
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<tr>
<td>$B_R$</td>
<td>0.5401</td>
<td>1.3887</td>
<td>0.1649</td>
<td>4.71</td>
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<tr>
<td>$C_R$</td>
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<td>-3.1991</td>
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<tr>
<td>$A_R / B_R$</td>
<td>-0.0384</td>
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<tr>
<td>$A_0$</td>
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<td>-16.3250</td>
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<tr>
<td>$B_0$</td>
<td>2.1350</td>
<td>6.4632</td>
<td>0.0000</td>
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<td>$C_0$</td>
<td>-0.3870</td>
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### TABLE 2, Continued

C. Simultaneous Estimates of Equations (5) and (6), continued

<table>
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<th>t Statistic</th>
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<th>See (%)</th>
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<tr>
<td>( A_T )</td>
<td>-3.0012</td>
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</tr>
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<td>( B_T )</td>
<td>1.3594</td>
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<tr>
<td>( C_T )</td>
<td>-0.0959</td>
<td>-0.7068</td>
<td>0.4797</td>
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</tr>
<tr>
<td>( A_T / B_T )</td>
<td>-2.2077</td>
<td>-3.2347</td>
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<tr>
<td>( A_R )</td>
<td>-0.0179</td>
<td>-0.1701</td>
<td>0.8649</td>
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<tr>
<td>( B_R )</td>
<td>0.0958</td>
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<td>0.7300</td>
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</tr>
<tr>
<td>( C_R )</td>
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<td>-2.0612</td>
<td>0.0393</td>
<td></td>
</tr>
<tr>
<td>( A_R / B_R )</td>
<td>-0.1862</td>
<td>-0.1597</td>
<td>0.8731</td>
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</tr>
<tr>
<td>( A_0 )</td>
<td>-3.0191</td>
<td>-13.1210</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>( B_0 )</td>
<td>1.4554</td>
<td>3.4291</td>
<td>0.0014</td>
<td></td>
</tr>
<tr>
<td>( C_0 )</td>
<td>-0.2434</td>
<td>-1.6598</td>
<td>0.1044</td>
<td></td>
</tr>
</tbody>
</table>

* All estimates made with the deseasonalized TSD variable.

It is evident from this exercise that the relationship between the real exchange rate and government expenditure is heavily dominated by trends in those variables. It is also appears that the data may have been generated by two different processes, one in which the time trend in government expenditure appears to have a dramatic effect on the real exchange rate (the estimate of \( A_0 \) being -3.42), and a second one involving deviations from the trend, which have a far weaker impact, if any at all.

If two distinct processes at work, an OLS estimate of any single equation will be biased since that approach forces a single set of residuals on the two processes. To deal with that problem, consider the following equations:

\[
(5) \quad TLTCR = Constant + A_T \cdot GC3D + B_T \cdot TSD + C_T \cdot LTTIMA + \nu
\]

\[
(6) \quad RLTCR = Constant + A_R \cdot GC3D + B_R \cdot TSD + C_R \cdot LTTIMA + \omega
\]

where TLTCR also is an OLS estimate of the quadratic time trend in LTCR and
RLTCR = LTCR - TLTCR are deviations from that trend. As of equations (5) and (6) sum to exactly equation (4), they constitute a linear disaggregation of equation (4); i.e., $A_T + A_T = A_0$, $B_T + B_T = B_0$, $C_T + C_T = C_0$, and as $v+w=u$, it is obvious that the residuals in equation (4) cannot simultaneously replicate the residuals of both equations (5) or (6). Note also that this specification permits all variables, including the trade surplus and the terms of trade, to have asymmetric effects on TLTCR and RLTCR.

Simultaneous estimates of equations (5) and (6), made by ESTIMA RATS nonlinear system (NLSYSTEM), appear in the upper half of panel C, Table 2. While the implied estimate of $A_0$ is identical with that in the upper part of panel B of Table 1, the estimate of $A_T$ is -2.91 and highly significant but the estimate of $A_R$ is nil: virtually the entire effect of government expenditure is associated with the time trend in the real exchange rate. Moreover, the estimates of the residuals, $v$ and $w$, are very different, since the correlation coefficient between them is -0.31.

As both the Durbin-Watson and Q statistics once again indicate high serial correlation in the residuals, equations (5) and (6) were re-estimated with the generalized method of moments (NLSYSTEM-GMM) and the results are summarized in the lower half of panel C, Table 2. The only apparent difference is a substantial decline in estimate of the Salter effect, particularly with respect to the deviations in the real exchange rate.

The accumulated evidence is striking; the only case in which a significant relationship was found between government expenditure and deviations of the real exchange rate from its time trend was in the OLS estimate of equation (4), and that estimate is subject to bias for a number of reasons. The more reliable GMM estimates indicate that the relationship between the Chilean real exchange rate and government expenditure during the sample period was strictly and exclusively one of common, but distinct, time trends. Moreover, the NLSYSTEM results for equation (5) indicate that the Arellano-Larraín estimate of the impact of government expenditure on the real exchange rate coincides almost exactly with the trend relationship.

Which, if any, of the various estimates of the impact of government expenditure on the real exchange rate might be relevant? One might argue that an estimates based on time trends captures the long-run effect while one based on deviations reflects the short run, but that interpretation fails the plausibility test. As equation (3') implies $(\partial LTCR / \partial g_y) / (\partial LTCR / \partial TSD) = 1 - m_n^g / m_n$, it follows from equation (4) that, in the long run, $m_n^g / m_n = 1 - A_0 / B_0$, the OLS estimate of which is 3.26 with a standard error of 0.47, and the OLS-GMM estimate is even larger. Moreover, it follows from equation (5) that, in the long run, $m_n^g / m_n = 1 - A_T / B_T$, the NLSYSTEM and NLSYSTEM-GMM estimates

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9 With up to six lags, a unit root for RLTCR was rejected at the 0.10 percent level of significance.
10 The instruments for the NLSYSTEM-GMM estimate were the same as for the OLS-GMM estimate of equation (4) except that RGC3D was replaced with GC3D.
of which are 1.82 and 2.21 with standard errors of 0.27 and 0.68, respectively. As estimates of this magnitude exceed the bounds of credibility, the long-run/short-run interpretation of the trend results must be discarded.

Alternatively, assume that $\partial \text{LTCR} / \partial \sigma = A_1$, in which case equation (4) implies that $m^g / m_n = 1 - A_1 / B_0$, the OLS estimate of which is 1.45 and whose standard error is 0.14. While that estimate is far more reasonable, $m^g_n$ still exceeds $m_n$ by nearly fifty per cent, which is still implausibly high in view of the heavily overlapping nature of the two groups involved. That leaves only the NLSYSTEM and NLSYSTEM-GMM estimates of $A_R$ and $B_R$ from equation (6), which are the least likely to be biased. Those estimates indicate values of $m^g / m_n$ of 1.04 to 1.19 and neither are significantly different from unity (their standard errors are 0.18 and 0.16, respectively).

In view of this evidence, one is forced to the conclusion that Arrellano and Larraín estimate of the effect of government expenditure on the real exchange rate is heavily biased by purely fortuitous time trends. Candor, however, also forces one to recognize that, since it may be impossible to obtain a reliable estimate of the relationship (if any) between government expenditure and the Chilean real exchange rate from the flawed Arrellano-Larraín data set, any results based on those data must be regarded with a certain degree of suspicion; indeed, a definitive estimate of that relationship must be based on a more extensive data set. Nonetheless, the alternative estimates presented above have some weighty considerations in their favor:

- in those cases in which a unit root for the real exchange rate variable could be rejected, the point estimates of the coefficient of the government expenditure variable were quite consistent as they ranged from zero to only about -0.3 and were not significant;

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11. For the OLS and OLS-GMM estimates, the standard errors of $m^g / m_n$ were estimated by a Taylor expansion, but with the NLSYSTEM routine one can estimate those ratios and their standard errors directly.

12. While there may be lags in adjustment of the real exchange rate to shocks in the relevant variables, there is no reason to believe that those lags have asymmetric effects on the estimates of $A_T$ and $B_T$, and hence on their ratio.

13. That conclusion is supported by a sort of "control" experiment. Since instances of fortuitous time trends abound, it is extremely easy to illustrate the sheer power of those trends; consider, for example, two variables totally devoid of any causal connection: the Italian money supply (M1) and the U.S. consumer price index during the post-Bretton Woods period. A simple OLS regression based on monthly data from January 1975 through December 1990 reveals that the Italian money supply "responds" to U.S. consumer prices with an elasticity of 2.17 and a t statistic of 118.59! When the counterparts of equations (5) and (6) were estimated by NLSYSTEM, the estimate of the trend coefficient remained at 2.17 (with a statistic of 137.34) but that of the deviations variable was -0.001 and grossly insignificant. As with the Chilean data, one of the variables, the U.S. price level, has a unit root, but its residuals from a time trend were integrated of order zero. As the two variables are related only by the passage of time, this result should surprise no one; what is more important, of course, is that these results suggest a methodology that might be useful for distinguishing between trend effects and true parameters in a broader context.
these estimates, together with those of the Salter effect, imply that the ratio
of marginal propensities to spend on nontraded goods, $m_n^g / m_n$, is no more than 1.2,
which is consistent with values of, say, 0.50 and 0.60 for $m_n$ and $m_n^g$, respectively,
versus 0.45 and 1.3 when based on the Arellano and Larraín estimates; and

although somewhat suspect, the estimates of the Salter effect for Chile are
consistent with the results of a recent study (Sjaastad, 1998) involving Australia and
Canada for a period from the late 1970s to the early 1990s in which the estimate of
the Salter effect for Australia was 2.2, and for Canada a mere 0.30; as that effect
varies inversely with the degree of openness of the economy, and since Canada is
more open than Chile but Australia less so, estimates ranging up to 1.5 for the
Chilean case are plausible.

Since none of those considerations support the Arellano-Larraín estimates
of the government-spending effect on the Chilean real exchange rate, the evidence
strongly supports the conclusion that they have grossly over estimated an effect that
may well have been totally absent from Chile during the period in question. The best
advice one might offer Arellano and Larraín at this point is that they embrace the Zvi
Griliches dictum; in a particularly original paraphrase of Teddy Roosevelt, Zvi once
declared that, when dealing with time-series data, it is wise to “speak softly, and
carry a lot of data”14.

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14 Griliches could not confirm this “oral” memory. In a note to the author dated 2 June 1997,
Griliches writes that “It is a nice phrase but I have no clear memory of it and I don’t think that
it got into any of my papers”.

