Session 3:
Current Account Dynamics

Terms of Trade and Current Account Fluctuations: Evidence from Canada

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Introduction

Since the seminal work of Sachs (1981), the intertemporal approach to the current account has become a popular tool to study the indebtedness of countries and the borrowing and lending behaviour in international financial markets. In a nutshell, the intertemporal approach explains current account fluctuations as being the result of optimal saving and investment behaviour of rational, forward-looking economic agents in an open economy.[1] One of its implications is well known as the present-value model (PVM) of the current account. In its simplest form, the PVM implies that the current account is determined by the discounted sum of expected future changes in the economy's cash flow (or net output).[2]

The standard PVM of the current account has been evaluated by many studies, using time-series data from different countries, over various sample periods, and at different frequencies.[3] The common result of these studies is that the standard PVM fails to explain postwar current account fluctuations

1. The small-open-economy, optimal-growth model of Hamada (1966) is an explicit precursor to the intertemporal approach to the current account. An excellent review of this approach can be found in Obstfeld and Rogoff (1995).
2. We will refer to this version of the present-value model as the standard PVM.
3. See, for example, Sheffrin and Woo (1990), Otto (1992), Ghosh (1995), and Bergin and Sheffrin (2000).

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of typical small open economies in general and Canada in particular. Indeed, the current account series predicted by the standard PVM is often found to be too smooth compared with the actual Canadian current account, a result that was characterized by Ghosh (1995) as the "excess smoothness puzzle" of the current account.

Although they use different analytical frameworks, two recent papers by Bergin and Sheffrin (2000) and Nason and Rogers (2004) emphasize the importance of stochastic variations in relative prices as a potential explanation for current account fluctuations in Canada.[4] More precisely, Bergin and Sheffrin show that amending the standard intertemporal model of the current account to include variable interest rates and exchange rates improves its fit substantially. Nason and Rogers, on the other hand, show that, among the features that are suspected to be responsible for the rejection of the standard PVM, world real interest rate shocks bring the "canonical" small-open-economy, real-business-cycle model closest to the data.[5]

In this paper, we develop a small open economy model with tradable and non-tradable goods and a time-varying world real interest rate. Unlike Bergin and Sheffrin (2000), however, we distinguish between exportable and imported goods, thus introducing an additional relative price, i.e., the terms of trade. Terms-of-trade shocks are widely regarded as a major force driving business cycle fluctuations in small open economies such as Canada.[6] This view has become even more popular after the oil-price shock in the early 1970s. In Canada, movements in the terms of trade are found to explain much of real exchange rate variability in the post Bretton Woods period.[7] This suggests that allowing for terms-of-trade variations can be helpful in explaining the Canadian current account.

The effects of terms-of-trade movements on the current account were initially studied by Harberger (1950) and Laursen and Metzler (1950), who show, using a Keynesian model, that an exogenous rise (fall) in the terms of

4. On the other hand, İşcan (2003) and Gruber (2004) show that allowing for durability and habit formation in consumption improves the ability of the PVM to fit the Canadian current account series. Furthermore, Normandin (1999) shows that departing from the infinite-horizon assumption typically used in the literature and introducing government bonds as part of household financial wealth help the standard model explain current account movements in Canada.
5. No consensus has been reached in the literature regarding the importance of real interest rate variations for aggregate fluctuations in a small open economy. For example, Hercowitz (1986) and Blankenau, Kose, and Yi (2001) provide evidence that real interest rate variations matter for aggregate fluctuations, while Mendoza (1991) finds no significant role for the real interest rate.
6. See Mendoza (1995), among others.
7. See Amano and van Norden (1995).

trade of a small open economy leads to an improvement in its trade balance. The reason is obvious: an improvement in a country's terms of trade raises its current income, and given a marginal propensity to consume less than unity, current consumption increases less than current income, causing private saving to increase. This so-called Harberger-Laursen-Metzler (HLM) effect has subsequently been examined within deterministic intertemporal models by Sachs (1981), Obstfeld (1982), and Svensson and Razin (1983), among others. More recently, the HLM effect was recast within dynamic general-equilibrium models by Backus (1993) and Mendoza (1995), for example.

This paper derives an approximate closed-form solution for the present-value representation of the current account, which encompasses the HLM effect in addition to the usual consumption-smoothing motive and the effects of future changes in the interest rate and the exchange rate, highlighted in Bergin and Sheffrin (2000). Moreover, while Bergin and Sheffrin identify only the intertemporal substitution effect of expected future changes in the consumption-based world real interest rate, our PVM allows us to study not only the intertemporal substitution effect but also the income and wealth effects associated with a change in the world real interest rate, as well as its instantaneous effect on net foreign interest payments.[8]

The cross-equation restrictions implied by the extended PVM are tested using Canadian data. The results show that the model without terms of trade is strongly rejected by the data, although its prediction tracks the actual current account series much better than the standard PVM. Including the terms of trade, however, does not improve the fit, and the extended PVM is still strongly rejected at all conventional levels of significance. This suggests that terms-of-trade shocks are not important for the Canadian current account, which corroborates earlier results by Otto (2003), who finds little evidence for the HLM effect in Canada.

The rest of the paper is organized as follows. Section 1 describes the model and derives a testable closed-form solution for the current account. Section 2 explains the testing procedure, describes the data, and discusses the results. Section 3 describes a robustness analysis, and the final section concludes.

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8. Obstfeld and Rogoff (1996, 30) explain in detail the effects of real interest rate changes on consumption within a simple two-period, open-economy model.

1 The Model

1.1 The environment

Consider a small open economy where a representative infinitely lived household consumes a mix of tradable and non-tradable goods. The consumption index is a Cobb-Douglas aggregator given by

$$C_t = \omega_1 (C_t^T)^{\varepsilon} (C_t^N)^{1-\varepsilon} \qquad 0 < \varepsilon < 1, \tag{1}$$

where C_t^T is consumption of the tradable good, C_t^N is consumption of the non-tradable good, ε is weight of the tradable good in the consumption basket, and $\omega_1 \equiv \varepsilon^{-\varepsilon}(1-\varepsilon)^{\varepsilon-1}$ is a positive parameter. The Cobb-Douglas-type aggregator (equation (1)) implies unit elasticity of intratemporal substitution between the two types of goods. The tradable good is used as a numeraire and its price is normalized to one. Denoting by Q_t the price of the non-tradable good, i.e., the real exchange rate, the demands for tradable and non-tradable goods are given by, respectively,

$$C_t^T = \varepsilon P_t^c C_t \tag{2}$$

and

$$Q_t C_t^N = (1-\varepsilon) P_t^c C_t, \tag{3}$$

where P_t^c is the consumption-based price index given by

$$P_t^c = Q_t^{1-\varepsilon}. \tag{4}$$

As in Obstfeld (1996) and Obstfeld and Rogoff (1996, 266), we assume that the tradable good is itself a Cobb-Douglas aggregator of domestic exportable goods and imported goods,

$$C_t^T = \omega_2 X_t^{\gamma} M_t^{1-\gamma} \qquad 0 < \gamma < 1, \tag{5}$$

where X_t is consumption of exportable goods, M_t is consumption of imported goods, γ is the weight of exportable goods in the traded-good basket, and ω_2 is a constant given by $\omega_2^{-1} = \gamma^{\gamma}(1-\gamma)^{1-\gamma}$. Denoting by P_t^x and P_t^m the prices of the exportable and imported goods, respectively, the demands for these goods are given by

$$P_t^x X_t = \gamma C_t^T \tag{6}$$

and

$$P_t^m M_t = (1-\gamma) C_t^T . \tag{7}$$

In addition, the following condition must hold:

$$1 = (P_t^x)^{\gamma} (P_t^m)^{1-\gamma} . \tag{8}$$

Notice that from this equation, the terms of trade, defined as the relative price of exports in terms of imports, can be expressed as a function of the price of the exportable good

$$P_t \equiv P_t^x / P_t^m = (P_t^x)^{1/(1-\gamma)} . \tag{9}$$

The only tradable assets in this economy are international bonds, which are indexed to the tradable consumption basket. International financial markets are perfect but incomplete.[9] That is, the representative household can borrow and lend freely at the world common real interest rate, r_t, to smooth consumption intertemporally, but cannot buy or sell state-contingent claims to diversify away idiosyncratic shocks. The assumption of a small open economy requires that this economy cannot affect the world real interest rate or the terms of trade.

At the beginning of each period, the representative household receives an endowment of exportable and non-tradable goods, denoted by NY_t^x and NY_t^n, respectively. It pays $(1+r_t)B_t$ on bonds purchased in period $t-1$, and allocates remaining net output to consumption and the purchase of new bonds. Therefore, the household's budget constraint expressed in terms of the tradable consumption basket is

$$\begin{aligned} B_{t+1} &= (1+r_t)B_t + P_t^x NY_t^x + Q_t NY_t^n - P_t^x X_t - P_t^m M_t - Q_t C_t^N \\ &= (1+r_t)B_t + P_t^x NY_t^x + Q_t NY_t^n - P_t^c C_t . \end{aligned} \tag{10}$$

The representative household has the following lifetime utility:

$$E_t \sum_{i=0}^{\infty} \beta^i \frac{C_{t+i}^{1-1/\sigma}}{1-1/\sigma} \quad 0 < \beta < 1, \quad \sigma > 0 , \tag{11}$$

9. See footnote 13.

where E_t, β, and σ are: the mathematical expectation operator conditional on the information available at time *t*, the subjective discount factor, and the elasticity of the intertemporal substitution, respectively. The problem of the representative household is to maximize the lifetime utility function (equation (11)) subject to the budget constraint (equation (10)) and to a non-Ponzi-game condition. The first-order conditions for this dynamic problem are the Euler equation

$$1 = \beta E_t(1 + r_t + 1)\left(\frac{P_t^c}{P_{t+1}^c}\right)\left(\frac{C_t}{C_{t+1}}\right)^{1/\sigma} \tag{12}$$

and the transversality condition for the bond holdings $\lim_{i \to \infty} E_t R_{t,i} B_{t+1+i} = 0$, where $R_{t,i}$ is the ex post market-discount factor at period *t* for period $t + i$ consumption, which is defined as

$$R_{t,i} \equiv \begin{cases} 1/\left(\Pi_{j=t+1}^{t+i}(1 + r_j)\right) & \text{if } i \geq 1 \\ 1 & \text{if } i = 0. \end{cases}$$

The Euler equation (12) implies that the relevant interest rate for smoothing consumption between periods *t* and $t + 1$ is the consumption-based world real interest rate $(1 + r_{t+1})(P_t^c/P_{t+1}^c)$. Other things being equal, an expected rise in the consumption-based price index in period $t + 1$ lowers the expected one-period gross rate of return of foregoing one unit of consumption at time *t*.

1.2 Derivation of a closed-form solution

In equilibrium, the condition $NY_t^n = C_t^N$ must hold. Thus, the budget constraint (equation (10)) becomes

$$\begin{aligned} B_{t+1} &= (1 + r_t)B_t + P_t^x NY_t^x - P_t^x X_t - p_t^m M_t \\ &= (1 + r_t)B_t + P_t^x NY_t^x - C_t^T, \end{aligned} \tag{13}$$

where the second equality follows from the fact that $C_t^T = P_t^x X_t + P_t^m M_t$. Iterating equation (13) forward and using the transversality condition yields the ex ante intertemporal budget constraint

$$\sum_{i=0}^{\infty} E_t R_{t,i} C^T_{t+i} = (1+r_t)B_t + \sum_{i=0}^{\infty} E_t R_{t,i} P^x_{t+i} NY^x_{t+i}.$$

Dividing both sides of this equation by $P^c_t Y_t$, and using the approximation $\ln(1+r_t) \approx r_t$, yields, after some algebra (see Appendix 1 for details),

$$\varepsilon\tau_t\left[1 + \sum_{i=1}^{\infty} E_t \exp\left\{\sum_{j=t+1}^{t+i} (\Delta c^T_j - r_j)\right\}\right] = \exp(r_t) b_t$$

$$+ \eta_t\left[1 + \sum_{i=1}^{\infty} E_t \exp\left\{\sum_{j=t+1}^{t+i} (\Delta ny^x_j + \Delta p^x_j - r_j)\right\}\right],$$

where $\tau_t = C_t / Y_t$ is the consumption-output ratio, $\eta_t = P^x_t NY^x_t / P^c_t Y_t$ is the ratio of exportable net output to total output, $b_t = B_t / P^c_t Y_t$ is the ratio of international bonds to total output, $\Delta c^T_t = \ln C^T_t - \ln C^T_{t-1}$, $\Delta ny^x_t = \ln NY^x_t - \ln NY^x_{t-1}$, and $\Delta p^x_t = \ln P^x_t - \ln P^x_{t-1}$. It is assumed that τ_t, η_t, b_t, Δc^T_t, Δny^x_t, Δy_t, r_t, and Δp^x_t follow stationary processes with the unconditional means τ, η, b, g^c, g^{ny}, r, and g^p, respectively. The intertemporal budget constraint is then linearly approximated by taking a first-order Taylor expansion around the unconditional means. For any variable x_t, let $\tilde{x}_t$ denote the deviation from its unconditional mean. The linearly approximated intertemporal budget constraint then is (see Appendix 1 for details):

$$\varepsilon\tilde{\tau}_t - \frac{1-\alpha}{1-\kappa}\tilde{\eta}_t \approx (1-\alpha)\exp(r)\tilde{b}_t + (1-\alpha)\exp(r) b \tilde{r}_t$$

$$- \varepsilon\tau \sum_{i=1}^{\infty} \alpha^i E_t[\widetilde{\Delta c^T_{t+i}} - \tilde{r}_{t+i}]$$

$$+ \eta\frac{1-\alpha}{1-\kappa} \sum_{i=1}^{\infty} \kappa^i E_t[\widetilde{\Delta ny^x_{t+i}} + \widetilde{\Delta p^x_{t+i}} - \tilde{r}_{t+i}], \qquad (14)$$

where $\alpha = \exp(g^c - r)$ and $\kappa = \exp(g^{ny} - \mu + g^p)$ are assumed to be less than one.[10]

10. The conditions $\alpha < 1$ and $\kappa < 1$ are required to satisfy boundedness of the expected present discounted-value terms of equation (14).

To derive a log-linear approximation of the Euler equation for the consumption basket (equation (12)), we follow Campbell and Mankiw (1989); Campbell (1993); and Campbell, Lo, and MacKinlay (1997, 306) in assuming that the world real interest rate r_t, the consumption price index $P_t^c = Q_t^{1-\varepsilon}$, and the consumption basket C_t are jointly conditionally homoscedastic and log-normally distributed. In this case, the Euler equation (12) can be log-linearized as

$$E_t\widetilde{\Delta c_{t+1}} = \sigma E_t\tilde{r}_{t+1} - \sigma(1-\varepsilon)E_t\widetilde{\Delta q_{t+1}}, \quad (15)$$

where the unconditional mean of Δc_t is given by $E\Delta c_t = \sigma(\ln\beta + \delta - \mu) - \sigma(1-\varepsilon)g^q$.[11] From this equation and the demand function for the tradable consumption basket (equation (2)), it is easy to show that the Euler equation for the tradable consumption basket is approximated by

$$E_t\widetilde{\Delta c_{t+1}^T} = \sigma E_t\tilde{r}_{t+1} + (1-\sigma)(1-\varepsilon)(E_t\widetilde{\Delta q_{t+1}}), \quad (16)$$

where the unconditional mean of Δc_t^T is given by $E\Delta c_t^T = \sigma r + (1-\sigma)(1-\varepsilon)g^q$.

Finally, to derive an approximate solution for the current account-output ratio $ca_t \equiv (CA_t/P_t^cY_t)$, we assume that the economy possesses a balanced growth path, where $\alpha = \kappa$. From the current account identity

$$CA_t \equiv r_tB_t + p_t^xNY_t^x - C_t^T \quad (17)$$

and equations (9), (14), and (16), we can obtain the following present-value representation of the current account-output ratio (see Appendix 2 for details):

$$\tilde{ca}_t = b\tilde{r}_t + [\eta + \varepsilon\tau(\sigma-1)]\sum_{i=1}^{\infty}\kappa^iE_t\tilde{r}_{t+i} - \eta\sum_{i=1}^{\infty}\kappa^iE_t\widetilde{\Delta ny_{t+i}^x}$$
$$+ \varepsilon\tau(1-\sigma)(1-\varepsilon)\sum_{i=1}^{\infty}\kappa^iE_t\widetilde{\Delta q_{t+i}} - \eta(1-\gamma)\sum_{i=1}^{\infty}\kappa^iE_t\widetilde{\Delta p_{t+i}}. \quad (18)$$

The first term in the RHS of equation (18), $b\tilde{r}_t$, shows the instantaneous effect of a change in the current world real interest rate on the current account. As can be seen from the current account identity (equation (17)),

11. δ is a constant term including the constant variances of r_t, $\Delta\ln C_t$, and $\Delta\ln Q_t$ and the constant covariances across them.

for example, if the economy is a net debtor (i.e., $B_t < 0$), a rise in r_t increases the net foreign interest payment instantaneously, and the current account moves into deficit. The second term, $[\eta + \varepsilon\tau(\sigma - 1)]\sum_{i=1}^{\infty} \kappa^i E_t \tilde{r}_{t+i}$, measures the impact of expected future changes in the world real interest rate on the current account. As discussed in Obstfeld and Rogoff (1996, chapter 2), this impact can be decomposed into substitution $(\varepsilon\tau\sigma)$, income $(-\varepsilon\tau)$, and wealth (η) effects. The traditional consumption-smoothing motive is captured by the third term, $-\eta\sum_{i=1}^{\infty} \kappa^i E_t \widetilde{\Delta ny^x_{t+i}}$: the household adjusts the current account to smooth consumption to an income shock.

The fourth term, $\varepsilon\tau(1-\sigma)(1-\varepsilon)\sum_{i=1}^{\infty} \kappa^i E_t \widetilde{\Delta q_{t+i}}$, reflects the effect of expected future changes in the real exchange rate on the current account, which can also be decomposed into *intertemporal* substitution $(-\varepsilon\tau\sigma(1-\varepsilon))$ and *intratemporal* substitution $(\varepsilon\tau(1-\varepsilon))$ effects (see Bergin and Sheffrin (2000) for further discussion).[12] The last term, $-\eta(1-\gamma)\sum_{i=1}^{\infty} \kappa^i E_t \widetilde{\Delta p_{t+i}}$, captures the effect of expected future changes in the terms of trade on the current account, or the HLM effect: given the expected future path of ny^x, an expected future rise in p increases the expected relative price of exportable goods in terms of the tradable basket (i.e., p^x_t) with elasticity $1-\gamma$, which, in turn, increases permanent income.[13] Hence, current consumption rises, while current income is unchanged. As a result, the current account moves into deficit.[14]

12. One advantage of the present-value representation derived in this paper is that it disentangles explicitly the effects of variable world real interest rate from the effects stemming from movements in the real exchange rate. In contrast, Bergin and Sheffrin (2000) embed these two effects in their model by constructing a measure of the consumption-based real interest rate. A possible drawback of this approach is that the series used in the estimation procedure depends on the structural parameters.

13. On the other hand, if a change in the terms of trade is expected to be permanent, the HLM effect disappears, because the household cannot smooth away a permanent shock, as the standard permanent income hypothesis predicts. See Svensson and Razin (1983) for the relationship between the HLM effect and the persistence of the terms-of-trade shocks.

14. Backus (1993) shows that under the assumption of complete markets, the relationship between the terms of trade and the trade balance is independent of the properties of terms-of-trade shocks. This is because market completeness means that there exists a complete set of state-contingent securities that enable the representative household to insure against all idiosyncratic risks, thereby implying that there is no permanent income effect arising from terms-of-trade shocks.

2 Econometric Analysis

2.1 Evaluating the PVM

To evaluate the PVM (equation (18)) empirically, we start by deriving the cross-equation restrictions that the PVM imposes on the unrestricted vector autoregression (VAR). Let X_t denote a 5×1 column vector defined as $X_t = [\tilde{r}_t \ \widetilde{\Delta ny_t^x} \ \widetilde{\Delta q_t} \ \widetilde{\Delta p_t} \ ca_t]'$. It is assumed that the probability distribution of X_t is well approximated by a pth order unrestricted VAR: $X_t = A^1 X_{t-1} + A^2 \ X_{t-2} + \ldots + A^p X_{t-p} + v_t$, where A^i is the *ith* coefficient matrix with an $(m, n)th$ typical element $a(m, n)^i$, and v_t is a 5×1 vector of unrestricted i.i.d. (identically, independently distributed) disturbances with variance-covariance matrix Ω.

Since any higher-order VAR has a first-order representation with a $5p \times 5p$ companion matrix *A*, we can rewrite the pth order VAR as $\chi_t = A\chi_{t-1} + v_t$, where $\chi_t = [X_t' \, X_{t-1}' \ldots X_{t-p-1}']'$ and $v_t = [v_t' \, 0 \ldots (0)]'$, respectively. Let e_i denote the $1 \times 5p$ row vector in which the ith element is 1, but the rest of elements are zeros. Then, the PVM (equation (18)) implies the following cross-equation restrictions:

$$e_5\chi_t = be_1\chi_t + \sum_{i=1}^{\infty} k^i\{[\eta + \varepsilon\tau(\sigma - 1)]e_1 - \eta e_2 + \varepsilon\tau(1-\sigma)(1-\varepsilon)e_3 - \eta(1-\gamma)e_4\}A^i\chi_t, \tag{19}$$

or, equivalently,

$$e_5 = be_1 + \{[\eta + \varepsilon\tau(\sigma - 1)]e_1 - \eta e_2 + \varepsilon\tau(1-\sigma)(1-\varepsilon)e_3 - \eta(1-\gamma)e_4\}\kappa A[I_{5p} - \kappa A]^{-1} = F(\sigma, \gamma, \varepsilon, \kappa\!: b, A, \eta, \tau). \tag{20}$$

These cross-equation restrictions can be tested statistically using a Wald test. More precisely, let $\hat{e}_5$ denote the estimated value of e_5, $\partial\hat{e}_5/\partial A$ the matrix of derivatives of $\hat{e}_5$ with respect to the elements $a(m, n)^i$ and *V* the variance-covariance matrix of those elements. Then

$$(\hat{e}_5 - e_5)'W^{-1}(\hat{e}_5 - e_5) \sim \chi^2(5p),$$

where

$$W = \left(\frac{\partial\hat{e}_5}{\partial A}\right)' V \left(\frac{\partial\hat{e}_5}{\partial A}\right).$$

In addition, a predicted current account series, $\widehat{ca}_t$, can be constructed as

$$\widehat{ca}_t \equiv be_1\chi_t + \{[\eta + \varepsilon\tau(\sigma - 1)]e_1 - \eta e_2 + \varepsilon\tau(1-\sigma)(1-\varepsilon)e_3 - \eta(1-\gamma)e_4\}\kappa A[I_{5p} - \kappa A]^{-1}\chi_t \tag{21}$$

and compared with the actual series.

2.2 Data

The PVM is tested using quarterly Canadian data from 1962Q2 to 2001Q2. The data sources are Statistics Canada and International Financial Statistics. Following Barro and Sala-i-Martin (1990), the world real interest rate series is constructed as a GDP-weighted average of real interest rates in the G-7 countries. For each country, the real interest rate is computed as the three-month treasury bill rate, or an equivalent short-term rate, adjusted by expected CPI inflation. The latter is obtained from a sixth-order autoregression, as suggested by the sequential likelihood ratio and Akaike information criteria. To construct the net exportable output series, we proceed as follows. We measure gross exportable output by subtracting from total real GDP the (real) value of output in the service industry. Since we do not have disaggregated data on GDP components, we compute the net exportable output by assuming that the share of output in the service industry that is used for investment and government spending purposes is equal to the share of aggregate investment and public spending in total output. The series of net exportable output is expressed in per capita terms using the civilian population, age 16 and over. Following Rogoff (1992) and Bergin and Sheffrin (2000), the real exchange rate is measured by the real effective exchange rate of the Canadian dollar, which is obtained by multiplying the nominal effective exchange rate by the Canadian consumer price index and dividing it by the consumption price index for the G-7 countries. The terms of trade are computed as the ratio of export to import prices (section 3 performs robustness analysis using an alternative measure of the terms of trade). In conformity with equation (18), the net exportable output, the real exchange rate, and the terms-of-trade series are logged and expressed in first differences. The current account series is constructed by adding the real trade balance and real foreign interest payments. The series is then divided by real output to obtain the current account-output ratio. Finally, all the series are demeaned.

The raw and transformed series are plotted in Figures 1 and 2, respectively.[15] The ratio of the current account to GDP is weakly correlated with all the transformed variables. In particular, the correlation between this series and changes in the terms of trade is less than 0.05, which is consistent with the value of 0.04 computed by Backus, Kehoe, and Kydland (1994), using Hodrick-Prescott-filtered terms-of-trade series.[16] Changes in the real exchange rate and the terms of trade are also weakly correlated (0.14), which implies that we could potentially identify the effects stemming from stochastic variations in these two relative prices.

Before testing the PVM (equation (18)), we need to check the stationarity of the series used in the unrestricted VAR. To do so, we conduct unit-root tests for the elements of the vector $X_t = [\hat{r}_t \ \widetilde{\Delta ny_t^x} \ \widetilde{\Delta q_t} \ \widetilde{\Delta p_t} \ \tilde{ca}_t]'$, based on the augmented Dickey-Fuller (ADF) τ-statistics. With each element x_t of the vector X_t, we estimate the following ADF equation by ordinary least squares:

$$\Delta x_t = \rho x_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta x_{t-i} + \varepsilon_t, \tag{22}$$

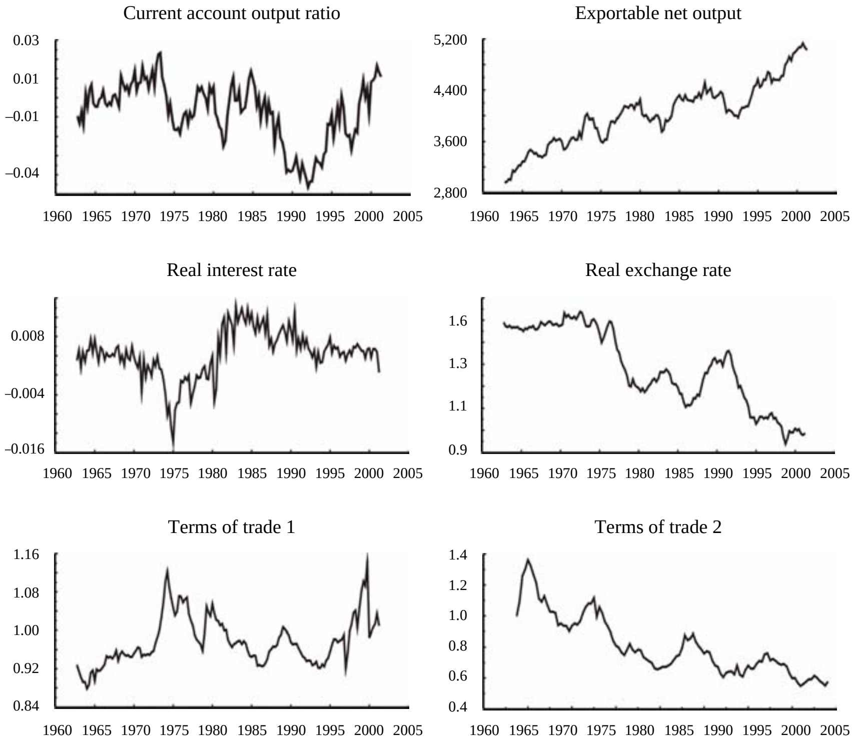
where we choose 1, 3, 5, and 7 as the optimal lag p. Because each element x_t is a demeaned series, we ignore the constant term in the above regression, following Bergin and Sheffrin (2000). The ADF τ-statistic is calculated as the standard t-statistic attached to the OLS estimate of ρ. Since the ADF τ-statistic is non-standard, Davidson and MacKinnon (1993) tabulate its asymptotic critical values under the null hypothesis of the unit root. In particular, the critical values for the unit-root null at the 10, 5, and 1 per cent significance levels are –1.62, –1.94, and –2.56, respectively.

Table 1 reports the results of the unit-root tests for the elements of the vector X_t. For three different lag specifications, the ADF τ-statistics reject the unit-root nulls for all the five elements at least at the 5 per cent significance level, except in two cases ($\tilde{r}_t$ with seven lags and $\tilde{ca}_t$ with five lags). Thus, we conclude that the elements of the vector X_t are stationary.

15. The series labelled terms of trade 1 corresponds to the ratio of export to import prices. The series labelled terms of trade 2 is the one used to check the robustness of the results and will be discussed in section 3.

16. In fact, Backus, Kehoe, and Kydland find little covariance between the trade balance and the terms of trade in Canada, at any lead or lag.

Figure 1
Raw Canadian data



2.3 Results

The purpose of this paper is to determine whether a present-value model of the current account that allows for stochastic variations in the terms of trade improves upon earlier models in explaining current account movements. Thus, to gauge the matching performance of PVM (equation (18)), it is useful to compare its predictions with those generated by two “restricted” versions: the standard PVM, where there are no variations in the interest rate, the exchange rate, or the terms of trade, and a model that allows for time-varying real interest rates and real exchange rates but with constant terms of trade.[17]

17. The term “restricted” should not be interpreted in a statistical sense here, for two reasons. First, as will be explained further, by construction, the PVM model presented in this paper does not nest the standard PVM. Second, the VAR parameters used to compute the predicted current account series are based on a different information set for each model.

Figure 2
Transformed Canadian data

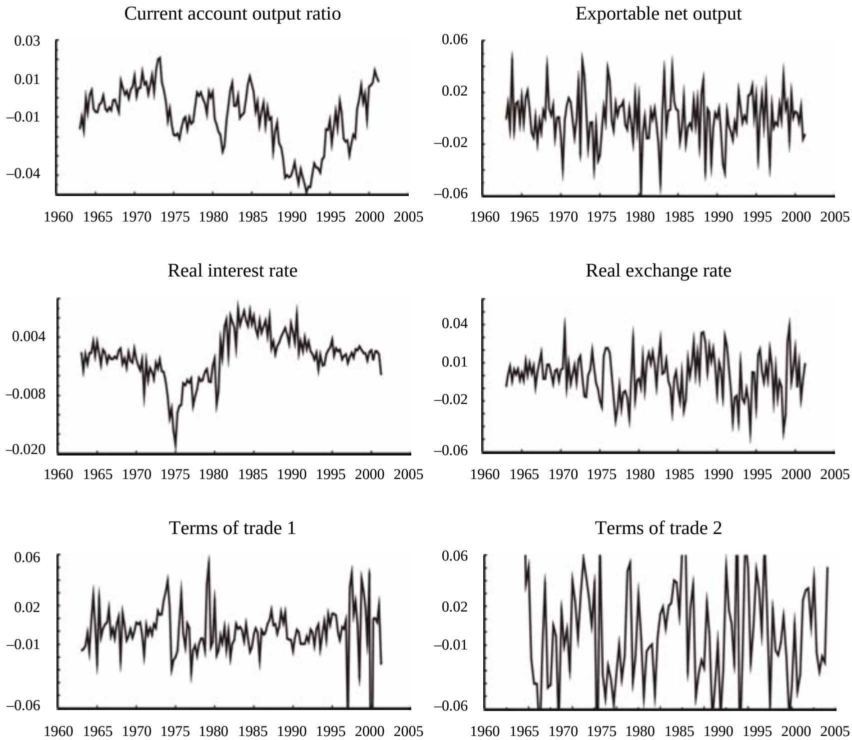


Table 1
Unit-root test results

	Lag length			
Variable	**1**	**3**	**5**	**7**
$\tilde{r}_t$	–2.103†	–2.105†	–2.048†	–1.805*
$\widetilde{\Delta n y_t^x}$	–8.206‡	–6.036‡	–5.125‡	–5.408‡
$\widetilde{\Delta q_t}$	–9.148‡	–5.234‡	–4.113‡	–3.248‡
$\widetilde{\Delta p_t}$	–7.109‡	–6.970‡	–4.782‡	–4.670‡
$\tilde{ca}_t$	–2.103†	–2.273†	–1.731*	–2.094†

Note: The superscripts *, †, and ‡ denote rejections of the null hypothesis of a unit root at the 10, 5, and 1 per cent significance levels, respectively.

The standard PVM assumes that there are no variations in the real interest rate, the exchange rate, or the terms of trade. That is,

$$\tilde{ca}_t = -\eta \sum_{i=1}^{\infty} \kappa^i E_t \widetilde{\Delta ny_{t+i}},$$

where ny_t is the log of net output. Since this model assumes that all goods are tradable, the parameter η is calibrated to match the average ratio of net output to total output, which is estimated to be 0.489 for Canada, while the parameter κ is set to 0.99. Figure 3 depicts the actual current account series and that predicted by the standard PVM. In this case, the underlying unrestricted VAR is bivariate and includes the variables $\widetilde{\Delta ny_t}$ and $\tilde{ca}_t$ only.[18] Figure 3 shows that the predicted series is much smoother than the actual one. That is, the standard model fails to generate movements in the current account of the same magnitude as those observed in the data. This failure, however, is not reflected in the results of the statistical tests reported in Table 2. This table shows that the Wald statistic has a *p*-value of 0.0747, meaning that the cross-equation restrictions implied by the standard PVM can be rejected at the 10 per cent significance level, but not at the 5 per cent level. This is somewhat surprising, given that earlier studies, such as those by Sheffrin and Woo (1990), Ghosh (1995), Bergin and Sheffrin (2000), and Nason and Rogers (2004), report strong rejections of the standard PVM.[19]

The second model that will serve as a benchmark is a PVM with real interest rate and real exchange rate variations. That is,

$$\tilde{ca}_t = b\tilde{r}_t + [\eta + \varepsilon\tau(\sigma - 1)] \sum_{i=1}^{\infty} \kappa^i E_t \tilde{r}_{t+i} - \eta \sum_{i=1}^{\infty} \kappa^i E_t \widetilde{\Delta ny^x_{t+i}}$$

$$+ \varepsilon\tau(1-\sigma)(1-\varepsilon) \sum_{i=1}^{\infty} \kappa^i E_t \widetilde{\Delta q_{t+i}}.$$

Bergin and Sheffrin (2000) show that extending the standard PVM along those dimensions improves its fit dramatically. To evaluate this extended version of the PVM in our context, we need to assign values to the parameters σ, ε, κ, τ, η, and *b*. The parameters τ, η, and *b* can be

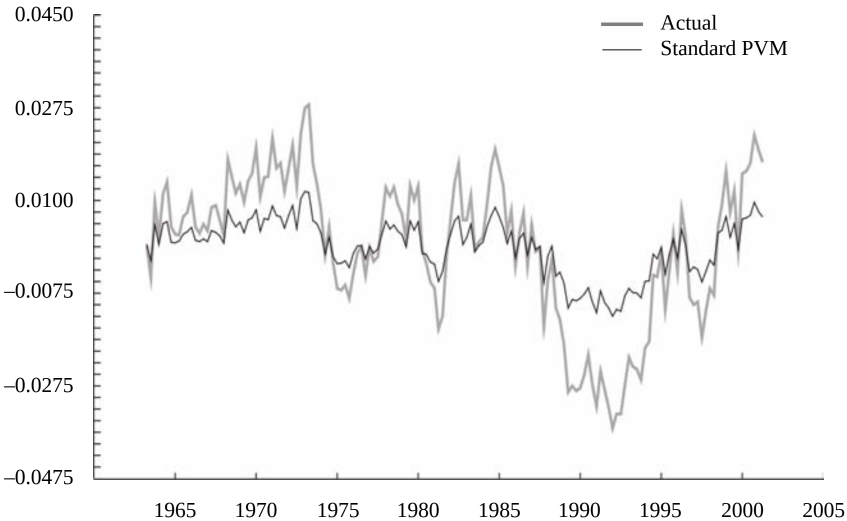
18. For the standard PVM, as well as for the two extended versions discussed below, the optimal lag length suggested by the Schwartz criterion is 1.

19. When contrasting our findings with those of earlier papers, one should bear in mind an important distinction: the standard PVM model tested in this paper involves the current account output ratio, rather than the *level* of the current account, as is typically done in the literature.

Table 2
Calibrated parameters

Parameter	Standard PVM	Extended PVM
τ	0.469	0.469
η	0.489	0.179
b	—	–0.269

Figure 3
Actual Canadian current account and the prediction of the standard PVM



estimated directly using data on the consumption-output ratio, the ratio of exportable net output to total output, and the ratio of international bonds to total output, respectively. The other parameters are more problematic, either because they are preference parameters or because we do not have reliable data to estimate them directly. Our strategy, therefore, is to estimate these parameters by minimizing the distance between the prediction of the PVM and the data. More precisely, we select the parameters that minimize the root-mean-squared error (RMSE) associated with the predicted current account series. This procedure yields a point estimate of the intertemporal elasticity of substitution, σ, of 0.008. This low value is consistent with Bergin and Sheffrin's estimate of 0.039.[20] The share of tradable goods in

20. Bergin and Sheffrin (2000) obtain this value by minimizing the Wald statistic.

total consumption, ε, is estimated to be 0.72. This estimate is higher than the value of 0.5 reported by Stockman and Tesar (1995), but it is too imprecise to allow reliable conclusions. Finally, the estimated discount factor, κ, is 0.999.

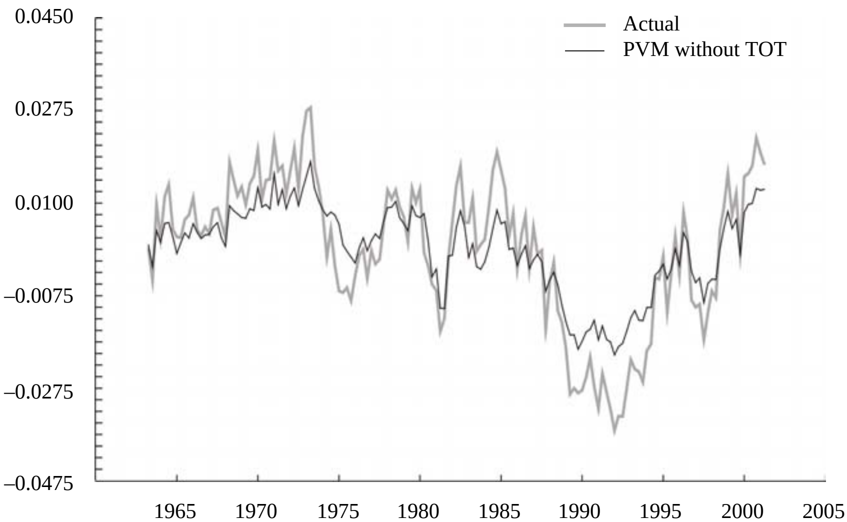
Figure 4 shows the current account series predicted by the PVM with time-varying interest and exchange rates. This series was generated using the point estimates of the structural parameters, and the estimated parameters of an unrestricted VAR that includes $\tilde{r}_t$, $\widetilde{\Delta ny_t^x}$, $\widetilde{\Delta q_t}$, and $\tilde{ca}_t$. As in Bergin and Sheffrin (2000), the predicted series fits the data substantially better than that implied by the standard PVM, although it is only 60 per cent as volatile as the actual series. Yet, the statistical test strongly rejects the cross-equation restrictions at any conventional level of significance. Given that the standard PVM could not be rejected at the 5 per cent significance level despite its poor fit, this suggests that passing the statistical test does not necessarily guarantee a good fit and vice versa, which raises some doubt regarding the usefulness of the Wald test as an overall assessment of the matching performance of present-value models.

To evaluate the PVM augmented with terms of trade, we estimate the parameter γ along with the parameters σ, ε, and κ by minimizing the RMSE associated with the predicted current account series. Equation (18) states that the effect of the terms of trade on the current account is inversely proportional to the value of γ. In the limiting case where $\gamma = 1$, the current account does not depend on the terms of trade at all. Our estimation procedure yields a point estimate of γ equal to 0.991, suggesting that terms of trade do not matter for the current account. Table 3 shows that the RMSEs associated with the PVM with and without terms of trade are essentially the same. This is illustrated in Figure 5, which shows that the current account series predicted by the two models are almost identical, confirming that terms-of-trade fluctuations are irrelevant to the Canadian current account.

Overall, these findings corroborate earlier results reported by Otto (2003), who uses a structural VAR approach to test for the presence of an HLM effect in a large sample of small open economies. Although he finds strong evidence for the existence of such an effect for the majority of countries, his results indicate that Canada is an outlier, in that terms of trade were found to have no significant effect on the Canadian trade balance. In addition, variance-decomposition results reported by Cashin and McDermott (2002) and Otto (2003) indicate that terms-of-trade shocks are not important in explaining current account movements in Canada.[21]

21. Using panel data from the G-7 countries and a different methodology, İşcan (2000) also finds little evidence that the terms of trade affect the current account.

Figure 4
Actual Canadian current account and the prediction of the PVM without terms-of-trade variations



Note: TOT = terms of trade.

3 Robustness Analysis

This section investigates the robustness of our results to the use of an alternative measure of the terms of trade. The terms-of-trade index used in this paper is constructed using unit values (value of imports/exports divided by some measure of volume), not properly weighted transactions prices. Such estimates are potentially biased measures of relative prices, because goods that are not traded or are relatively less traded because their relative price is too high are given zero or little weight in the index. In theory, however, the relative prices should be weighted by production, not trade, shares.[22] To check whether this issue is responsible for the lack of evidence of an HLM effect in Canada, we test the PVM (equation (18)) using the relative non-energy commodity price index as a proxy for the terms of trade.[23] With this new measure, the correlation between the ratio of the current account to output and changes in the terms of trade is now equal to

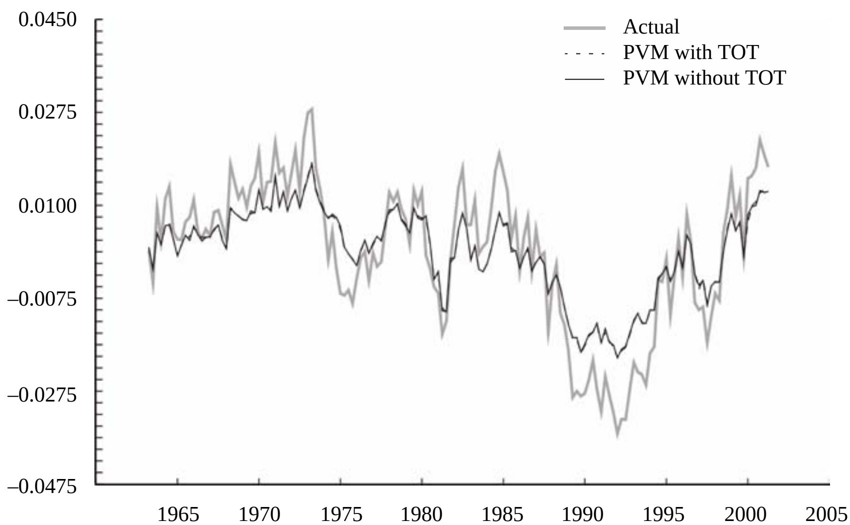
22. We thank Lawrence Schembri for bringing this point to our attention.
23. This variable is used as a measure of the terms of trade by the Bank of Canada and is found to have significant effects on the Canadian exchange rate.

Table 3
Tests of different versions
of the PVM of the current account

	Model		
Parameter	**Standard PVM**	**PVM without TOT**	**PVM with TOT**
κ	0.9900	0.9993	0.9999
		(0.0823)	(0.0225)
σ	—	0.0085	0.0001
		(1.1559)	(0.1414)
ε	—	0.7246	0.7164
		(4.5193)	(4.4208)
γ	—	—	0.9911
			(1.4580)
Statistic			
RMSE	0.0964	0.0071	0.0070
Wald statistic	5.1890	31.7250	32.5020
p-value	0.0747	0.0000	0.0000
$\sigma_{\hat{ca}}/\sigma_{\hat{ca}}$	0.3859	0.6047	0.6105

Notes: Standard errors are between parentheses. For the standard PVM, the parameter η is set to 0.489. For the PVM with and without terms of trade, the parameters τ, η, and b are fixed to 0.469, 0.179, and –0.269, respectively. RMSE is the root-mean-squared error.

Figure 5
Actual Canadian current account and the predictions
of the PVM with and without terms-of-trade variations



0.21. The latter series is also more positively correlated with changes in the real exchange rate, as the correlation is now equal to 0.18.

Table 4 shows that the results remain virtually unchanged when we use the alternative measure of the terms of trade. In particular, the estimate of the parameter γ is identical to the value reported in Table 3, and the cross-equation restrictions implied by the PVM (equation (18)) are strongly rejected by the data.[24] Figure 6 further shows that the terms of trade are not important in explaining the Canadian current account. This suggests that our results are robust, at least to the construction of terms-of-trade series.

Conclusion

This paper has extended the standard intertemporal model of the current account to allow for stochastic variations in three relative prices: the world real exchange rate, the real exchange rate, and the terms of trade. Previous research has shown that variations in the world real interest rate and the real exchange rate substantially improve the fit of the intertemporal model. For Canada, however, a significant portion of current account fluctuations remains unexplained even when movements in the world real interest rate and the real exchange rate are taken into account. The purpose of this paper, therefore, was to investigate whether including the terms of trade improves the ability of the intertemporal model to explain the historical path of the Canadian current account.

To do this, the paper has derived a closed-form solution for the present-value representation of the current account that highlights, in addition to the usual consumption-smoothing motive, three different channels through which movements in the real interest rate, the real exchange rate, and the terms of trade affect the current account. The restrictions implied by the extended model were subjected to present-value tests. Our results show that the extended model is strongly rejected by the data, and that terms-of-trade movements do not affect the Canadian current account in a significant way. These findings support earlier results reported by Otto (2003), who finds little evidence that terms of trade matter for the current account in Canada.

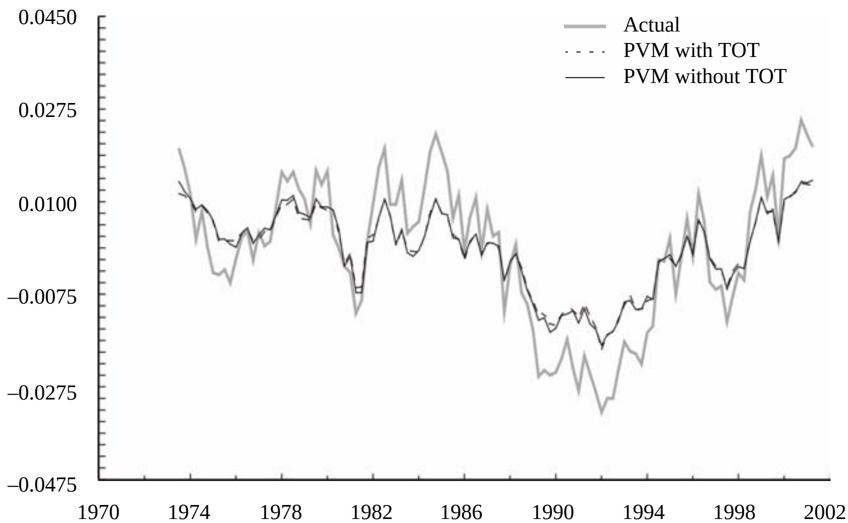
24. These results are based on a shorter sample, because the non-energy commodity price series is available only starting from 1973Q1.

Table 4
Robustness analysis: Results using an alternative measure of the terms of trade

	Model	
Parameter	**PVM without TOT**	**PVM with TOT**
κ	0.9993	0.9994
	(0.0963)	(0.0906)
σ	0.0087	0.0012
	(1.4692)	(0.5126)
ε	0.6388	0.6171
	(4.0642)	(4.1062)
γ	—	0.9895
		(1.0141)
Statistic		
RMSE	0.0075	0.0077
Wald statistic	18.6650	24.5700
p-value	0.0009	0.0001
$\sigma_{\hat{ca}}/\sigma_{ca}$	0.5808	0.5585

Notes: See Table 3.

Figure 6
Actual Canadian current account and the predictions of the PVM with and without terms-of-trade variations, using an alternative measure of the terms of trade



Appendix 1
Derivation of the Log-Linearized Intertemporal Budget Constraint (Equation (14))

Our log linearization of the intertemporal budget constraint follows Kano (2003). Dividing both sides of equation (13) by $P_t^c Y_t$ gives

$$\frac{C_t^T}{P_t^c Y_t} \sum_{i=0}^{\infty} E_t R_{t,i} \frac{C_{t+i}^T}{C_t^T} = (1+r_t) \frac{B_t}{P_t^c Y_t} + \frac{P_t^x N Y_t^x}{P_t^c Y_t} \sum_{i=0}^{\infty} E_t R_{t,i} \frac{P_{t+i}^x N Y_{t+i}^x}{P_t^x N Y_t^x}. \qquad \text{(A1.1)}$$

Notice that for any variable x_t, the relation

$$\frac{x_{t+i}}{x_t} = \frac{x_{t+i}}{x_t} \frac{x_{t+2}}{x_{t+1}} \cdots \frac{x_{t+i}}{x_{t+i-1}}$$

holds. Also, from equation (2), $C_t^T / P_t^c Y_t = \varepsilon C_t / Y_t = \varepsilon \tau_t$. Therefore, the intertemporal budget constraint can be rewritten as

$$\varepsilon \tau_t \left[1 + \sum_{i=1}^{\infty} E_t R_{t,i} \prod_{j=t+1}^{t+i} \left(\frac{C_j^T}{C_{j-1}^T} \right) \right] = (1+r_t) \frac{B_t}{P_t^c Y_t} + \eta_t \left[1 + \sum_{i=1}^{\infty} E_t R_{t,i} \prod_{j=t+1}^{t+i} \left(\frac{P_j^x N Y_j^x}{P_{j-1}^x N Y_{j-1}^x} \right) \right]. \qquad \text{(A1.2)}$$

Notice that for any variable X_t, the relation

$$\prod_{j=t+1}^{t+i} X_j = \exp\left\{ \sum_{j=t+1}^{t+i} \ln(X_j) \right\}$$

holds. From this relation and the definition of $R_{t,i}$, equation (A1.2) can be further rearranged as

$$\varepsilon \tau_t \left[1 + \sum_{i=1}^{\infty} E_t \exp\left\{ \sum_{j=t+1}^{t+i} (\Delta c_j^T - r_j) \right\} \right] = \exp(r_t) b_t$$

$$+\eta_t\left[1+\sum_{i=1}^{\infty}E_t\exp\left\{\sum_{j=t+1}^{t+i}(\Delta\ln p_j^z+\Delta ny_j^x-r_j)\right\}\right], \quad \text{(A1.3)}$$

where $(1+r_t) = \exp\{\ln(1+r_t)\}\approx\exp(r_t)$ and $b_t\equiv B_t/(P_t^cY_t)$.

Taking a first-order Taylor expansion of the LHS of equation (A1.3) around the mean values gives

$$\widetilde{\text{the LHS}}\approx\frac{\varepsilon}{1-\alpha}\tilde{\tau}_t+\frac{\varepsilon\tau}{1-\alpha}\sum_{i=1}^{\infty}\alpha^iE_t\{\widetilde{\Delta c_{t+i}^T}-\tilde{r}_{t+i}\}, \quad \text{(A1.4)}$$

where

$$\alpha = \exp\left(g^{C^T}-r\right)$$

is assumed to be less than 1. The RHS of equation (A1.3) is also approximated as

$$\widetilde{\text{the RHS}}\approx\exp(r)\tilde{b}_t+\exp(r)b\tilde{r}_t+\frac{\eta_t}{1-\kappa}\sum_{i=1}^{\infty}\kappa^iE_t\{\widetilde{\Delta p_{t+i}^x}$$

$$+\widetilde{\Delta ny_{t+i}^x}-\tilde{r}_{t+i}\}+\frac{1}{1-\kappa}\tilde{\eta}_t, \quad \text{(A1.5)}$$

where $\kappa = \exp(g^p+g^{ny}-r)$ is assumed to be less than 1. From equations (A1.4) and (A1.5), we have

$$\varepsilon\tilde{\tau}_t-\frac{1-\alpha}{1-\kappa}\tilde{\eta}_t\approx(1-\alpha)\exp(r)\tilde{b}_t+(1-\alpha)\exp(r)b\tilde{r}_t$$

$$-\varepsilon\tau\sum_{i=1}^{\infty}\alpha^iE_t[\widetilde{\Delta c_{t+i}^T}-\tilde{r}_{t+i}]+\eta\frac{1-\alpha}{1-\kappa}\sum_{i=1}^{\infty}\kappa^iE_t$$

$$[\widetilde{\Delta ny_{t+i}^x}-\tilde{r}_{t+i}+\widetilde{\Delta p_{t+i}^x}],$$

which is equation (14) in the main text.

Appendix 2
Derivation of the Present-Value Model (Equation (18))

For simplicity, assume that the economy is on a balanced growth path: the growth rate of the tradable consumption basket is the same as that of the exportable net output. That is, $\alpha = \kappa$. Then, substituting equation (16) into the intertemporal budget constraint (equation (14)) yields

$$\varepsilon\tilde{\tau}_t - \tilde{\eta}_t = (1-\kappa)\exp(r)\tilde{b}_t + (1-\kappa)\exp(r)b\tilde{r}_t - [\eta + \varepsilon\tau(\sigma-1)]$$

$$\sum_{i=1}^{\infty} \kappa^i E_t\tilde{r}_{t+i} + \eta \sum_{i=1}^{\infty} \kappa^i E_t\widetilde{\Delta ny^x_{t+i}} - \varepsilon\tau(1-\sigma)(1-\varepsilon)$$

$$\sum_{i=1}^{\infty} \kappa^i E_t\widetilde{\Delta q_{t+i}} + \eta \sum_{i=1}^{\infty} \kappa^i E_t\widetilde{\Delta q^x_{t+i}}. \tag{A2.1}$$

To derive the optimal current account ratio equation, divide both sides of the current account identity (equation (17)) by $P^c_t Y_t$; this yields

$$ca_t \equiv \frac{CA_t}{P^c_t Y_t} = \{\exp[\ln(1+r_t)] - 1\}b_t + \eta_t - \varepsilon\tau_t \approx [\exp(r_t)$$

$$-1]b_t + \eta_t - \varepsilon\tau_t.$$

Taking a first-order Taylor expansion of this equation gives

$$\tilde{ca}_t([\exp(r) - 1]\tilde{b}_t + \exp(r)b\tilde{r}_t + \tilde{\eta}_t - \varepsilon\tilde{\tau}_t). \tag{A2.2}$$

Substituting (A2.1) into (A2.2) and using equation (9) yields the optimal current account ratio,

$$\tilde{ca}_t = [\kappa\exp(r) - 1]\tilde{b}_t + \kappa\exp(r)b\tilde{r}_t + [\eta - \varepsilon\tau(\sigma-1)]\sum_{i=1}^{\infty} \kappa^i E_t\tilde{\tau}_{t+i}$$

$$-\eta \sum_{i=1}^{\infty} \kappa^i E_t\widetilde{\Delta ny^x_{t+i}} + \varepsilon\tau(1-\sigma)(1-\varepsilon)\sum_{i=1}^{\infty} \kappa^i E_t\widetilde{\Delta q_{t+i}}$$

$$-\eta(1-\gamma)\sum_{i=1}^{\infty}\kappa^{i}E_t\widetilde{\Delta p_{t+i}}.$$

Since $\kappa\exp(r) = \exp(g^{ny}+g^{p})$ takes a value close to one, in particular, in quarterly data, it is a reasonable approximation to set the coefficients on the first and second terms in the RHS to zero and *b*, respectively.

Thus,

$$\tilde{ca}_t = b\tilde{r}_t + [\eta+\varepsilon\tau(\sigma-1)]\sum_{i=1}^{\infty}\kappa^{i}E_t\tilde{r}_{t+i} - \eta\sum_{i=1}^{\infty}\kappa^{i}E_t\widetilde{\Delta ny^{x}_{t+i}}$$

$$+\varepsilon\tau(1-\sigma)(1-\varepsilon)\sum_{i=1}^{\infty}\kappa^{i}E_t\widetilde{\Delta q_{t+i}} - \eta(1-\gamma)\sum_{i=1}^{\infty}\kappa^{i}E_t\widetilde{\Delta p_{t+i}},$$

which is equation (18) in the main text.

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Discussion

Gregor Smith

The main finding of the study by Bouakez and Kano is that changes in the terms of trade probably do not cause changes in Canada's current account. I think this finding is correct, and I have nothing but praise for their work. In this discussion, I shall first give a simple explanation of their approach, for their paper is quite technical. I shall then conclude with suggestions on where to look for explanations of the thus far unexplained volatility in the current account.

Abridged Version

Present-value models of the current account begin by taking output and the terms of trade as given. Figuring out a path for consumption spending then implies a path for international borrowing. To see how this approach works, suppose that there are two time periods. Suppose also that a country begins with net foreign assets B_0, imports to consume, and exports NY^x at relative price P (the terms of trade) to pay for that:

$$C_1 + \frac{C_2}{1+r} = (1+r)B_0 + P_1 NY_1^x + \frac{P_2 NY_2^x}{1+r}. \qquad (1)$$

You can see that terms-of-trade shocks affect the national budget just like output shocks do. With consumption smoothing, consumption will respond more to permanent than to temporary shocks, and so the current account will do the opposite.

Formally, $C_1 = C_2$ implies:

$$C_1 = \frac{1+r}{2+r}\left[(1+r)B_0 + P_1 NY_1^x + \frac{P_2 NY_2^x}{1+r}\right]$$

$$= \frac{1}{2+r}B_0 + \frac{1+r}{2+r}P_1 NY_1^x + \frac{P_2 NY_2^x}{2+r}. \tag{2}$$

The current account becomes:

$$CA_1 = TB_1 + rB_0$$

$$= P_1 NY_1^x - C_1 + rB_0$$

$$= P_1 NY_1^x - \frac{1+r}{2+r}\left[(1+r)B_0 + P_1 NY_1^x + \frac{P_2 NY_2^x}{1+r}\right] + rB_0$$

$$= \frac{1}{2+r}[P_1 NY_1^x - P_2 NY_2^x] - \frac{1}{2+r}B_0. \tag{3}$$

If a terms-of-trade shock is permanent—in other words, if both P_1 and P_2 change—then the current account does not move in response. [Note: My simple example rules out effects of the terms of trade via changes in the interest rate or substitution between non-traded goods and imports.]

Econometric Methods

This toy current account model (3) reflects saving for a rainy day; an expected decline in export earnings in the future leads to a larger current account balance today. But of course $P_2 NY_2^x$ is not perfectly known in advance. Imagine trying to forecast it using an autoregression:

$$P_2 NY_2^x = \rho_1 P_1 NY_1^x, \tag{4}$$

with a coefficient ρ_1. To see how the econometric, cross-equation restrictions arise, focus on the trade balance. Using our forecast (4) to replace $P_2 NY_2^x$ in the theory (3) gives:

$$TB_1 = \frac{1}{2+r}P_1 NY_1^x(1-\rho_1). \tag{5}$$

This result shows that the response of the trade balance (and current account) is larger the less persistence there is in export earnings (the lower is the value of ρ_1). Again, if all changes are permanent, then $\rho_1 = 1$, and the changes lead to no movement in the current account. One way to test the theory would be to estimate these two equations (4) and (5) and to determine whether ρ_1 is the same in both of them.

A second way to test the theory begins by including more information in the forecasts. Here, then, is a second possible forecasting model:

$$P_2 NY_2^x = \beta_0 + \beta_1 P_1 NY_1^x + \beta_2 TB_1 . \tag{6}$$

It is natural to include TB_1, for, according to the theory (3), the trade balance partly reflects the expected future value of export earnings. Now the predicted trade balance is:

$$\begin{aligned} TB_1 &= \frac{1}{2+r}[P_1 NY_1^x - \beta_0 - \beta_1 P_1 NY_1^x - \beta_2 TB_1] \\ &= \frac{\beta_0}{2+r} + \left[\frac{1}{2+r} - \beta_1\right] P_1 NY_1^x - \frac{\beta_2}{2+r} TB_1 . \end{aligned} \tag{7}$$

If the predicted trade balance is to be equal to the actual one, then $\beta_1 = 1/(2+r)$ and $\beta_2 = -(2+r)$. Equivalently, in my toy example, simply rearranging the theory gives the optimal forecast of future export earnings as:

$$E_1 P_2 NY_2^x = P_1 NY_1^x - (2+r) TB_1 , \tag{8}$$

so the theory restricts the two coefficients in this forecasting regression. These are the restrictions that are formally tested by Bouakez and Kano, and rejected.

Notice that this optimal forecast (8) does not provide information directly on the persistence properties of the terms of trade: β_1 does not appear. Let us look at the persistence directly. If we run a regression like the first one (4) in the Bouakez-Kano terms-of-trade series, we get $\hat{\rho}_1 = 0.911$ (0.03), or with the alternative series, $\hat{\rho}_1 = 0.968$ (0.02). Looking back at the trade-balance equation (6), you will see that this means the theory predicts very little response in the trade balance or the current account, which is what Bouakez and Kano find. My forecasting model (4) is very simple, though. It would be interesting to decompose the terms of trade into permanent and temporary components to check on the relative importance of these two types of changes.

Bouakez and Kano's equation (18) includes these terms:

$$\tilde{c}a_t = -\eta \sum_{i=1}^{\infty} \kappa_i E_t \Delta n y^x_{t+i} \ \ldots \ -\eta(1-\gamma) \sum_{i=1}^{\infty} \kappa_i E_t \Delta p_{t+i}. \tag{9}$$

The first term is the one traditional to this approach, while the second one is due to the terms of trade. Bouakez and Kano find $\hat{\gamma} = 1$, so the second term plays no role. Note that γ appears nowhere else in the equation—it is measuring this response only—so this negative finding does not depend on some weird over-identification. Goodger (2004) studies Canada, Australia, the Netherlands, and the United Kingdom, using a calibrated version of the present-value model. He too finds no role for terms-of-trade shocks for any of these countries.

In sum:

(i) shocks to the terms of trade have been quite persistent, so the insurable part has been small; and

(ii) statistically, the response of international borrowing and lending to this insurable part is zero.

Finally, here is another way of thinking about the absence of an effect of the terms of trade. Bouakez and Kano report that the correlation between ca/y and changes in the terms of trade is less than 0.05. We know that the theory involves other lags as well. We also know that it is the correlation between the terms of trade and the part of the current account that cannot be explained by other variables that is at issue. Nevertheless, with this low, contemporary correlation, it would take truly heroic (i.e., wrong) econometrics to identify a significant relationship.

What Is Missing?

Measuring the effect of the terms of trade on the current account requires a statistical model that fits historical data well. But these present-value models always seem to be rejected in formal tests. The models are still around, because (i) they track the low-frequency movements in the data, and equivalently, (ii) they find significant roles for output fluctuations and (to a lesser extent) for real interest rates and real exchange rates. But, as is well known, they cannot match the range of variability in the actual current account. The figures in the Bouakez-Kano paper illustrate these features very well.

Given these problems in fitting the ca/y series, should we be suspicious of the Bouakez-Kano findings? I do not think so. It is unlikely that this finding arises because of some omitted variables. Imagine the current account this way:

$$CA = S(P, G) - I(P, z), \tag{10}$$

where P is the terms of trade, and G is another variable—omitted from the present study—that affects national saving. Investment potentially is affected by the terms of trade and also by country-specific productivity changes, z.

Consider the saving side of the equation. Excluding this G-effect on the current account would influence the conclusion about the terms-of-trade effect only if it is correlated with both the terms of trade and the current account. Its absence will not affect $\hat{\gamma}$ in the linear, statistical model (9) if it affects the current account, but is unrelated to the terms of trade. Measures of fiscal policy might fortuitously be correlated with the terms of trade—so that their omission would potentially bias $\hat{\gamma}$—but Nason and Rogers (2003) show that it is quite difficult to find evidence of large fiscal-policy effects on the current account.

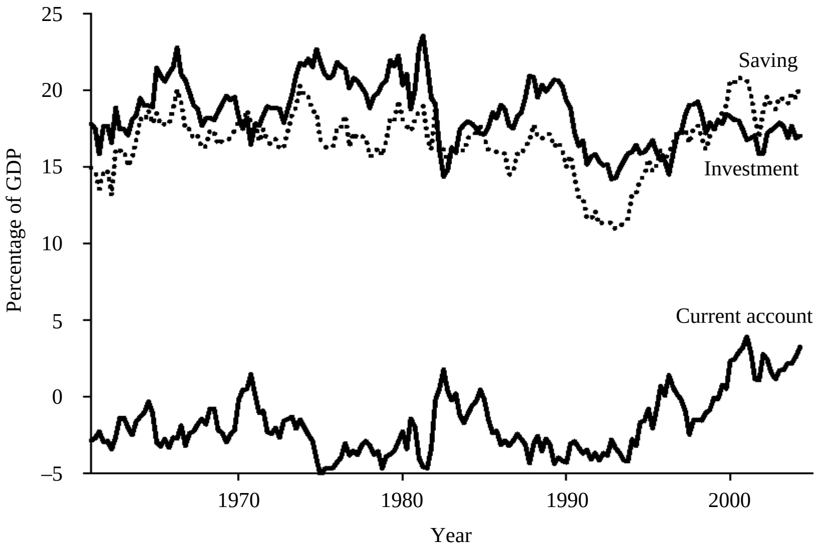
What about investment? Again, it is possible that saving—the part of the current account modelled in this study—does respond to the temporary component of the terms of trade, but that there is an offsetting response from investment so that the net effect is zero. However, İşcan (2000) finds little effect of the terms of trade on investment (or the current account).

One concludes that focusing on the terms of trade will not improve our explanations of the swings in the current account. So what will? I suggest that we turn to models of investment, rather than refining present-value models based on the permanent-income hypothesis for consumption. The statistical studies by İşcan (2000) and Marquez (2002) are two of the surprisingly few in this area. They find significant roles for national productivity in explaining changes in the current account.

General-equilibrium models like those of İşcan (2000) and Letendre (2004) study the Canadian current account by trying to predict output, investment, and saving jointly, rather than taking output as given as the traditional, present-value models do. Letendre's approach includes world real interest rates and productivity shocks. He tracks the Canadian trade balance quite well, and perhaps better than the traditional, present-value model does. But his model does not track investment well, so it leaves plenty of work still to do.

Figure 1 shows Canadian saving and investment shares from 1961 into 2004. The investment share excludes government investment, and is given by 100(V498095+V498100)/V498074. The current account share is given by 400(V114421/V498074) from CANSIM II.

Figure 1
Saving and investment shares of GDP



I have deliberately rigged the diagram so that the investment share and the current account are shown with the same dark line, to enhance the impression that these curves mirror each other and most of the variation in the current account is due to variation in investment rather than saving. In fact, the variances are linked like this:

$$var\left(\frac{CA}{Y}\right) = var\left(\frac{S}{Y}\right) + var\left(\frac{I}{Y}\right) - 2cov\left(\frac{S}{Y}, \frac{I}{Y}\right)$$

$$4.038 = 4.426 + 4.089 - 4.477 . \qquad (11)$$

Fluctuations in the investment and saving shares of GDP give rise to roughly the same amounts of variation in the current account. Still, investment decisions are a natural focus for anyone interested in explaining the volatility in the current account.

References

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