What are the Sources of Current Account Fluctuations in the G6 Countries?

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**Abstract**

We analyze the sources of current account fluctuations for the G6 economies. Based on Bergin and Sheffrin’s (2000) two-goods inter-temporal model, we build a SVAR model including the world real interest rate, net output, the real exchange rate, and the current account. The theory model allows for the identification of structural shocks in the SVAR using long-run restrictions. Our results suggest three main conclusions: i) the present-value model of the CA is supported for all countries but France; ii) the results lend some support for the two-good intertemporal model, since both external supply and preferences shocks account for an important proportion of CA fluctuations; iii) the excess response of the CA to temporary output shocks is less pronounced than in previous studies.

**Keywords:** Current account, real exchange rate, two-good intertemporal model, SVAR

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1 Introduction

Current account (CA) fluctuations in open economies have acquired a central importance in both empirical and theoretical models of international macroeconomics. In recent years, understanding the causes of CA changes has acquired an even more important role because of the existence of large and persistent global imbalances.\(^1\) The current financial crisis has been associated with the unfolding of these imbalances, a concern that was already reflected in IMF (2004) who claim that one of the main risks for the global economy was in “achieving an orderly resolution of global imbalances.”

There exist multiple models that analytically evaluate the current account. The canonical Mundell-Fleming-Dornbusch model remains an important tool for policy makers and has been used to explain issues such as “twin deficits.” Nonetheless, in the 1980’s a number of studies moved towards the so-called ‘intertemporal approach’ in which the CA is viewed as reflecting intertemporal consumption decisions and productivity shocks. Importantly, the intertemporal current account approach assumes that the current account of a small open economy is independent of global shocks and that the current account only responds to temporary country-specific shocks and not to permanent ones. The theory behind this basic model has been extended into many directions so as to include investment, interest rates, traded and nontraded goods, price rigidities, pricing to market and monetary policy (see Obstfeld and Rogoff, 1996). These models have helped understanding the driving factors behind CA changes and net foreign asset accumulation. Their implications are also directly or indirectly testable, making them a logical benchmark against which to analyze empirical data.

Bergin and Sheffrin (2000) present a model of the CA that introduces a richer set of variables, allowing for the analysis of the role of (variable) world interest rates and

\(^1\) See, for instance, the recent models of Caballero, Farhi and Gourinchas (2008) and Obstfeld and Rogoff (2004).
the real exchange rate (RER). Their model follows the standard analysis of Dornbusch (1983) and Obstfeld and Rogoff (1996) by introducing a traded and a non-traded sector in a small open economy setting with a variable interest rate. The model is then linearized, and the restrictions from the present value model are then tested for Australia, Canada and the UK in a similar fashion to the pioneering work of Campbell (1987). The introduction of variable interest rates and the RER allows for the analysis of the role played by external shocks, which can be a major source of CA fluctuations in small economies.

Although tests of the present value approach are a core element of the literature, recently, researchers moved on to the structural vector autoregression (SVAR) approach. Theoretical models are used to impose minimal identification restrictions on VAR models and then used to test the important implication of the intertemporal model that country-specific permanent shocks do not have any effect on the current account. Many researchers have recently followed this methodology such as Ahmed and Park (1994), Lane (2001b), Nason and Rogers (2002), Lee and Chinn (2006), and Kano (2008).

In this paper, using the two-goods small open economy model of Bergin and Sheffrin (2000), we analyze the sources of CA fluctuations in the G6 (G7 minus the US) countries which allows us to introduce a time-varying world real interest rate and the RER. The model allows us to have four different sources of shocks: domestic permanent, domestic temporary, external demand, and external supply shocks. This will also help understand the dynamic relation between CA and RERs, which is the focus of, for instance, Lee and Chinn (2006). We do so by estimating a four-variable SVAR model, which is identified, based on theory predictions, using a long-run Blanchard and Quah (1989) scheme.

The rest of this paper is organized as follows. In Section 2, we review some of the abovementioned empirical studies. Section 3 presents the theory model. Section 4 presents the data and their properties. Section 5 presents the impulse-response
functions and variance decompositions arising from the SVAR. Finally, Section 6 concludes.

2 Literature Review

From the 1980’s, researchers have focused on finding a superior alternative framework to the Mundell-Fleming-Dornbusch model. Those last two decades, a number of studies have moved towards the so-called ‘intertemporal-approach’, which is based on micro-founded dynamic optimising models, where preferences, technology, and capital markets are directly modelled. International asset markets play a central role in this framework: they enable economies to trade consumption goods over time by allowing them to borrow from and lend to each other (Obstfeld and Rogoff, 1996).

Despite the rapid improvements in theory models, empirical testing lagged behind for a while. Most of the initial empirical studies were based on extensions of the Campbell (1987) and Campbell and Shiller (1987) consumption-based present value models. These works were pioneered by Sheffrin and Woo (1990a, b), Otto (1992) and Gosh (1995). They essentially use overidentifying restrictions arising from theory models applied to a VAR representation of the present value formula, which can then be tested. This is also the approach used in Bergin and Sheffrin (2000). Using quarterly data from 1960:1 to 1996:4 and countries that had previously been problematic, Australia, Canada, and the UK, they concluded that the two-good intertemporal model reduces the deviation of the actual consumption path from the optimal one significantly for the first two countries. They also express the belief that this better fit is due to the inclusion of the exchange rate in the model, leading support for the two-goods version of the model.

Recently, researchers have moved away from the use of the present value approach to the use of the structural vector autoregression (SVAR) approach to test the
implications of the intertemporal model. As previously mentioned, the intertemporal model’s main implication is that the current account is primarily driven by country-specific temporary shocks, and not permanent ones. Hence, in order to test the adequacy of the intertemporal model, one should be able to decompose the system shocks between temporary and permanent ones, which naturally lends itself to a SVAR structure.\(^2\)

Ahmed and Park (1994) use a four-variable long-run SVAR model to examine macroeconomic fluctuations in seven OECD small open economies. Using the Blanchard and Quah (1989) identification method, they are able to identify four distinct structural shocks, which are external shocks, domestic supply shocks, domestic absorption shocks and domestic price level shocks. Their results show that, firstly, domestic absorption shocks are the main shocks explaining movements of the trade balance and, secondly, that external shocks do not seem to be trivial in explaining fluctuations of the trade balance.

Lane (2001b) estimates a trivariate VAR system including the first-difference of the ratio of the U.S. and the world output, the consumer price levels ratio between the U.S. and the rest of the world, and the U.S. current account to GDP ratio. Using long-run neutrality restrictions, Lane identifies three orthogonal structural shocks; supply, absorption and monetary shocks. Using the accumulated impulse responses, he showed that a positive monetary shock on the current account leads to its short-run deterioration at first and then, a persistent surplus is observed.

Nevertheless, Lee and Chinn (2006) explain that, if in the steady-state the stock of net foreign assets is constant, then neither real nor monetary disturbance would have any long-run effects on the current account to GDP ratio. They estimated a bivariate model, including the first difference of the real exchange rate and the current account to GDP ratio for the G-7 countries. They identified the structural shocks as

\(^{2}\) Recently, Bergin (2003 and 2006) proposes direct tests of the models through maximum likelihood estimation of the parameters of the linearized model, in a fashion similar to estimated DSGE models (see Smets and Wouters, 2003).
productivity shocks (country-specific permanent shocks) and monetary shocks (country-specific temporary shocks). In order to be in accordance with the NOEM literature and allow for pricing-to-market behaviour, they restricted temporary shocks so as not to have any long-run effect on the level of the real exchange rate. These identifications made possible the estimation of the short-run dynamics of the variables. They show that, in most of the countries, a positive monetary policy shock leads to a short-run real exchange rate depreciation and a short-run current account surplus. Their main conclusion is consistent with most of the theoretical models: “permanent shocks have large long-term effects on the real exchange rate, but relatively small effects on the current account; temporary shocks have large effects on the current account and exchange rate in the short-run, but not on either variable in the long-run.”

Finally, Kano (2008) uses a three-variable SVAR model that consists of the world real interest rate, the domestic net output change, and the current account expressed as a percentage of net output. He identifies three structural shocks, which are global shocks, country-specific temporary shocks, and country-specific permanent shocks. The identification scheme of the SVAR exploits firstly the orthogonality of the world real interest rate and country-specific shocks, and secondly, the absence of a long-run response of net output to transitory shocks. This scheme is based on the fact that the current account in a small open economy should be independent of global shocks, and that fluctuations of the current account to country-specific shocks depend on the persistence of those shocks. Using data for Canada and the UK, he concludes that although country-specific transitory shocks induce very large fluctuations of the current account and thus explain most of the movements of the current account, they play a minimal role in explaining fluctuations in net output growth.

In our model, we introduce the RER together with the CA-output ratio, the world real interest rate and net output. This allows us to distinguish between external and
preference shocks, both of which can induce CA fluctuations and hence long-run changes in the net foreign asset position of the country. This is in addition to the standard domestic temporary and permanent shocks.

3 Theory

Here we describe the Bergin and Sheffrin (2000) model which we use as a benchmark for identification. This model considers a small open economy (SOE) producing traded and nontraded goods, and an infinite number of representative households consuming both goods. It is assumed that international bonds are the only assets of the SOE. Given that the country can borrow and lend with the rest of the world, we also make the assumption that the world real interest rate is not constant. Knowing this, we can represent the country’s current account by:

\[
CA_t = B_t - B_{t-1} = r_t B_{t-1} + Y_t - I_t - G_t - C_t
\]

where \(CA_t\) is the current account, \(B_t\) is the stock of external assets at the beginning of the period, \(r_t\) is the time-varying world real interest rate expressed in terms of tradable goods, \(Y_t\) denotes domestic output, \(I_t\) investment, \(G_t\) government spending, and \(C_t\) consumption. Consumption expenditure can be expressed in terms of traded goods as \(C_t = C_{Tt} + P_t C_{Nt}\), where \(C_{Tt}, C_{Nt}\) and \(P_t\) are consumption of traded good, consumption of nontraded good and the relative price of nontraded goods in terms of traded ones, respectively. Note that all variables are in real per-capita terms.

The intertemporal maximisation problem for the representative agent is to choose a consumption path that will maximise lifetime utility:

\[
\max_{C_{Tt}, C_{Nt}} E_0 \sum_{t=0}^{\infty} \beta^t U(C_{Tt}, C_{Nt})
\]

s.t.

\[
Y_t - (C_{Tt} + P_t C_{Nt}) - I_t - G_t + r_t B_{t-1} = B_t - B_{t-1}.
\]
where \[ U(C_{\tau}, C_{\bar{\tau}}) = \frac{1}{1-\sigma} (C_{\tau}^{\sigma} C_{\bar{\tau}}^{1-\sigma})^{1-\sigma}, \]

\[ \sigma > 0, \sigma \neq 1, 0 < \alpha < 1, \]

and \( \frac{1}{\sigma} \) represents the intertemporal elasticity of substitution and \( \alpha \) is the share of traded goods in total consumption. Bergin and Sheffrin (2000) define the index of total consumption as \( C^*_{\tau} = C_{\tau}^{\sigma} C_{\bar{\tau}}^{1-\sigma} \) and a consumption-based price index, \( P^*_\tau \), as the minimum amount of consumption expenditure expressed in terms of traded goods, \( C_{\tau} = C_{\bar{\tau}} + P_{\tau} C_{\bar{\tau}}, \) such that \( C^*_{\tau} = 1 \), given \( P_{\tau} \) (see Obstfeld and Rogoff, 1996).

Equations (1) and (2) will yield a set of dynamic equations which are then log-linearized. Assuming firstly log normality for the world real interest rate, the consumption growth rate, and the percentage change in the relative price of nontraded goods and, secondly, that the variance and covariance among variables are time-invariant, we obtain the Euler equation:

\[ E_t \Delta c_{t+1} = k + \gamma E_t r^*_t \]

where \[ r^*_t = r_t + \left[ \frac{1-\gamma}{\gamma} (1-\alpha) \right] \Delta p_{t+1}, \]

\( \gamma = 1/\sigma \) is the intertemporal elasticity of substitution, and \( k \) is a constant.

This condition is crucial since it shows that the consumption-based real interest rate, \( r^* \), which depends on both the interest rate (\( r \)) and the relative price of non-traded goods (\( p \)), influences the optimal consumption path of the consumer.

To further decompose the consumption Euler equation, we substitute (5) into (4) to obtain:

\[ E_t \Delta c_{t+1} = k + \gamma E_t \left[ r^*_t \right] + (1-\gamma)(1-\alpha) E_t \left[ \Delta p_{t+1} \right] \]

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\( ^3 \) All lower case letters are in logarithms except the real interest rate, which we used \( \log(1 + r_t) \approx r_t \).
where, \( \Delta c_{t+1} = \log C_{t+1} - \log C_t \) and \( \Delta p_{t+1} = \log P_{t+1} - \log P_t \), \( \gamma \) represents the intertemporal elasticity of substitution \( \frac{1}{\sigma} \), and \( \alpha \) shows the proportion of traded goods and therefore \( 1-\alpha \) represents the proportion of nontraded goods.

We can now move to solving analytically the current account behaviour. To begin with, the optimisation problem of the representative consumer implies the existence of an intertemporal budget constraint. Following Bergin and Sheffrin (2000), we define \( R_s \) as the market discount factor for consumption at date \( s \), such that:

\[
R_s = \frac{1}{\prod_{j=1}^{s} (1 + r_j)}
\]  

(7)

The budget constraint used in the optimisation problem needs to be recalled:

\[
B_t - B_{t-1} = Y_t - (C_t + P_t \cdot C_{NO_t}) - I_t - G_t + r_t B_{t-1}
\]  

(8)

or

\[
B_t - B_{t-1} = NO_t - C_t + r_t B_{t-1}
\]  

(9)

where \( NO_t = Y_t - I_t - G_t \) is the net output.

Iterating (8) forward, and imposing the transversality condition, \( \lim_{t \to \infty} E_0 (R_t B_t) = 0 \), gives the following expression for the intertemporal budget constraint:

\[
\sum_{t=0}^{\infty} E_0 (R_t C_t) = \sum_{t=0}^{\infty} E_0 (R_t NO_t) + B_0
\]  

(10)

where \( B_0 \) is the initial net foreign assets. The log-linearized intertemporal budget constraint\(^4\) becomes:

\[
n0_0 - \frac{c_0}{\Omega} \left( 1 - \frac{1}{\Omega} \right) b_0 = -\sum_{t=1}^{\infty} \beta^t \left[ \Delta NO_t - \frac{\Delta C_t}{\Omega} - \left( 1 - \frac{1}{\Omega} \right) r_t \right]
\]  

(11)

where \( \Delta NO_t = \log NO_t - \log NO_{t-1}, \Delta C_t = \log C_t - \log C_{t-1} \) and all lower case letters represent the logarithms of the respective upper case ones, except of the world real interest rate for which an approximation has been used such that \( \log(1+r_t) \approx r_t \).

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\(^4\) For details of the log-linearization, see Bergin and Sheffrin (2000) p. 557.
Finally, \( \Omega = 1 - \frac{\bar{B}}{\sum_{i=0}^{\infty} R_i C_i} \) is a constant less than unity and \( \bar{B} \) represents the steady state value of net foreign assets.

Now, taking the expectations of (11) and combining it with the Euler equation in (4), gives:

\[
no_t - \frac{c_t}{\Omega} - \left(1 - \frac{1}{\Omega}\right)b_t = -E_t \sum_{i=1}^{\infty} \beta^i \left[ \Delta no_{t+i} - \frac{k + \rho_{t+i}^*}{\Omega} \left(1 - \frac{1}{\Omega}\right) r_{t+i}\right]
\]  

(12)

Assuming that in the steady state around which we linearize the value of net foreign assets is equal to zero, so that \( \bar{B} = 0 \), we have \( \Omega = 1 \) and finally get:

\[
ca^*_t = -E_t \sum_{i=1}^{\infty} \beta^i \Delta no_{t+i} + E_t \sum_{i=1}^{\infty} \beta^i \left[\gamma r_{t+i}\right] + E_t \sum_{i=1}^{\infty} \beta^i \left[(1 - \gamma)(1 - \alpha) \Delta p_{t+i}\right] + \text{ctant}, 
\]  

(13)

where, based on (9), \( ca^*_t \equiv no_t - c_t \).

Equation (13) illustrates two important effects. In the right hand side of the equation, the first part represents the consumption-smoothing effect. If net output is expected to fall, the CA will increase as the representative agent smoothes consumption intertemporally. This leads to the standard conclusion that only temporary net output shocks produce current account fluctuations. The second two terms of the equation represent the consumption-tilting effect. An increase in this interest rate raises the CA as it induces a lower consumption below its smoothed level.\(^5\) The relative price term also captures this effect: if the price of traded goods is temporarily low, the expected future increase makes the future repayment of a loan in traded goods more expensive in terms of the consumption bundle, reducing current consumption and improving the CA. This effect shows how the consumption-based

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\(^5\) Note that this the case if the economy starts with zero net foreign assets, as assumed in the steady state of this model. However, the response to the consumption-based real interest rate can potentially change if the economy departs sufficiently from this condition: if initially the country is a large net lender, the effect could become negative.
real interest rate changes, which includes world real interest rates and changes in the RER, also produce current account fluctuations.

As we can implicitly see, this model consists of four variables. The first one, which appears on the left hand side, represents the current account to net output ratio. Then, on the right hand side two variables can be observed: the net output and the consumption based real interest rate. However, as previously explained, the consumption based real interest rate is the weighted sum of the world real interest rate and the change in the relative price of non-traded and traded goods; or in other words it depends on both the world real interest rate and real exchange rate. Based on this model, those four variables can be represented as a VAR system on which we can impose theory restrictions. We can then analyze the main implication of the present-value model: that a domestic temporary net output shock will lead to a surplus of the current account, while domestic permanent net output shocks will have an insignificant impact on the current account. We can also analyze the contribution of consumption tilting effects due to external and preference shocks.

4 Specification of the SVAR

From the discussion above, the current account, net output, world real interest rate, and RER are the four variables that form our VAR system. With this system we can then identify four distinct structural shocks: domestic temporary net output shocks, preferences shocks, domestic permanent net output shocks, external supply shocks. However, these shocks need to be identified by imposing theory restrictions. In this section, we explain the identification method used.

We have a four-variable SVAR model such that \( X_t = \left( r_t, \Delta n_{ot}, \Delta p_t, \frac{CA_t}{NO_t} \right) \). We assume that these variables are driven by four distinct shocks: external supply shocks, domestic permanent net output shocks, preferences shocks and, finally, domestic
temporary net output shocks. Those shocks are specified as \( \varepsilon_i = (\varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4) \), where \( \varepsilon_1, \varepsilon_2, \varepsilon_3, \) and \( \varepsilon_4 \) represent the above mentioned shocks, respectively.

We can specify our structural VAR in compact form as follows:

\[
BX_t = \Gamma_0 + \Gamma_1(L)X_{t-1} + \varepsilon_t
\]

where \( B \) is a full-rank matrix whose diagonal elements are all unity, \( X_t \) is a (4x1) vector, such that \( X_t = \left( r_t, \Delta n_{t0}, \Delta p_t, \frac{CA}{NO_t} \right) \), \( \Gamma_0 \) is a (4x1) vector representing the constant terms, \( \Gamma_1(L) \) is a matrix of the polynomials in the lag operator, such that \( \Gamma_1(L) = \Gamma_0^0 + \Gamma_1^1 L + \Gamma_1^2 L + \ldots \), \( \varepsilon_t \) is a (4x1) vector representing the structural shocks, which are orthogonal to each other and have a contemporaneous covariance matrix, \( \Sigma \).

Pre-multiplication by \( B^{-1} \) allows us to obtain the VAR model in its reduced-form. This is the model actually estimated when the off-diagonal elements of \( B \) are unknown.

\[
X_t = B^{-1}\Gamma_0 + B^{-1}\Gamma_1(L)X_{t-1} + B^{-1}\varepsilon_t
\]

or

\[
X_t = A_0 + A_1(L)X_{t-1} + \epsilon_t
\]

where \( A_0 = B^{-1}\Gamma_0, A_1 = B^{-1}\Gamma_1, \epsilon_t = B^{-1}\varepsilon_t \); \( \epsilon_t \) is a (4x1) vector of serially uncorrelated reduced-form error terms, that are composite of all structural shocks and have a covariance matrix, \( \Omega \).

Matrix \( \Omega \) has \( (n^2 + n)/2 \) elements, where \( n \) is the number of variables in the model. Moreover, as previously mentioned, \( B \) is a full-rank matrix whose diagonal elements are all unity, thus it contains \( n^2 - n \) unknown values. The structural model has \( n^2 \) unknown values (those of \( B \) plus the \( n \) values \( \text{var}(\varepsilon_t) \)). Hence, in order to identify the \( n^2 \) unknowns from the known \( (n^2 + n)/2 \) independent elements of \( \Omega \), it is necessary to impose an additional \( n^2 - [(n^2 + n)/2] = [n^2 - n]/2 \) restrictions on the system. In other words, \( (n^2 - n)/2 \) restrictions need to be imposed on the reduced form model in order to identify the structural VAR, which a mounts to 6 restrictions in our 4
variables model. We make use of the Blanchard and Quah (1989) long-run restrictions method, since it lends itself naturally to theory-driven restrictions. Following Blanchard and Quah (1989), we can represent equation (14) in a vector moving average form:

\[ X_t = \mu + C_0 \varepsilon_t + C_1 \varepsilon_{t-1} + C_2 \varepsilon_{t-2} + \ldots \]

\[ = \mu + C_0 L^0 \varepsilon_t + C_1 L^1 \varepsilon_t + C_2 L^2 \varepsilon_t + \ldots \]

\[ = \mu + C(L) \varepsilon_t \quad (17) \]

where \( C(L) = C_0 + C_1 L + C_2 L^2 + \ldots \) and \( L \) is the lag operator.

We can then specify the SVAR model in its vector moving average form, so as to be able to identify the abovementioned structural shocks:

\[
\begin{bmatrix}
    r_t \\
    \Delta \text{no}_t \\
    \Delta \rho_t \\
    \text{CA}/\text{NO}_t \\
\end{bmatrix}
= \begin{bmatrix}
    C_{11}(L) & C_{12}(L) & C_{13}(L) & C_{14}(L) \\
    C_{21}(L) & C_{22}(L) & C_{23}(L) & C_{24}(L) \\
    C_{31}(L) & C_{32}(L) & C_{33}(L) & C_{34}(L) \\
    C_{41}(L) & C_{42}(L) & C_{43}(L) & C_{44}(L) \\
\end{bmatrix}
\begin{bmatrix}
    \varepsilon_1 \\
    \varepsilon_2 \\
    \varepsilon_3 \\
    \varepsilon_4 \\
\end{bmatrix} \quad (18)
\]

Or in compact form,

\[ X_t = C(L) \varepsilon_t \quad (19) \]

where \( X_t = (r_t, \Delta \text{no}_t, \Delta \rho_t, \text{CA}/\text{NO}_t) \) is a (4x1) vector representing our variables, \( C(L) \) is a (4x4) matrix of the polynomials in the lag operator, and \( \varepsilon_t = (\varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4) \) represents the vector of the structural shocks. Importantly, the order of the shocks matters for interpretation issues. Our identification scheme works as follows. Shock \( \varepsilon_1 \) represents external supply shocks and it is the only shock that changes the level of the world real interest rate in the long-run, since it corresponds to external changes in the marginal product of capital. This shock can also (potentially) have permanent effects on the rest of the variables of the system. From the theory model, for instance, external supply shocks can change the CA due to consumption tilting effects. Similarly, \( \varepsilon_2 \) shows domestic permanent net output shocks. These induce changes in net output in the long-run. However, due to the SOE assumption, they do not have
an impact on the world real interest rate. We also allow permanent output shocks to have long-run impacts on the RER. Although not modelled in the basic theory framework, Balassa-Samuelson effects due to productivity changes could potentially affect the equilibrium RER. The third shock ($\varepsilon_3$) is interpreted as a preference (demand) shock which can have permanent effects on the RER and, through consumption tilting, on the CA/NO. Preference shocks do not have an impact on either output or the world real interest rate in the long-run. The former is because of the assumption that demand shocks are neutral in the long-run. The latter occurs because of the same reason, plus the assumption of SOE. And, finally, the domestic temporary net output shocks ($\varepsilon_4$) can only have long-run effects on the current account to net output ratio, but not on the rest of the variables in the system.

We can then proceed with the identification of the structural shocks from the reduced-form VAR model, for which six identifying restrictions are needed. The long-run impacts are shown by setting $L=1^6$ in equations (18) or (19):

$$
\begin{bmatrix}
C_{11}(1) & C_{12}(1) & C_{13}(1) & C_{14}(1) \\
C_{21}(1) & C_{22}(1) & C_{23}(1) & C_{24}(1) \\
C_{31}(1) & C_{32}(1) & C_{33}(1) & C_{34}(1) \\
C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1)
\end{bmatrix}
$$

(20)

Our scheme restricts the $C(1)$ matrix to be lower triangular. This enables us to apply the Choleski decomposition on the weighted variance-covariance matrix of the reduced-form VAR, to uniquely identify all the elements of $C(1)$. The SOE assumption implies that $C_{12}(1)$, $C_{13}(1)$ and $C_{14}(1)$ are equal to zero. The long-run neutrality of demand shocks translates into restricting $C_{23}(1)$ to be equal to zero. The theory assumption that the real exchange rate is determined by preferences for tradable and non-tradable goods as well as productivity shocks means that temporary net output shocks do not affect the RER in the long run. That is, $C_{34}(1)$ is restricted to be zero. Finally, the assumption that temporary domestic shocks do not

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6 The same argument follows when including more lags.
have a long-run impact on net output implies that $C_{24}(1)$ is equal to zero, which completes our 6 restrictions. Hence, the long-run impact matrix becomes the lower triangular

$$
\begin{bmatrix}
C_{11}(1) & 0 & 0 & 0 \\
C_{21}(1) & C_{22}(1) & 0 & 0 \\
C_{31}(1) & C_{32}(1) & C_{33}(1) & 0 \\
C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1)
\end{bmatrix},
$$

and the VAR is just-identified.

5 Empirical Results

5.1. Data and unit root tests

We use quarterly data of the G6 countries, that is, the G7 excluding the US, which cannot be considered a small open economy. Our countries are hence: Canada, UK, France, West Germany, Japan, and Italy. The US is used to obtain the world real interest rate. All data used in this paper are real, seasonally adjusted at annual rates. For most of the countries the data span the period 1980:1 to 2007:4, apart from West Germany’s data which cover a period from 1972:2 to 1991:4.

Based on the Fisher equation, the world real interest rate at time $t$ is the U.S. nominal short-term interest rate minus the inflation rate between $t$ and $t+1$, which assumes the existence of an iid expectational error with zero mean and constant variance. As explained in the previous section, for the relative price of non-tradable to tradable goods, we used as a proxy the real effective exchange rate as provided by IMF. Finally, the real net output and the current account to net output are generated from the appropriate national accounts data. The Appendix provides full details of the construction of the data.

We carried out ADF and ERS tests for unit roots on our data using the superior MIC method of Ng and Perron (2001) for optimal lag selection. The results show that
most variables are non-stationary in levels and stationary in first differences [hence I(1)]. The only exceptions are the real interest rate when using the whole sample period and including a deterministic trend, and the CA/NO for the UK (but only at the 10% level).

The existence of a nonstationary CA to NO ratio is at odds with the transversality condition imposed in the intertemporal budget constraint (see Taylor, 2002, and Christopoulos and León-Ledesma, 2004). In other words, it would imply that temporary shocks would have permanent effects on the CA/NO ratio, which is unlikely for the set of countries we are analyzing. It is well known that unit root tests suffer from important power problems when the alternative is a highly persistent process. These problems can be even more important in the presence of breaks and nonlinear adjustment. For these reasons, and to be consistent with the theory model, we continue our analysis assuming that CA/NO is stationary, hence entering the VAR in levels. A similar caveat applies to the world real interest rate. As shown in Neely and Rapach (2008), real interest rates appear to be very persistent, much more so than consumption growth, which is clearly stationary, to which they should be liked by the consumption Euler equation. Although accounting for structural breaks increases the likelihood of finding stationarity, the fact remains that real interest rates appear to be very persistent. During the period analysed we capture the deflation period of the early 1980s and the Great Moderation period of low real interest rates in the US. This implies that real interest rates display a clear downward trend during the sample analysed (see Figure 1). Including this trend, we can reject the null of a unit root using the ADF test. We hence enter the real interest rate in levels, consistent with the theory.

![Figure 1](image)

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7 See also Ferreira and León-Ledesma (2007) for an analysis of real interest rate differentials. Despite real interest rates appearing non-stationary, differentials are found to be mean-reverting.

8 We also run the model using the first difference of the real interest rate. The results did not change qualitatively in general terms, although it affected the outcome for some countries. Results available on request.
5.2 Model specification

The first step is to select the appropriate lag length for our reduced-form VAR model. Based on this, the same lag length will apply to our SVAR. Given that the data sample is not very long, we are inclined to seek a parsimonious model in order to preserve the degrees of freedom.

After having performed some information-criterion-based tests, which provide us with the appropriate lag length, the Akaike Info Criterion (AIC) test and the Final Prediction Error (FPE) test show that two lags need to be considered for the estimation for Canada, France and Japan, four for the UK, one for West Germany, and finally, three for Italy.

We then estimate the VAR models and apply the Blanchard and Quah’s (1989) decomposition. Making use of the full system of equations, this enables us to obtain the impulse responses of our endogenous variables to identified structural shocks and do variance decomposition analysis.

5.3 Impulse Response Functions Analysis

Figure 2 plots the impulse response functions (IRFs) and the accumulated impulse response functions (AIRFs) of the CA/NO to one standard deviation shock for each of the four structural shocks. More precisely, in the first raw, the first figure shows the impulse response of CA/NO to external supply shocks; the second one shows the impulse response of CA/NO to permanent output shocks; the next one is the response to preferences (demand) shocks and the last one shows responses to domestic temporary net output shocks. The second raw for each country shows the accumulated impulse response of this variable to four abovementioned shocks. Using the Elfron & Hall Bootstrap Percentile CI with 1000 replications, we also obtained the 95% confidence intervals represented by the two dashed lines around the IRFs and the AIRFs.
It is important to remember that the SVAR allows for any of the shocks to have long-run effects on the CA/NO. Hence, potentially, any shock can have a significant impact on the accumulated IRFs (or, in other words, an impact on net foreign assets). The present-value theory would predict that only temporary domestic shocks can affect the CA in the long-run, but not temporary ones. Since we “let the data speak”, we can then check if the PVM prediction holds for our data.

The expected theoretical sign of these shocks on the cumulative CA/NO can be observed in equation (13). Positive world supply shocks that increase the world interest rate would improve the CA; positive domestic permanent shocks to output should have no effect on the CA; positive preference shocks that increase the real exchange rate would worsen the current account as agents expect a future depreciation; positive temporary net output shocks would improve the CA as agents expect it to fall in the future.

For Canada, Japan and the UK, external supply shocks appear to be significant as can be seen in both the IRFs and AIRFs. More precisely, it leads to a CA surplus for the UK as expected, but a negative one for both Canada and Japan. The negative effect for Japan can be related to its large position as net creditor for the whole sample period. However, the negative effect for Canada does not appear to be compatible with its net debtor position. For the rest of the countries, the effect is only significant for Italy between 4 and 8 quarters and for Germany for the first 2 quarters. However, the accumulated response is statistically insignificant.

Domestic permanent net output shocks have a positive impact on the CA for France and for the UK only for the first four quarters (and negative between 11 and 15 quarters). However, for the UK the impact of the permanent shock on the accumulated CA becomes insignificant after 6 quarters. It is only for France that the response of the CA violates the predictions of the present value model. Interestingly,

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9 Provided that income effects do not compensate for the consumption tilting effect as commented earlier. The same logic applies to the effect of preferences shocks.
the addition of a time-varying interest rate and the RER, appears to make the results for Canada and the UK compatible with the intertemporal approach. Both countries have been found to be problematic in previous studies. These results are hence important for empirical tests of the PVM model of the CA, since they support the model for all but one country, namely France.

Turning now to preferences shocks, the IRFs show a very similar picture to the impact of external supply shocks. They essentially reproduce the dynamic path of the external supply shocks but, as expected, with the opposite sign. The exception to this is the UK, where preferences shocks do not appear to have any significant impact on the CA. The puzzle, of course, remains in the case of Canada, since we would expect a negative CA effect.

At last, as expected, all countries are positively affected by a domestic temporary net output shock. The effect is very large and persistent and from the accumulated IRFs, it is clear that for all countries the CA improves and, therefore, net foreign assets increase.

Taking everything into consideration, there are two main conclusions that can be drawn. Firstly, except from France, the analysis is in line with the initial assumption of the standard intertemporal model of the current account, which states that domestic temporary shocks have a long-run effect on the current account while permanent ones do not. Secondly, and importantly, the addition of time-varying interest rates and the real exchange rate appears to be important for Canada, Japan and the UK.

5.4 Variance Decomposition

Table 2 summarizes the variance decompositions of the CA/NO, which will enable us, for an s-period ahead forecast, to calculate the proportion of the fluctuations in a series that is due to its “own” shocks versus shocks to the other variables. In this table, the second column represents the proportion of the forecast error variance
attributable to external supply shocks; the third column is the proportion attributable to domestic permanent net output shocks; the fourth one shows the proportion attributable to preferences shocks and, finally, the last column illustrates the proportion attributable to domestic temporary net output shocks. All those results are shown for a forecast horizon equal to 1, 4, 8, 20, and 40.

The results presented in this table are in accordance with the impulse response functions for all countries. More precisely, for Canada, a quarter after impact, the external supply shock explains 40% of fluctuations in the current account and 41% is explained by the domestic temporary net output shock, while the rest (16%) is attributable to preferences shocks. Even 10 years after the shock (40 quarters), the main shocks explaining current account fluctuations remain these three.

In quarter 1, France’s current account fluctuations are explained mainly by domestic permanent output shocks, with temporary domestic shocks accounting for 33% of the fluctuations and external supply shocks 22%. As with Canada, this structure remains stable throughout.

For Germany, it is external supply and domestic temporary shocks that mostly drive the CA in the short run. In the long-run, however, the external supply shocks reduce their proportion to 27%, whereas domestic temporary shocks gain in importance by explaining almost all of the rest. Preferences shocks only explain 4% of the current account fluctuations.\footnote{It is worth noting that the sample period for West Germany is substantially different than that for the rest of the countries.}

In the case of Italy, 84% of the CA fluctuations in the short run are explained by temporary net output shocks. External supply shocks, however, gain in importance and explain 21% just after 8 quarters. Both domestic permanent and preferences shocks have only small participation.

For the UK, 50% of the short-run fluctuations is explained by domestic temporary shocks and the other 50% is explained by external and domestic permanent shocks.
After 40 quarters, however, domestic permanent shocks halve their importance and the CA is driven equally by external supply and domestic temporary shocks.

Japan is the case in which changes in the forecast variance of the CA are less driven by domestic temporary output shocks. It is external shocks that drive around 60% of these fluctuations. In the longer run, preference shocks also seem to explain a sizeable proportion.

It is important to note that Kano (2008) refers to the excess response of the CA to temporary output shocks as a puzzle, since they explain about 80% and 72% of CA fluctuations in the long-run for Canada and the UK respectively. In our results, these are reduced very substantially to 36% and 46% reflecting, perhaps, the importance of the introduction of a two-sector setting that allows for the consideration of the RER. However, a look at Table 2 presenting the FEVD for net output, still reflects that, with the exception of France and Italy, temporary net output shocks contribute very little to explain fluctuations in net output. Hence, it remains puzzling that a shock that explains little about net output changes can explain a large proportion of CA changes. Nevertheless, in our results the puzzle is alleviated, as the domestic temporary shock explains less than 50% of CA fluctuations in four of our countries.

To conclude, given that external supply and preferences shocks account for an important proportion of current account fluctuations, our results lend some support for the two-good intertemporal model, which takes into account a varying world real interest rate and real exchange rate. This is in line with the conclusions in Lee and Chinn (2006), who state that the signs of the impulse responses and the variance decompositions point toward models that differentiate tradable from non-tradable goods. France appears as the main exception, since the basic predictions of the PVM of the CA are clearly violated.
6 Conclusions

Research on the sources of current account (CA) fluctuations has played an important role in international macroeconomics in the last decades. This is because of, first, the recent CA imbalances in the world economy and, secondly, the implications it has for present value models (PVM) of the current account. In this paper we have analyzed the main shocks driving CA fluctuations in the G6 (G7 minus the US) countries by separating domestic temporary and permanent shocks, and also external supply shocks and preferences shocks. We follow the theoretical setting of Bergin and Sheffrin (2000), which allows for the introduction of a time-varying world real interest rate and the existence of tradable and non-tradable sectors. Based on the implications of this model, we then estimate a SVAR model with minimal long-run identifying restrictions à la Blanchard and Quah (1989).

Our results show two main conclusions. First, the PVM of the CA is consistent with the behaviour of the data for all countries except for France, where permanent domestic shocks have a long-run impact on the CA. Secondly, preferences shocks and, mainly, external supply shocks appear to play an important role in explaining CA fluctuations in our sample of countries. Our model also reduces the degree of excess response of the CA to temporary output shocks found in previous literature. A puzzle remains, however, in the response of the CA in Canada to external supply and preferences shocks, which appear to have the opposite sign to the theory predictions.
Figure 1. US Real Interest Rate
Figure 2. IRF’s and AIRF’s of the CA/NO

CANADA:
FRANCE:
JAPAN:
## Table 1. SVAR Forecast Error Variance Decomposition

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Table 2. SVAR Forecast Error Variance Decomposition of $\Delta n_t$

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APPENDIX: Data.

Based on the Fisher equation, the world real interest rate of the U.S. is computed by subtracting the inflation rate from the nominal short-term interest rate. In other words, in order to find the real interest rate in period $t$, one needs to subtract the inflation rate from period $t$ to $t + 1$ from the nominal short-term interest rate in period $t$. Importantly, the Treasury Bill rate for the United States is used for the nominal short-term interest rate. All data are quarterly distributed. The inflation rate is calculated using the consumer price index (CPI), by taking the CPI in period $t + 4$, subtracting the one from period $t$, then dividing everything by the CPI in period $t$ and multiplying the whole result by a hundred to obtain a percentage rate. The data were collected from the IMF (IFS) and cover a period from 1972:2 to 2007:4.

For the relative price of nontradable goods to tradable goods, the real exchange rate is used. The IMF(IFS) provides data for the real effective exchange rate index for a period covering 1980:1-2008:1, except for West Germany, for which data are provided from 1970:1 to 1991:4.

The net output is derived based on the identity given in the previous section: 

$$NO_t = Y_t - I_t - G_t.$$  

Therefore, we compute it as gross domestic product (GDP) less gross investment, which is gross fixed capital formation plus changes in inventories, less government consumption expenditure. All data are seasonally-adjusted annual rates and are divided by the population and the GDP deflator (2000=100) in order to transform them into real per capita terms. All data were collected from the IMF (IFS).

Finally, the current account to net output ratio was computed using the data of the current account of the balance of payments in U.S. dollars. This was then divided by the nominal GDP enabling us to obtain the desired variable. All variables were divided by the population and the GDP deflator (2000=100) in order to transform them into real per capita terms. Data were obtained from the IMF (IFS).
References:


International Monetary Fund (2004), World Economic Outlook. IMF, Washington DC.


