Testing an optimizing model of the current account via the consumption function

Steven M. Sheffrin and Wing Thye Woo*

University of California, Davis, CA 95616, USA

As the intertemporal allocation of consumption lies at the heart of the optimizing approach to current account determination, we assess the validity of this new view by testing an open economy consumption function. This method avoids some interpretation difficulties in previous studies. For the four countries examined, we generally could not reject the overidentifying restrictions imposed by the specification of our model. An extended version of the model does not find any clear evidence of substitution between private and public consumption. All our results are robust to two different measures of the external asset stock.

In the past decade, researchers have begun to explore the implications of modeling the current account based on the assumptions of representative individuals and rational expectations. Greenwood (1983) and Sachs (1982) have developed models highlighting these features and empirical tests of some of the emergent hypotheses have been conducted by Ahmed (1986), Dwyer (1986), and Sachs (1981). The empirical studies have only looked at selected aspects of the problem: Ahmed focused on permanent versus temporary movements in government spending, Dwyer tested whether budget deficits affected the current account, while Sachs stressed the role of investment and corresponding changes in the current account.

This paper develops a general framework for testing optimizing models of the current account which encompasses the previous empirical work on this hypothesis. The nesting of previous empirical work is made possible by the fact that intertemporal allocation of consumption lies at the heart of the new current account models. Blanchard (1983b) shows that the investment decision in the small open economy is independent of the consumption decision, the former depending solely on the marginal product of capital compared to the world rate of interest. This implies that once expectations about the future evolution of GDP \(y\), investment \(i\) and government expenditure \(g\) are formed, the trade account balance \(x\) is the residual item in the optimal allocation of consumption \(c\), subject to the usual non-Ponzi conditions. Hence we assess the validity of the new view of current account determination by testing the open economy consumption function.\(^1\)

* We thank Yongxin Cai for excellent research assistance, and the two anonymous referees for constructive criticisms.
Any test of a representative agent model requires both theoretical and econometric assumptions. On the theoretical level we work with the assumptions implicit in standard treatments of permanent income theory that make consumption proportional to the expected present value of wealth. While these assumptions, quadratic utility and a constant interest rate, are strong, they provide a tightly specified benchmark for examining optimizing models of the current account. Our econometric assumptions are more flexible. We simply assume that output, investment, and government expenditure follow a vector autoregressive process which we then use to forecast their expected future values. The rational expectations hypothesis requires that the stochastic processes governing \( (y', i, g) \) be the one used implicitly by agents in their calculations.

Section I derives a simple open economy consumption function, and Section II discusses econometric and data issues. Section III reports the results on data from Belgium, Canada, Germany, and the United Kingdom. Section IV extends the model to take into account Aschauer's (1985) finding from US data that increases in the availability of government services will cause private agents to reduce their consumption. We test the generality of Aschauer's result by estimating the extended model on our four countries. Section V presents our conclusions.

I. Theoretical framework

We first derive the condition which must be imposed in order to prevent external lending from becoming a Ponzi scheme. Consider the consequences of a country lending $1 at the world interest rate, \( r \), and continuing to lend every period to cover both principal and interest. This will cause the stock of external assets to grow at the rate of \( (1 + r) \). Obviously it is suboptimal for the lender to roll over the principal and capitalize the interest payments for forever. The lender's refusal to finance a Ponzi scheme means that she will demand that the net present value of her foreign asset position to be zero, i.e., full repayment of her lending. In the infinite horizon case, her demand translates to:

\[
\beta^i b_{t+i} = 0 \quad \text{as } i \text{ goes to infinity},
\]

where \( \beta = 1/(1+r) \), and \( b_{t+i} \) is the stock of external assets at the beginning of period \( t+i \).

In a discrete-time formulation with all transactions initiated and completed at the beginning of the period, the stock of external assets evolves according to the equation:

\[
b_{t+1} = (1+r)b_t + (1+r)[y_t - c_t - i_t - g_t],
\]

where the last term is the interest factor times the excess of income over spending. Solving \( 2 \) forward and using the transversality condition \( 1 \), we obtain

\[
b_t = -\sum_{0}^{\infty} \beta^i x_{t+i},
\]

where \( x_{t+i} = y_{t+i} - c_{t+i} - i_{t+i} - g_{t+i} \). Thus, at any point in time, the stock of external asset equals the present discounted value of the stream of future trade deficits.

We now turn to the representative individual's choice problem. We assume that her utility function is quadratic and that her subjective discount rate equals
the exogenous world interest rate. Specifically, the agent at time $t$ maximizes

$$E_t\left(-\sum_0^\infty \beta^i \left(1/2(c-c_{t+i})^2\right)\right),$$

where $c =$ bliss point, $E_tX_{t+i} = E(X_{t+i} | \Omega_t)$, and $\Omega_t =$ information set at time $t$, containing the current and past values of all the variables.

The agent’s intertemporal budget constraint can be derived by using the GDP identity:

$$c_{t+i} = y_{t+i} - i_{t+i} - g_{t+i} - x_{t+i}. $$

Discounting each $c_{t+i}$ by $\beta^i$, and summing from $i = 0$ to $i = \infty$, we obtain:

$$\sum_0^\infty \beta^i c_{t+i} = \sum_0^\infty \beta^i(y_{t+i} - i_{t+i} - g_{t+i}) - \sum_0^\infty \beta^i x_{t+i}. $$

Substituting in equation (3), the consumer will maximize (4) subject to:

$$\sum_0^\infty \beta^i c_{t+i} = \sum_0^\infty \beta^i RZ_{t+i} + b_t,$$

where:

$$R = \begin{bmatrix} 1, & 0, & -1, & 0, & -1, & 0 \end{bmatrix},$$

$$Z_{t+i} = \begin{bmatrix} y_{t+i}, & y_{t+i-1}, & i_{t+i}, & i_{t+i-1}, & g_{t+i}, & g_{t+i-1} \end{bmatrix}.$$ 

It is straightforward to show that the maximization of (4) subject to (7) will yield the open economy consumption function:

$$c_t = (1-\beta)\sum_0^\infty \beta^i E_t(Z_{t+i}) + (1-\beta)b_t,$$

which has the implication that

$$E_t(c_{t+i}) = c_t \quad \text{for} \quad i > 0.$$ 

Equation (9) is the Hall (1978) consumption result. Consumers plan a constant consumption path for all time; however, this planned consumption path is adjusted upwards or downwards depending on new information which changes the expectations of future $Z_t$.

Our theory does not require us to specify any specific processes for the vector $(y_t, i_t, g_t)$; this feature of our model allows us to encompass a wide variety of theories. As examples, Sachs (1981) and Blanchard (1983) discuss the case in which productivity shocks lead a country to borrow from abroad and increase investment to take advantage of the gap between the world interest rate and the (higher) marginal productivity of capital. The extra output earned through this investment will finance repayment of the debt at a later date. In another example, suppose that it is impossible to change tax rates but government spending is temporarily high. Rather than cutting consumption fully to accommodate the higher government spending, the level of existing consumption is maintained by borrowing from abroad. Finally, any temporary fall in output which does not directly change investment opportunities will also lead to borrowing from abroad. Our model encompasses all these cases as well as all their combinations and related cases.
We note that by deriving the intertemporal budget constraint for the consumer from the summing and discounting of the GDP identity, equation (5), we have forced the government to balance its budget in the present discounted value sense. In short, our model embodies the Ricardian Equivalence Principle (REP). An implication of REP is that holding the path of government spending constant, changes in simply the timing of taxes will not change consumption or the current account. There has been an extensive theoretical and empirical debate over the applicability of the REP in macroeconomics but since the results of this debate have been far from conclusive, we maintain REP as a working hypothesis. All the work in this paper also relies on the maintained hypothesis of rational expectations. This is embodied in our work by assuming that agents' subjective expectations are equal to the conditional expectations of the true stochastic processes.

We now derive the first differenced version of equation (8). There are two reasons for doing so. The first is in compliance with the asymptotic theory underlying our estimation procedure which requires that the data series be stationary. It is not realistic to assume that \( (y_t, c_t, i_t, g_t, x_t) \) be stationary in levels. The second reason is to show how our testing procedure is related to the procedure in Hall (1978) which regresses \( (c_t - c_{t-1}) \) on elements in \( \Omega_{t-1} \) with the null hypothesis being that they are orthogonal.

Our derivation is based on the decomposition:

\[
E_t(X_{t+i}) - E_{t-1}(X_{t+i-1}) = [E_t(X_{t+i}) - E_{t-1}(X_{t+i})] + [E_{t-1}(X_{t+i}) - E_{t-1}(X_{t+i-1})],
\]

where \( i > 0 \).

Equation (8) is thus reduced to:

\[
\Delta c_t = (1 - \beta) R \sum_{i=0}^{\infty} \beta^i E_{t-1}(\Delta Z_{t+i}) + (1 - \beta) \Delta b_t + (1 - \beta) R \sum_{i=0}^{\infty} \beta^i [E_t(Z_{t+i}) - E_{t-1}(Z_{t+i})],
\]

where \( \Delta X_t = X_t - X_{t-1} \).

Since the third term in equation (11) is the discounted sum of the revisions in expectations made in time \( t \), we can write

\[
w_t = (1 - \beta) R \sum_{i=0}^{\infty} \beta^i [E_t(Z_{t+i}) - E_{t-1}(Z_{t+i})],
\]

where by construction

\[
E_{t-1}(w_t) = 0,
\]

\[
E_t(w_t, w_{t-1}) = 0 \quad \text{for } i > 0,
\]

and obtain

\[
\Delta c_t = (1 - \beta) R \sum_{i=0}^{\infty} \beta^i E_{t-1}(\Delta Z_{t+i}) + (1 - \beta) \Delta b_t + w_t.
\]
Equation (15) tells us that Hall’s procedure is equivalent to testing if

\begin{equation}
E_{t-1}(\Delta b_t) = -R \sum_{0}^{\infty} \beta^i E_{t-1}(\Delta Z_{t+i}).
\end{equation}

Since \( \Delta b_t = E_{t-1}(\Delta b_t) + k_t \) with \( k_t \) being orthogonal to \( \Omega_{t-1} \), equation (16) is:

\begin{equation}
\Delta b_t = \left[ -\sum_{0}^{\infty} \beta^i E_{t-1}(\Delta Z_{t+i}) + k_t \right].
\end{equation}

Equation (17) shows that, in an open economy setting, the Hall procedure is similar to testing whether the current account (\( \Delta b_t \)) predicts anticipated declines in net output (GDP net of government and investment expenditure).

We choose to estimate equation (15) directly instead of using the Hall procedure because, one, we will get a value for \( \beta \); and, two, we will be able to examine Aschauer’s thesis that consumer spending is responsive to the provision of government services. Finally, as Bernanke (1985) points out, our approach can be used to determine the precise manner in which a model fails to conform to the theory. For example, the estimated model can be used to predict how much consumption should respond to a given shock and thus whether consumption is too ‘smooth’ or too ‘volatile’.

II. Econometric procedure and data selection

In the absence of explicit theoretical guidance, the standard procedure for generating expectations of \( \Delta Z_{t+i} \) to permit estimation of equation (15) is to project \( \Delta Z_t \) forward on the basis of past data (e.g., Sargent, 1978). This is equivalent to regarding conditional expectations as linear projections on the information set. In short, we assume that \( \Delta Z_t \) is a covariance stationary stochastic process given by:

\begin{equation}
\Delta Z_t = A\Delta Z_{t-1} + \epsilon_t,
\end{equation}

where

\begin{equation}
E(\Delta Z_{t-i}\epsilon_t) = 0 \quad \text{for} \quad i > 0.
\end{equation}

Then

\begin{equation}
E_t(\Delta Z_{t+i}) = A^i \Delta Z_t \quad \text{for} \quad i > 0
\end{equation}

and

\begin{equation}
E_{t-1}(\Delta Z_{t+i}) = A^{i+1} \Delta Z_{t-1} \quad \text{for} \quad i > 0.
\end{equation}

Substituting (21) into (15) leads to:

\begin{equation}
\Delta c_t = (1-\beta)R[I-\beta A]^{-1}A\Delta Z_{t-1} + (1-\beta)\Delta b_t + u_t,
\end{equation}

where

\begin{equation}
u_t = w_t + (1-\beta)R[I-\beta A]^{-1}\epsilon_t.
\end{equation}

We do not need to make any extra assumptions about orthogonality (exogeneity, loosely speaking) in order to legitimize the joint estimation of equations (18) and (22). The rational expectations hypothesis used in the
derivation of equation (15) and in the motivation of equation (18) guarantees that \( w_t \) and \( e_t \) are orthogonal to \( \Omega_t \). Consistent estimation is assured because both \( Z_{t-1} \) and \( b_t \) are predetermined. The stock of external assets outstanding at the beginning of time \( t \) (\( b_t \)) is predetermined and equals the compounded sum of past trade account balances.

We apply three tests to the model. Our first test examines whether the cross-equation restrictions implied by equations (18) and (22) are valid restrictions on the unrestricted vector autoregression:

\[
(Z_t, e_t) = \begin{bmatrix} \pi_1 \\ \pi_2 \end{bmatrix} Z_{t-1} + \begin{bmatrix} 0 \\ a \end{bmatrix} b_t + \begin{bmatrix} e_t \\ u_t \end{bmatrix},
\]

where \( \pi_1, \pi_2 \) and \( a \) are arbitrary coefficients. The reasoning is that if equations (18) and (22) are indeed true, they will provide the best fit on the data. This means that the correct model would fit the data just as well as an unrestricted characterization of the data as given in equation (24). We can thus use the likelihood ratio test to assess the validity of the open economy consumption function. We first estimate equation (24) by itself, and then reestimate it after imposing the structure of the open economy consumption function given by (22).

However, it is well known (e.g., Mankiw and Shapiro, 1985) that the tests of rational expectations models using small samples are biased toward rejection. To deal with this problem, we adopt the suggestion from Sims (1980) that the usual Chi-square statistic be adjusted by the factor \( (T-k)/T \) where \( T \) is the sample size and \( k \) equals the total number of regression coefficients estimated divided by the number of equations' in the unconstrained estimation of (24). To reduce the possibility of incurring a Type II error, i.e., accepting the null hypothesis when it is false, we do not regard the passing of the Sims-amended likelihood ratio test as sufficient evidence for the model.

The other two tests we use are: one, the estimated value of \( r \) has to be statistically indistinguishable from a nonnegative value, and, two, the Durbin-Watson statistics have to be satisfactory. Violation of any one of these three criteria will cast doubt on the model. It turns out that the Durbin-Watson statistic requirement is met in all our cases.\(^6\)

Our testing procedure follows from the fact that we had a closed form solution to the consumption allocation problem. The closed form solution was possible because of our assumption of a constant real interest rate for each country. In a seminal article, Hansen and Singleton (1982) show how models for which closed form decision rules cannot be found can still be tested by estimating Euler equations. We did not pursue this alternative procedure because, one, its implementation would require us to manufacture a real interest rate series for each country to replace the one constant real interest rate in our procedure; and, two, our principal aim is to test how well a simple but tightly specified model would fit the data. Furthermore, the work of Bernanke (1985) on US consumption data suggests similar results for both estimation methods.

Since our model is for a small open economy where the rate of interest is exogenous, we excluded the United States from our sample. The choice of other countries was determined by the availability of data over an extended period, and by the absence of severe and protracted capital controls in the countries. The last criterion was implemented by examining the annual reports on Exchange Arrangements and Exchange Restrictions published by the International Monetary
Fund. The four countries we selected for testing were Belgium, Canada, Germany, and the United Kingdom.

We confined the analysis to annual data because we felt that this model of current account determination is more a statement of longer-run tendencies than of short-run dynamics. The period of estimation was determined solely by data availability. To make the data compatible with the representative agent approach, we converted all the series to real per capita terms.

As external asset positions are not available on an annual basis, we constructed them from benchmark figures. In theory, it does not matter whether one uses the current account data or the capital account data for the construction. However, the 'errors and omissions' item in the balance of payments accounts of these countries can be quite large, and hence \( b \) does vary considerably by the method of construction. We therefore present two sets of results for each estimation, one with \( b \), constructed from the current account data and the other with \( b \), from capital account data. This provides an additional check on the robustness of our findings.

III. Results for the basic model

The first step is to obtain an adequate representation of equation (18). The results in Part I of Table 1 indicate that two lags for each component of \( Z_i \) are a satisfactory representation for the four countries; longer lags do not fit the data significantly better. Part II shows that the two-lag representation is generally stable across equal subperiods. Since the \( Z_i \) process for Belgium just barely passed the stability test at the 5 per cent level, this means that if we reject the cross equation restrictions implied in equation (22) we cannot entirely be sure whether it is inadequacy of the consumption model or of the \( Z_i \) representation.

Table 2 shows that the cross equation restriction of the open economy

<table>
<thead>
<tr>
<th>Country</th>
<th>( \chi^2(12) )</th>
<th>Marginal significance</th>
<th>Estimation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>11.5</td>
<td>48.7</td>
<td>1959–85</td>
</tr>
<tr>
<td>Canada</td>
<td>4.4</td>
<td>97.5</td>
<td>1953–85</td>
</tr>
<tr>
<td>Germany</td>
<td>7.6</td>
<td>81.5</td>
<td>1955–85</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>11.6</td>
<td>47.8</td>
<td>1953–85</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>( \chi^2(21) )</th>
<th>Marginal significance</th>
<th>Subperiods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>32.2</td>
<td>5.6</td>
<td>1956–70</td>
</tr>
<tr>
<td>Canada</td>
<td>15.8</td>
<td>78.1</td>
<td>1951–68</td>
</tr>
<tr>
<td>Germany</td>
<td>13.1</td>
<td>90.5</td>
<td>1953–69</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>18.5</td>
<td>61.7</td>
<td>1951–68</td>
</tr>
</tbody>
</table>

Notes: Estimation periods are determined solely by data availability. Marginal significance is the probability value at which the null hypothesis would be rejected.
Table 2. The basic model.

<table>
<thead>
<tr>
<th>Country</th>
<th>$\chi^2(6)$</th>
<th>Estimated interest rate (%)</th>
<th>Standard error</th>
<th>Absolute $t$-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>10.6</td>
<td>-5.70</td>
<td>4.09</td>
<td>1.39</td>
</tr>
<tr>
<td>Canada</td>
<td>4.8</td>
<td>2.59</td>
<td>4.36</td>
<td>0.59</td>
</tr>
<tr>
<td>Germany</td>
<td>7.3</td>
<td>4.51</td>
<td>6.79</td>
<td>0.66</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>7.5</td>
<td>78.12</td>
<td>32.34</td>
<td>2.42</td>
</tr>
</tbody>
</table>

Part II: External wealth position calculated using capital account data

<table>
<thead>
<tr>
<th>Country</th>
<th>$\chi^2(6)$</th>
<th>Estimated interest rate (%)</th>
<th>Standard error</th>
<th>Absolute $t$-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>10.8</td>
<td>-2.34</td>
<td>3.88</td>
<td>0.60</td>
</tr>
<tr>
<td>Canada</td>
<td>4.6</td>
<td>-2.88</td>
<td>4.67</td>
<td>0.62</td>
</tr>
<tr>
<td>Germany</td>
<td>8.9</td>
<td>19.25</td>
<td>11.91</td>
<td>1.62</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>10.1</td>
<td>-1.41</td>
<td>6.35</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Notes: Critical values for $\chi^2(6)$
- 10 per cent: 10.6
- 5 per cent: 12.6
- 1 per cent: 16.8

Estimation period for Belgium is 1956–85, for Germany is 1953–85 and for Canada and United Kingdom is 1951–85.

can not be rejected regardless of how $b_t$ is constructed. The result that the marginal significance level is lowest for Belgium may be due to instability in the $Z_t$ process. While the estimated values of $r$ vary tremendously, they are still statistically indistinguishable from a nonnegative number. The fact that the estimated interest rates do vary considerably for alternative constructions of the stock of external assets suggests either data problems or that the model is simply not very informative on the value of the interest rate.

Given our prior that $r$ is positive, we proceed to test the model by adding this positive $r$ constraint to the cross-equation constraints of (22). The Fischer and Lorie (1964) study on rates of return on investment in common stocks shows that $r$ is highly sensitive to the period used for its computation. The ex-post return, $r$, ranges from -49 per cent per annum to 21 per cent per annum. It is hence not surprising that the constrained value of $r$ varies widely in the literature. For example, Blanchard (1983a) in his automobile study reports two sets of results, the first with $r = 0$ and the second with $r = 27$ per cent per annum. Shiller (1981) in his study of stock price volatility uses an annual interest rate of 6.3 per cent to discount future dividends. We decided to start with $r$ set at 13 per cent because Bernanke concluded (1985, p. 43) that 'the observed consumption-income relations [in the United States] could be described by the PIH [Permanent Income Hypothesis] only if consumers have faced real interest rates of about fourteen percent per year.'

Table 3 reports that the open-economy consumption function is accepted for Canada, Germany, and the United Kingdom but not for Belgium. However, it is accepted for Belgium when $r = 5$ per cent. In other runs not reported here, we find that the cross-equation constraints still hold for Canada, Germany, and the
Optimizing model of the current account

Table 3. Basic model with discount rate constrained.

<table>
<thead>
<tr>
<th>Country</th>
<th>$\chi^2(7)$</th>
<th>Constrained interest rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium I</td>
<td>16.8</td>
<td>13</td>
</tr>
<tr>
<td>Belgium II</td>
<td>13.3</td>
<td>5</td>
</tr>
<tr>
<td>Canada</td>
<td>7.38</td>
<td>13</td>
</tr>
<tr>
<td>Germany</td>
<td>8.4</td>
<td>13</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>7.2</td>
<td>13</td>
</tr>
</tbody>
</table>

Part II: External wealth position calculated using capital account data

<table>
<thead>
<tr>
<th>Country</th>
<th>$\chi^2(7)$</th>
<th>Constrained interest rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium I</td>
<td>15.5</td>
<td>13</td>
</tr>
<tr>
<td>Belgium II</td>
<td>10.8</td>
<td>5</td>
</tr>
<tr>
<td>Canada</td>
<td>8.59</td>
<td>13</td>
</tr>
<tr>
<td>Germany</td>
<td>9.2</td>
<td>13</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>12.8</td>
<td>13</td>
</tr>
</tbody>
</table>

Notes: Critical values for $\chi^2(7)$
10 per cent 12.0
5 per cent 14.0
1 per cent 18.5

Estimation periods are as in Table 2.

United Kingdom when $r = 5$ per cent. It appears that the fit of the model on the data on these three countries are not much affected by the value of $r$.

IV. Extension of the basic model

Aschauer (1985) argues that the relevant argument in the consumer utility function in (4) should be effective consumption, $\hat{c}_t$, rather than actual consumption, $c_t$. The two are related by:

\[ \hat{c}_t = c_t + \theta y_t. \]

The rationale for equation (25) is that it is conceivable that consumer spending responds to the provision of government services. For example, if a city builds a public swimming pool then private agents will have less incentive to build their own backyard pools.

Aschauer's proposal can be easily incorporated into our framework for testing. Specifically, the budget constraint (7) is replaced by:

\[ \sum \beta^i \hat{c}_t = \sum \beta^i K Z_{t+1} + b_t, \]

where $K = \{1, 0, -1, 0, -(1 - \theta), 0\}$. Then the maximization of the utility function (with $\hat{c}_t$ instead of $c_t$) subject to equation (26) will yield:

\[ c_t = (1 - \beta) K \sum_0^x \beta^i E_i(Z_{t+1}) + (1 - \beta) b_t - \theta y_t. \]
Proceeding in a similar manner as above, we obtain:

\[ \Delta c_t = C \Delta z_{t-1} + (1 - \beta) \Delta b_t + j_t, \]

where \( C \) is a function of \( A, \beta \) and \( \theta \) and \( E_{t-1}(j_t) = 0 \) for \( i > 0 \).

The difference between the estimation for the problem here and the one in Section III is that the cross-equation constraints come from the solution to the modified consumption equation above. Although Aschauer (1985) does not suggest what the bounds on \( \theta \) ought to be, there are strong grounds to believe that Aschauer’s proposal is plausible only if \( 0 \leq \theta \leq 1 \). If \( \theta < 0 \), this would imply negative externalities from government spending. If \( \theta > 1 \), this would imply that the government could make better use of goods than consumers in terms of improving their utility. Both hypotheses are unlikely—hence, we believe \( 0 \leq \theta \leq 1 \).

Kormendi (1983) recognizes that \( g_t \) in equation (15) should apply only to government consumption (i.e., the provision of government services) and not to total government expenditure because the latter includes government investment. Aschauer, however, uses total government expenditure in his estimations and he finds \( \theta \) to be between 0.23 and 0.42. In our work, \( g_t \) refers to government consumption.

The results of our estimation are reported in Table 4. None of the eight point estimates of \( \theta \) fall within the plausible range. The hypothesis that \( \theta \) is zero can only be rejected for Germany and the United Kingdom at the 5 per cent level and the parameters are not plausible in either case. Table 5 reports estimates for \( \theta \) after we set \( r \) to values that were accepted in Section III. The results are equally implausible and inconclusive.

There are several reasons why we may be obtaining implausible estimates. First, the current account data may be inaccurate. Second, we are requiring the

<table>
<thead>
<tr>
<th>Table 4. Basic model with consumption substitution (figures in brackets are standard errors).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I: External wealth position calculated using current account data</td>
</tr>
<tr>
<td>Country</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Belgium</td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>United Kingdom</td>
</tr>
<tr>
<td>Part II: External wealth position calculated using capital account data</td>
</tr>
<tr>
<td>Belgium</td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>United Kingdom</td>
</tr>
</tbody>
</table>

Notes: Critical values for \( \chi^2(5) \)
- 10 per cent  = 9.2
- 5 per cent   = 11.1
- 1 per cent   = 15.1

** = \( t \)-statistic \( \geq 2 \)
* = \( t \)-statistic \( \geq 1.5 \)

Estimation periods are as in Table 2.
V. Conclusion

Our results provide some very limited support for a tightly specified optimizing model of the current account based on consumption-smoothing possibilities in world capital markets. For all four countries, we generally could not reject the overidentifying restrictions imposed by the specification of the model. This result was robust to alternative constructions for the stock of external foreign assets in the empirical work. We were less successful in pinning down parameter estimates. Interest rates, as is true in almost all similar work, cannot be estimated very precisely. We also could not find plausible estimates for the substitutability of government on private consumption. Nonetheless, the fact that the model passed the overidentifying restrictions test for all four countries suggests that the optimizing framework in an open economy is potentially consistent with the data.

These results have two important implications. First, since these models are based on a high degree of capital mobility, it suggests that this condition was met in our model. This should not be too surprising because we chose countries we believed had a high degree of capital mobility. Our test results suggest that these presumptions were correct.

The second point is that our model provides some very modest support for adopting the Ricardian Equivalence Principle to explain consumption and current

---

**Table 5. Basic model with consumption substitution, discount rate constrained (figures in brackets are standard errors).**

<table>
<thead>
<tr>
<th>Country</th>
<th>Substitution parameter $\theta$</th>
<th>Constrained interest rate (%)</th>
<th>$\chi^2(6)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>7.45 (8.62)</td>
<td>5</td>
<td>7.2</td>
</tr>
<tr>
<td>Canada</td>
<td>-0.09* (0.05)</td>
<td>13</td>
<td>6.2</td>
</tr>
<tr>
<td>Germany</td>
<td>-0.99* (0.63)</td>
<td>13</td>
<td>9.0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2.34** (0.99)</td>
<td>13</td>
<td>8.6</td>
</tr>
</tbody>
</table>

**Notes:** Critical values for $\chi^2(6)$

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2(6)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 per cent</td>
<td>10.6</td>
</tr>
<tr>
<td>5 per cent</td>
<td>12.6</td>
</tr>
<tr>
<td>1 per cent</td>
<td>16.8</td>
</tr>
</tbody>
</table>

* $** = t$-statistic $\geq 2$

* $* = t$-statistic $\geq 1.5$

Estimation periods are as in Table 2.

government spending variable to play two distinct roles in the model. It serves as a forecasting variable for future $(y, i, g)$ and enters into the utility function. There may not be enough power in the data to distinguish between these two roles.
account behavior in the sense that this was one of the maintained hypotheses in our work. This find may seem surprising to some readers because of the well-publicized association of the government deficit and the current account deficit in the 1980s for the United States and also the evidence in Dwyer (1986) suggesting an association between deficits and the current account. However, this evidence by itself is not sufficient to refute the Ricardian Equivalence Principle.

Most expositions of the REP assume that government spending is the autonomous variable and taxes are adjusted to accommodate the path of government spending. In this case, it would be true that a correlation of budget deficits with current account deficits would provide evidence against our model. However, if taxes are viewed by the public as autonomous and government spending as accommodating, then trade and budget deficits can be correlated without refuting the REP. Assume that changes in taxes are costly and the citizenry is determined to keep tax levels unchanged. If government spending is temporarily high, it would be optimal in this case for the country to borrow from abroad and repay the debt when government spending falls. Similar arguments could even be made for the United States in the 1980s following the 1981 tax cut. If the taxation levels implied by these cuts were viewed as permanent and the public recognized that this implied lower government spending in the future, then borrowing from abroad could be rationalized.¹⁰

This paper has not provided evidence for the United States in favor of either Ricardian equivalence or the open economy consumption function. The modest results in the paper do suggest that the data are not at variance with the assumption of considerable capital mobility, at least for the countries we examined.

Appendix

Benchmark figures for calculation of net external credit position series for Belgium, Germany, and the United Kingdom are from the 1981 column of Table 1 in Eurostat News, 1985:3. The benchmark figure of the Canadian net external credit position series is from the 1970 column of Table 21.32 in Canada Year Book, 1978. The rest of the data are from the IFS tape.

<table>
<thead>
<tr>
<th>Category</th>
<th>IFS series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private consumption</td>
<td>96f</td>
</tr>
<tr>
<td>Government consumption</td>
<td>91f</td>
</tr>
<tr>
<td>Investment</td>
<td>93e + 93i</td>
</tr>
<tr>
<td>Gross Domestic Product</td>
<td>99b</td>
</tr>
<tr>
<td>Price Index</td>
<td>(99b/99br)</td>
</tr>
<tr>
<td>Population</td>
<td>99z</td>
</tr>
</tbody>
</table>

¹⁰ External asset position constructed from capital account data: For Belgium and the United Kingdom, \((77fd - 77ed + 79cd) / rf\). For Canada and Germany, \((77bzd + 79cd) / rf\).

¹⁰ External asset position constructed from current account data: For Belgium and the United Kingdom, \((99c - 98c + 90e)\). For Canada and Germany, \((90c - 98c - 98e)\).
Optimizing model of the current account

Notes

1. Johnson (1986) takes a related approach to the current account for Canada. Our work differs from his in the use of alternative estimation techniques and a broader coverage of countries.
2. All variables are expressed in real terms, and where appropriate in per capita terms as well.
3. This formulation allows us to solve the model using certainty equivalence. Blanchard and Mankiw (1988) review recent consumption studies which proceed without certainty equivalence.
4. This proof is available on request from the authors.
5. With our quadratic utility function, any other assumption would violate the spirit of our work. Barsky et al. (1986) show that REP does not hold if taxes are not lump sum and if more general specifications of risk are used. Bernheim (1987) surveys the REP debate.
6. For the annual data in this paper, Durbin–Watson tests are all, as a practical manner, necessary to detect serial correlation. In quarterly data, other tests would be necessary.
7. The data are more fully described in the Appendix. As in IMF usage, 'errors and omissions' is a separate category from current account and capital account. It is not included in both measures of $b_1, b_2$ will be biased in the direction which authorities systematically err in their imputations of unrepatriated foreign earnings.
8. Fisher and Lorie (1964), Table 1.
9. The ratios of government consumption to GNP for Belgium, Canada, West Germany, and the United Kingdom are 0.15, 0.22, 0.17, and 0.18, respectively. These numbers tend to increase monotonically during the sample and exhibit relatively little variance around the upwards trend.
10. This argument is similar to Kochin (1985) who shows that efficient taxation will cause consumption to fluctuate with tax changes, and hence with budget deficits.

References


Dwyer, Gerald. 'Government Deficits and the Current Account,' mimeo, June 1986.


KOCHIN, LEVIS. 'The Observational Equivalence of Rational and Irrational Consumers if Taxation is Efficient,' Seventh West Coast Academic Conference, Federal Reserve Bank of San Francisco, Fall 1985, 103–121.


