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Demand Shcoks and Trade Balance Dynamics

José García-Solanes (U. de Murcia)
Jesús Rodríguez López (U. Pablo de Olavide)
José Luís Torres Chacón (U. de Málaga)

JEL Codes: F3
Keywords: Current Account, SVAR.

UNIVERSIDAD PABLO DE OLAVIDE SEVILLA
Department of Economics

Demand Shocks and Trade Balance Dynamics[a]

José García-Solanes
Departamento de Fundamentos del Análisis Económico
Universidad de Murcia.
Campus de Espinardo
30100 Murcia, Spain.
e-mail: solanes@um.es
Tel. +34 968 36 37 82

Jesús Rodríguez López
Departamento de Economía, Métodos Cuantitativos e Historia Económica
Universidad Pablo de Olavide de Sevilla
Ctra. Utrera km. 1, 41013 Sevilla (Spain).
e-mail: jrodlop@upo.es

José Luis Torres Chacón
Departamento de Teoría e Historia Económica
Universidad de Málaga
Campus de El Ejido 29071 Málaga (Spain)
e-mail: jtorres@uma.es

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Abstract: This paper studies the current account dynamics in the G-7 countries plus Spain. We estimate a SVAR model which allows us to identify three different shocks: supply shocks, real demand shocks and nominal shocks. We use a different identification procedure from previous work based on a microfounded stochastic open-economy model in which the real exchange rate is a determinant of the Phillips curve. Estimates from a structural VAR show that real demand shocks explain most of the variability of current account imbalances, whereas, contrary to previous findings, nominal shocks play no role. The results we obtain are consistent with the predictions of a widely set of open-economy models and illustrate that demand policies are the main responsible of trade imbalances.

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1 Introduction

Current account imbalances, which are lasting and have reached unprecedented size in many countries and regions, have catapulted the theoretical and empirical analysis of the factors that drive the pattern of external disequilibrium in recent years. Three main approaches have been adopted in the literature, with markedly diversified and sometimes contradictory results.

The first approach includes cross section and panel regression techniques. Chinn and Prasad (2003), for example, applied this methodology to a large group of industrialised countries and found that government budget imbalances and initial stocks of net foreign assets are the main determinants of external disequilibria. Chinn and Ito (2005) analysed the problem in two groups of countries, and found that the main determinants of trade imbalances are instead factors of institutional order, such as boom in equity markets in the case of industrialised countries, and financial deepening in the case of developing economies. Gruber and Kamin (2005) extended the time and geographical dimension of the Chinn and Prasad (2003) analysis and found that no set of standard determinants can convincingly explain the huge trade deficit of the US economy. However, Bussière *et al.* (2005) found that productivity shocks do explain the trade imbalances in a panel of 21 OECD countries. Finally, Bartolini and Lahiri (2006) obtained a mild endorsement of the "twin deficits" hypothesis in a panel of 18 OECD countries using panel regression techniques.

The second approach consists of simulating very large multi-country models. Erceg, Guerrieri and Gust (2005), (2006) for instance, simulated a modified version of SIGMA – the model of the International Finance Division of the FED – and found that fiscal shocks have small effects on the US trade balance. On the contrary, the model accords the greatest roles to *i*) increased productivity growth in the United States since it makes this country a magnet for foreign saving, and *ii*) the slump in foreign domestic demand because it creates excessive saving in foreign economies.

The third approach uses structural VAR analysis and also produces a wide range of diversified results. Elliot and Fatás (1996), for instance, estimated a VAR model to analyze the effects of productivity shocks in the US, Japan and four European countries (France, Italy, Germany and the UK), and encountered that the current account is countercyclical in response to country-specific shocks in productivity. Prasad and Gable (1998) adopted a multivariate strategy. They estimated the responses of the trade balance to three alternative shocks in 22 OECD countries in the period 1975(I) to 1995(IV) and found that: *i*) nominal shocks account for a large fraction of fluctuations in the trade balance, *ii*) demand shocks have an intermediate contribution, and *iii*) supply shocks have limited effect. Prasad (1999) applied the same model to seven OECD countries for the period 1974(I)-1996(IV) and obtained similar results to those of Prasad and Gable. The multivariate methodology was also applied by Kano (2003) to study the joint dynamics of changes in the net output, the ratio of the current account over the net output, and the real interest rate. He discovered that the current account responds neither to global shocks nor to country-specific permanent disturbances.

Within this strand of analysis, Kim and Roubini (2004) applied a non-recursive identification scheme to assess the effects of government budget deficit on the current account and the real exchange rate of the United States, and found that although current account movements are essentially led by output shocks, they are also affected positively by fiscal shocks. Lee and Chinn (2006) built a bivariate SVAR model and obtained that whereas permanent real shocks appreciate the real exchange rate and improve the current account, temporary disturbances depreciate the RER and improve the current account temporarily in seven OECD countries during the period 1979-2000. Finally, Koray and McMillin (2006) constructed a VAR model with seven variables to analyze the effects of expansionary fiscal shocks in the US. Their results indicate that fiscal deficits lead to long-lived real exchange rate depreciations and permanent improvement in the trade balance.

In this paper we perform empirical analysis within the third methodological avenue. Our structural VAR analysis intends to to solve some identification problems that we find in the previous literature. As it is well known, the procedure at hand allows one to identify at most as many structural shock types as there are variables in the system. In addition, the sets of shocks and variables must satisfy the triangular condition. Some recent papers do not fully comply with the last requirement. In Prasad and Gable (1998) and Prasad (1999), for instance, one of the shocks included in the analysis is nominal, whereas all the three endogenous variables -relative output, real exchange rate and trade balance- are real. The VAR constructed by Lee and Chinn (2006) has the same objection as it includes two shocks, one of which is nominal, but the two endogenous variables are real.

Papers that consider a large set of shocks and variables, such as Koray and McMillin (2006), which includes seven shocks, are not exempt from identification problems if the time sample is not sufficiently long. The reason is that since both the number of coefficients to be estimated and the number of restrictions imposed on the system depend on the number of variables in the VAR, the time series must be long enough to allow a reliable estimation. Furthermore, the probability that some of the identifying restrictions are not credible increases with the number of them included in the analysis.

To overcome these difficulties, we use a trivariate framework in the line of Clarida and Galí (1994), which seems appropriate for the length of our sample -1974(I) to 2005(II)- and the quarterly frequency of our data, and employs sets of variables and shocks that satisfy the triangular restriction imposed on the VAR system. We identify three types of exogenous (relative) disturbances: real demand shocks, real supply shocks, and nominal shocks, and include three endogenous variables, relative real output, the current account to GDP ratio, and the effective nominal exchange rate.

Most of the available empirical VAR studies are either not backed by theoretical models –for example Kim and Roubini (2004) and Chinn (2005)– or use simple frameworks in the Mundell-Fleming tradition, in which microfoundations are absent. In the theoretical part of this paper we elaborate a stochastic model with three important ingredients: *i*) we derive equations by assuming that all agents, public and private, maximize their behavior, *ii*) we assume that, in a short horizon, firms adjust prices slowly following an optimizing pricing behavior à la Calvo (1983), and *iii*) the real exchange rate enters the Phillips curve as a variable that transmits price increases of imported raw materials and intermediate goods onto domestic inflation. The short and long run solutions to this model provide the basis for the identification restrictions that we apply in the empirical part of the paper.

Let us outline our main findings. As opposed to previous studies which conclude that demand shocks have negligible effects on trade balance and current account fluctuations, we show that relative demand shocks account for most of the variability of the trade balance in all countries of the sample. The share of trade balance variability explained by real demand shocks ranges from 96% in France to 66% in Canada. Contrary to some results in previous literature (Prasad, 1999, Lee and Chinn, 2006), we find that the effects of nominal shocks on the trade balance are almost insignificant. However, nominal shocks turn out to play a dominant role in the short and long run movements of the nominal exchange rates. The latter evidence endorses full support to the disequilibrium theory of exchange rate determination, according to which the largest part of exchange rate volatility in the short run can be attributed to financial market disturbances.

The rest of the paper is as follows. In Section 2 we present the theoretical framework. Section 3 contains the data description and some preliminary tests. Section 4 identifies the shocks affecting relative output, the trade balance to the GDP ratio, and effective nominal exchange rate. Section 5 contains some discussions about the robustness of the results. Finally, Section 6 presents our concluding remarks and derives some policy implications.

2 The Model

In this section we develop a stochastic general equilibrium model that illustrates the way through which different external shocks affect both the long run value and the cyclical dynamics of the endogenous variables. We consider a small open economy whose monetary authorities are concerned with output and inflation stabilization, which imply that, after observing an external shock, the central bank implements monetary actions to achieve the optimal combination of output and inflation. This means that the observed combinations of output and inflation are a compound of shocks and central bank's reactions to shocks.

In a short term perspective, we assume that prices adjust slowly because, as a result of various costs, firms fully optimize prices only periodically and follow simple rules for changing their prices at other times, in the tradition of Calvo (1983). In this setting, the number of firms that change prices in any given period is specified exogenously. In a long term horizon however, prices adjust completely.

Following the same approach as Prasad (1999) and Chinn and Lee (2006), we use relative output variables in order to control for changes in external demand conditions. Hence, when talking about domestic relative output of one specific country, we mean his domestic output with respect to a trade-weighted average of real GDP in the countries of the foreign zone.

The model builds on Detken and Gaspar (2003) and García-Solanes and María-Dolores (2005). Our version incorporates two main novelties with respect to these previous works: first, the exchange rate and the interest rate are expressed in real terms and, second, the real exchange rate intervenes in the aggregate supply function as a cost push variable.[1] The latter feature allows the model to deal more conveniently with open economies. It is composed of the following equations:

$$L = \frac{1}{2}E_t\sum_{j=0}^{\infty}\beta^j\left(\lambda\widetilde{y}_{t+j}^2+\pi_{t+j}^2\right), \tag{1}$$

$$\pi_t = \alpha\widetilde{y}_t+\beta E_t\pi_{t+1}+\gamma q_t+\varepsilon_t, \tag{2}$$

$$\widetilde{y}_t = -\varphi r_t+E_t\widetilde{y}_{t+1}+\delta q_t+d_t, \tag{3}$$

$$\overline{y}_t = \overline{y}_{t-1}+z_t, \tag{4}$$

$$r_t = E_t q_{t+1}-q_t+\tau_t. \tag{5}$$

Equation (1) is a standard central bank's intertemporal loss function that penalizes deviations of inflation and output gap from their targets. The inflation differential, π_t, is defined with respect to the socially desired rate, while the (log of) output gap, $\widetilde{y}_t$, is calculated with respect to the long run or potential level, $\overline{y}_t$. E_t is the rational expectations operator in period t, β is the discount factor and λ is the relative weight attached to output variability.[2]

Equation (2) is an aggregate supply in the spirit of the New Keynesian Phillips curve that incorporates inertia in pricing setting. As indicated above, our version incorporates an important feature of open economies, which is the transmission of imported costs into domestic inflation via the -

[1] The influence of the real exchange rate in the way considered in our aggregate supply function may be microfounded assuming that firms optimise profits.

[2] This weight is related negatively to the aversion to inflation variability.

natural log of the - real exchange rate, q_t. The latter is defined in such a way that an increase denotes a real depreciation of the domestic currency. The conventional part of the equation may be derived assuming - as in Calvo (1983) - that firms maximize the difference between expected marginal revenue and unit costs, and that only a fraction of them, given exogenously, is allowed to adjust prices each period.[3] It can be shown that as the probability of adjusting prices increases, the aggregate supply becomes steeper (α raises).[4] Equation (3) indicates that the aggregate demand depends negatively on the real interest rate (r_t) and positively on both the output expected for the next period and the real exchange rate. The expected output in the aggregate demand is due to consumption smoothing reasons by households that maximize an intertemporal utility function under budget restrictions.[5]

Equations (2) and (3) contain shocks with different stochastic properties. Short run supply shocks are assumed stationary AR processes: $\varepsilon_t = \rho\varepsilon_{t-1} + \xi_t$, while demand shocks are allowed to have a permanent as well a transitorry component as in Prasad (1999): $d_t = hd_{t-1} + \eta_t$, with $0 < h < 1$ and $0 < \rho < 1$.The short run supply shock is deemed to capture everything affecting marginal costs and/or temporary changes in firms' productivity that affects inflation rate in the short run, and the demand shock represents shifts in autonomous private and public expenditures. Equation (4) indicates that the potential output, $\overline{y}_t$ is assumed a simple random walk process, which means that shocks hitting the relative potential output, for instance durable variations in productivity, have a permanent nature. Equation (5) is the uncovered real interest-rate parity condition including a stochastic country risk premium, τ_t, which is also a stationary AR process: $\tau_t = l\tau_{t-1} + \kappa_t$. The residuals ξ_t, η_t, κ_t and z_t are assumed uncorrelated i.i.d. variables.

2.1 Short-run equilibrium in the presence of sluggish price adjustment

It is assumed that the private sector forms expectations on inflation and output, taking into account the information available at that time. After looking at the realization of shocks in the current period, the central bank utilizes this information to set its monetary policy. The monetary instru-

[3]Some recent papers adopt an alternative assumption, considering that the number of firms changing prices in any given period is determined endogenously (state dependent pricing models). See, for instance, Burstein (2003) and Goloslov and Lucas (2003). As emphasized by Eichenbaum and Fisher (2004), empirically plausible versions of state dependent pricing models produce similar results to those in the line of Calvo (1983) for many experiments that are relevant in countries with moderate rates of inflation.

[4]When the probability of adjusting prices is one, which means that all firms change their prices at each moment (the case of full price flexibility), the aggregate supply is a line completely vertical (see, for instance, Woodford (2003, chapter 2).

[5]See, for instance, Fraga, Goldfajn and Minella (2003).

ment is the nominal interest rate, which is set to achieve the optimal value of the real interest rate in each period. The four endogenous variables, π_t, $\widetilde{y}_t$, q_t, r_t, are determined simultaneously.

Let us explain the solving procedure. Assuming that the central bank cannot commit to a state-contingent rule of the inflation rate, and consequently takes expectations as given, the first order condition is obtained by minimizing the loss function with respect to the output gap and the inflation rate, subject to the aggregate supply:

$$\begin{aligned}(\pi_t^*, \widetilde{y}_t^*) &= \arg\min \frac{1}{2} E_t \sum_{j=0}^{\infty} \beta^j \left(\lambda \widetilde{y}_{t+j}^2 + \pi_{t+j}^2\right) \\ & \text{s.t. } \pi_t - \alpha \widetilde{y}_t - \beta E_t \pi_{t+1} - \gamma q_t - \varepsilon_t.\end{aligned}$$

The result is

$$\widetilde{y}_t = -\frac{\alpha}{\lambda} \pi_t. \tag{6}$$

Substituting this expression in (2), and combining (6) with (3) and (5), it is easy to derive:

$$q_t = \frac{1}{\gamma}\left(1 + \frac{\alpha^2}{\lambda}\right)\pi_t - \frac{\beta}{\gamma} E_t \pi_{t+1} - \frac{\varepsilon_t}{\gamma}. \tag{7}$$

$$-\frac{\alpha}{\lambda}\pi_t = -\frac{\alpha}{\lambda} E_t \pi_{t+1} + (\varphi + \delta)\, q_t - \varphi E_t q_{t+1} - \varphi \tau_t + d_t, \tag{8}$$

Using (7) to obtain expectations on the real exchange rate, and substituting in (8) we reach

$$\frac{\varphi}{\gamma} \beta E_t \pi_{t+2} - A E_t \pi_{t+1} + B \pi_t = -\left(\varphi \rho - (\varphi + \delta)\right) \frac{\varepsilon_t}{\gamma} - d_t + \varphi \tau_t, \tag{9}$$

with

$$\begin{aligned}A &= \frac{\beta(\delta + \varphi)}{\gamma} + \frac{\alpha}{\lambda} + \frac{\varphi}{\gamma}\left(1 + \frac{\alpha^2}{\lambda}\right), \\ B &= \frac{\alpha}{\lambda} + \frac{\delta + \varphi}{\gamma}\left(1 + \frac{\alpha^2}{\lambda}\right).\end{aligned}$$

Equation (9) has one endogenous variable, π_t, in current value and in forward expectations. It can be solved applying, for instance, the method of undetermined coefficients. The result is:

$$\pi_t = C_1 \varepsilon_t - C_2 d_t + C_3 \tau_t, \tag{10}$$

with

$$
\begin{aligned}
C_1 &= \frac{\delta + \varphi(1-\rho)}{(B - A\rho)\gamma + \varphi\beta\rho^2}, \\
C_2 &= \frac{\gamma}{(B - (1-h)A)\gamma + (1-h)\varphi\beta}, \\
C_3 &= \frac{\varphi\gamma}{(B - Al)\gamma + \beta\varphi l^2}.
\end{aligned}
$$

For a very large spectrum of parameter values, it may be verified that $C_1, C_2$and C_3 are positive.

Combining (10) with (6) it is easy to derive:

$$
\widetilde{y}_t = -\frac{\alpha}{\lambda} C_1 \varepsilon_t + \frac{\alpha}{\lambda}\gamma C_2 d_t - \frac{\alpha}{\lambda} C_3 \tau_t. \tag{11}
$$

Finally, taking expectations in (10) and substituting in (7) we obtain the equilibrium value of the real exchange rate:

$$
q_t = D_1 \varepsilon_t - D_2 d_t + D_3 \tau_t, \tag{12}
$$

with

$$
\begin{aligned}
D_1 &= \left(1 + \alpha^2/\lambda - \beta\rho\right) \frac{C_1}{\gamma} - \frac{1}{\lambda}, \\
D_2 &= \frac{1}{\lambda}\left[1 + \alpha^2/\lambda - \beta(1-h)\right] C_2 > 0, \\
D_3 &= \frac{1}{\lambda}\left(1 + \alpha^2/\lambda - \beta l\right) C_3 > 0.
\end{aligned}
$$

As can be seen in equation (12), demand shocks have an appreciating effect on the real exchange rate in the short run. The reason is that since demand shocks increase the relative demand for domestic output, the real exchange rate needs to depreciate in order to establish equilibrium in this market. An increase in the risk premium impacts positively (depreciation) on the real exchange rate because, other things remaining equal, it triggers capital outflows. Finally, the net effect of transitory - cost augmenting - supply shocks on the real exchange rate in the short run is not clearly determined in most frequent cases where the term C_1 is positive. Consequently, the sign of the latter effect is ambiguous.

To derive the equilibrium level of (the log of) the nominal exchange rate (s_t), we take into consideration that this variable equals the sum of (the log of) the real exchange rate, the inflation rate and the log of the price level of the last period ($s_t = q_t + \pi_t + p_{t-1}$):

$$
\begin{aligned}
s_t = {} & \frac{1}{\gamma}\left[\left(1 + \alpha^2/\lambda - \beta\rho + \gamma\right) C_1 + 1\right] \varepsilon_t \\
& -\frac{1}{\gamma}\left[\left(1 + \frac{\alpha^2}{\lambda} - \beta(1-h)\right) + \gamma\right] C_2 d_t \\
& +\frac{1}{\gamma}\left(1 + \alpha^2/\lambda - \beta l + \gamma\right) C_3 \tau_t + p_{t-1}
\end{aligned} \tag{13}
$$

By assuming that the two main determinants of the trade balance are relative output and the real exchange rate, the equation for the home country trade balance is:

$$tb_t = aq_t - by_t = aq_t - b\left(\overline{y}_t + \widetilde{y}_t\right), \tag{14}$$

where the parameters a and b stand for the elasticities of the trade balance with respect to the real exchange rate and relative output, respectively.

Taking into consideration the effects of shocks on relative output and the real exchange rate analyzed above, we obtain the sign with which these shocks impact over the trade balance in the short run. Transitory cost-pushing supply shocks, which probably result in a depreciation of the real exchange rate, concomitantly with a transitory contraction in domestic output, produce a probably positive effect, but the negative effect cannot be excluded. On the contrary, demand shocks impact negatively on trade flows because they appreciate the real exchange rate and expand domestic output. Permanent shocks in the relative potential output contribute to deteriorate the trade balance in the short run because they increase the demand for imports.

Risk premia contribute to improve the trade balance through their depreciating effects on the real exchange rate, and their contracting effect on output. It has been proven, for example, that improvements in the preferences of foreign investors for US assets, as well unexpected increases in the excess supply for money in the US, lead to temporary deficits in the US current account. The statistical properties of risk premia shocks indicate that trade deficits created by these disturbances "reverse" as time elapses.

2.2 Long-run solution

In the long run, as parameter α increases, the probably of adjusting prices at any moment tends to unity. In other words, prices tend to be fully flexible. It can be seen that for $\alpha = \infty$ the aggregate supply is a line completely vertical and deviations of both inflation and the relative output from their respective long-run values tend to zero. Consequently,

$$\begin{aligned} \pi_t &= 0, \\ y_t &= \overline{y}_t = \overline{y}_{t-1} + z_t. \end{aligned} \tag{15}$$

In the long run, output deviations from the long-run level (z_t) are equal to the demand for those deviations as expressed by equation (3). In turn, the price level must now absorb both movement in potencial output and permanent switches of the aggegate demand. Given that $E_t z_{t+1} = 0$, from (3) the equilibrium in the goods market must satisfy this condition:

$$z_t = -\varphi r_t + \delta q_t + \eta_t. \tag{16}$$

Under normal circumstances, the uncovered real interest-rate party condition holds in the long run (τ_t tends to disappear). However, in countries where the public budget is not guided by discipline rules, a permanent country risk may arise if fiscal expansions deteriorate the quality of domestic assets. Assuming that the permanent risk is proportional to the size of permanent demand shocks, the long-run version of equation (5) is:

$$r_t = E_t q_{t+1} - q_t + n\eta_t. \tag{17}$$

Note that if permanent demand shocks do not affect the quality of domestic assets, the coefficient n equals zero. By substituting the value of r_t in (16) into(17) and solving for $q_t$we derive:

$$\overline{q}_t = -\frac{(1-n\varphi)}{h\varphi+\delta}\eta_t + \frac{1}{\varphi+\delta}z_t \tag{18}$$

Taking into account (15) and (18), the long run value of the trade balance is:

$$\overline{tb}_t = \frac{-a(1-n\varphi)}{h\varphi+\delta}\eta_t + \left(\frac{a}{\varphi+\delta} - b\right)z_t - b\overline{y}_{t-1}. \tag{19}$$

Since $\overline{s}_t = \overline{q}_t + p_t$, it follows that:

$$\overline{s}_t = -\frac{(1-n\varphi)}{h\varphi+\delta}\eta_t + \frac{1}{\varphi+\delta}z_t + p_t. \tag{20}$$

Equations (15), (18), (19) and (20) can be interpreted as the long run solution for the model. These equations imply that in the long run, *a*) the level of output is not affected by either demand shocks or nominal shocks; *b*) the long-run level of the trade balance is affected by demand shocks and permanent changes in the potential output, but not by nominal shocks; and *c*) the long-run level of the nominal exchange rate is affected by the three structural shocks: permanent supply shocks, permanent demand shocks and nominal shocks. The latter influence takes place through variations in the price level. Since $\overline{y}_t$ and $\overline{q}_t$ are neutral with respect to nominal shocks, in the long run the price level and the nominal exchange rate respond proportionally to the impact of nominal disturbances. These are the restrictions that will be used to identify the structural model. Variables are not constrained in the short run.

3 Data description and unit roots

We use quarterly observations for the G-7 countries (Germany, France, Italy, the UK, the US, Canada and Japan) plus Spain. The sample period extends from 1974.1 to 2005.2, and our data are taken from the IMF International Financial Statistics Database. We estimate a three-variate VAR including relative real GDP, the ratio of trade balance to GDP and the nominal effective exchange rate. The latter is measured using weighted averages of bilateral nominal exchange rate against major trading partners.

As in the theoretical model, domestic real output is constructed as a proportion of foreign real output in order to isolate country-specific output shocks which, according to the intertemporal approach, are the main determinants of the current account. The empirical study of Glick and Rogoff (1995) confirms in fact that the effects of country-specific shocks on the current account are more important than those caused by global shocks.

All variable are measured in natural logarithms except for the trade balance that is calculated as a percentage of GDP. Relative output is derived by substracting the logarithm of the index of domestic real output from the logarithm of an index of foreign output. The index of foreign output is computed by taking a trade-weighted average of real GDP of foreign countries. Weights have been taken from the OECD (see Durand, Madaschi and Terribile, 1998).

A variety of unit root tests are performed to ascertain whether the endogenous variables should be written in first differences or in absolute values. Table 1 presents some unit root tests for the data. Using both the Augmented Dickey Fuller (ADF) and the Phillips Perron (PP) tests ,the results indicate that the null hypothesis of a unit root cannot be rejected for all the series against the alternative hypothesis of stationarity around a deterministic trend. In both cases the test statistics are smaller than the 10% critical value (in absolute value) for all the series in levels. Therefore, we conclude that the series are non-stationary. To confirm that a first difference induces stationarity in these variables, test statistics for first differences are also computed. Except for the ratio of the current account to GDP in some particular cases, the test statistics are larger (in absolute value) than their respective 10% critical values, confirming that the variables are integrated for order 1 and that a first difference suffices for stationarity. We have also implemented the KPSS unit root test proposed by Kwiatkowski *et al.* (1992). In this case, the null hypothesis is that the series is stationary against the alternative of unit root. Results from the KPSS test lead to similar conclusions to those obtained from the ADF and PP tests. These unit root tests results are consistent with the outcome of the theoretical model, which implies that the three variables are nonstationary.

Considering that the trade balance represents the bulk of the current account flow in the countries of our sample, the statistical properties that we detect for the former variable to some degree contradict the assumptions of the intertemporal approach to the current account. Indeed, intertemporal models suggest that the current account is stationary in levels on the basis of long-term sustainability considerations. However, our results could be compatible with this hypothesis provided that sustainability binds intertemporal decisions of economic agents during time horizons longer than the one considered in our sample. Consequently, our empirical tests will be carried out using first differences for relative output and nominal exchange rate, and levels for the trade balance ratio.

[**Insert Table 1 here**]

4 Impulse responses and decomposition of the variance

We estimate eight independent VARs, one for each country. According to the model, a three-variable VAR containing relative output growth rate, trade balance relative to the GDP, and the rate of nominal exchange rate variation, $(\Delta y_t, tb_t, \Delta s_t)$, can be exploited for identifying the structural shocks. This is done in two steps. First, we estimate the prediction errors from the reduced form of the model. The different information criteria suggest to use VAR of order 2 to 3 lags. And second, we apply a set of *long run* restrictions given by the model in Section 2: *a*) output is solely affected by supply shocks in the long run; *b*) nominal shocks do not impulse the trade balance dynamics in the long run; *and c*) although with different sign and magnitude, the nominal exchange rate can be affected by any of the three structural shocks in the long run. No short run restriction is on the other hand imposed, so that the three variables in the vector $(\Delta y_t, tb_t, \Delta s_t)$ can be affected by any of the structural shocks within this term. This set of long run restrictions produce a triangular (or Cholesky) identification schedule. We also test for cointegration of each of the eight systems using Johansen (1988) cointegration test. For all the cases, we found no evidence of cointegration.[6]

In this section we examine the impulse responses for relative output, the trade balance and the nominal exchange rate. Permanent supply shocks primarily refer to positive exogenous improvements in the production function, but may also include positive oil shocks and permanent cost reductions. Permanent demand shocks correspond essentially to fiscal expansions and improvements in the international preferences for domestic output. Nominal shocks reflect either increases in the risk premium or disturbances that create unforeseen increases in the excess supply of money. According to our model, the expected responses of the endogenous variables are as follows:

Supply shocks. A positive permanent supply shock increases output in both the short and long run and depreciates the long run values of both the nominal and the real exchange rate. The predicted results corresponding to output and the nominal exchange rate are observed in each country, except for the exchange rate in Canada where small permanent appreciations are detected some years after the shock. The exchange rate responses in this country could be attributed to long-run Balassa and Samuelson effects

[6] These results are available from the authors upon request.

(not included in our one-sector theoretical model). Since output expansions and exchange rate depreciations impact the trade balance with opposite directions, the net effect on the last variable may have any sign. In fact, the trade balance permanently improves in Canada and the UK, and deteriorates in the remaining countries.

Demand shocks. According to our model, in the short run positive demand shocks impact positively on output and appreciate the nominal and the real exchange rate. In the long run, demand shocks do not affect real output, but they affect the nominal and real exchange rate. Although the typical long-run effect on the exchange rate is an appreciation, depreciation may also occur if the quality of domestic assets is considerably deteriorated by expansionary demand shocks. The combination of both shocks leads the trade balance to worsen in the long-run. All these results are observed in Canada, France, Germany, Japan and the UK.

Nominal shocks. This type of shocks does not influence domestic output in the long run, but it does depreciate both the nominal and the real exchange rates in the short run. Consequently, a transitory nominal shock should temporarily improve the trade balance. In the long run, however, positive nominal shocks depreciate the nominal exchange rate (by increasing the internal price level), without modifying the real exchange rate. As a result, nominal shocks should not alter the trade balance in the long run. The response of the nominal and real exchange rate and of the trade balance to nominal shocks support the disequilibrium approach to exchange rates and trade flows, and might be explained by pricing to market (PTM) behavior, as considered, for instance, by Betts and Devereux (2000). In this set-up, a high degree of PTM reduces the traditional "expenditure-switching" effects of exchange rate depreciation because nominal exchange rate movements are very imperfectly passed through to domestic prices. Under full PTM, both nominal and real exchange rates depreciate in the short run, but the trade balance does not change[7].

In the following lines the results are presented looking at the responses of each endogenous variable in each country.

4.1 Relative output

Figure 1 shows the impulse responses of relative output in return to unit positive shocks. External lines correspond to error bands as calculated from parametric bootstrapped techniques. As can be seen, permanent supply shocks are the factors that cause the largest variations in relative output in each country. In general, output experiences an important positive shot in

[7]The fact that the trade balance does not improve in the short run, despite the depreciation in the real exchange rate could also be rationalised with $J-$curve effects in each country. Many empirical studies show, in fact, that real exchange rate depreciations worsen the trade balance during several quarters.

the short run that is completed very gradually in the following years. In other words, supply shocks have a permanent positive effect on the level of relative output as predicted by the theoretical model.

The effects of permanent demand shocks on output also agree with the model in general terms: they are positive in the short run in all countries except for Spain, where the response is negative but close to zero. But in all cases the effects tend to disappear progressively as time elapses, as predicted by the model. Nominal shocks are associated either with unexpected increases in the excess supply of money - that reduces the domestic interest rate - or with temporary increases in the risk premium. Both factors depreciate the exchange rate, which contributes to increase the demand for domestic output in the short run. As a result, nominal shocks increase output in the short run, but these effects are slight and very short lived. As can be seen in Figure 1, the effects of nominal shocks are, indeed, very small in each country and melt completely away after two to five years.

Table 2 reports the forecast error variance decomposition of shocks on output. In all cases, the variance of supply shocks is overwhelmingly dominant: it ranges from 97% in Japan to 54% in Italy and 70 in the UK. Demand factors range in second place by order of magnitude: their contribution to the variability of relative output goes from 27% in UK to less than 1% in France. Finally, the variance of output caused by nominal shocks is the smallest one except for France and Italy where it achieves 16% and 42%, respectively.

[**Insert Table 2 and Figure 1 here**]

4.2 Trade balance

As mentioned above, the trade balance is expressed as a ratio to GDP in order to control for scale effects. The impulse responses of this variable are presented in Figure 2. As can be seen, demand shocks cause the most important responses in the trade balance in both the short and the long horizons. This is a new result when compared to previous evidence, for instance Prasad (1999) and Lee and Chinn (2006). The reason of our findings lies on the fact that demand shocks transmit their effects through two complementary channels, the real exchange rate and domestic product, with the same influence sign, at least in the long run. Since positive demand shocks have a permanent negative impact (appreciation) on the real exchange rate, their effects on the trade balance have also a negative permanent component in the long run. As examined above, these effects are fully in accordance with the theoretical model.

Our empirical analysis reveals that the impact of positive demand shocks on the trade balance is always negative in both the short and long run, which fully agrees with a very large body of empirical and theoretical studies.

However, it strongly departs from the findings of Kim and Roubini (2004) and Koray and McMillin (2006) restricted to the effects of fiscal impulses in the U.S. In both papers, fiscal shocks are associated with real exchange rate depreciations and improvements in the current account.

The variance decompositions presented in Table 3 confirm that demand shocks are the most significant determinant of trade balance fluctuations in each country of our sample. In fact, the share of trade balance variability explained by demand shocks goes from 97% in Germany to 71% in Canada.

[**Insert Table 3 and Figure 2 here**]

Our theoretical analysis showed that the effects of permanent supply shocks on the trade balance have an ambiguous sign because the output and exchange rate effects on the trade balance tend to work in opposite directions over short and long time horizons. Figure 2 shows, indeed, that the impact sign is not unanimous: it is positive in Canada and the UK and negative in the remaining countries. In all cases, however, the effects increase gradually over time in absolute terms.

The variance decomposition analysis reveals that the effects of supply shocks on the trade balance are not sizeable in the short run except for Canada, Italy and the UK. Interestingly, the contribution of supply shocks to the forecast error variance of changes in the trade balance increases over time in Spain and the US.

The effects of nominal shocks on the trade balance are almost insignificant in both the short and the long time horizons, confirming the results of our theoretical analysis. It is true, however - again complying with our model - , that the net impact may have any sign, and that it is stronger in the short run than in the long run. In fact, in the long run the net impact tends to zero in each country because nominal shocks are essentially transitory in nature. The variance decomposition analysis proves that the contribution of nominal shocks to the forecast error variance of the trade balance is negligible. For the long run horizon, it ranges between 0% in Canada to 4 % in Spain. The decreasing impact over time is clearly observed in the US and Spain. This result diverges from previous findings by Prasad (1999), Guiliodori (2004) and Lee and Chinn (2006), according to which nominal shocks have a large contribution on the variability of the trade balance.

4.3 Nominal exchange rate

In the long run, the impact of permanent supply disturbances should be a permanent depreciation in the exchange rate. The reason is that lasting increases in the potential output require depreciations in the exchange rate to raise the aggregate demand for domestic output. This is the response shown in Figure 3 for four countries of the sample, France, Germany, Italy and Japan. However, in the remaining countries the final impact is an appreciation. The last result is compatible with two-sector models in which Balassa and Samuelson effects play an important role. This empirical finding is also obtained in other contexts. For instance, Clarida and Gali (1994) obtained appreciations in some bilateral real exchange rates of developed countries in response to a productive shock, in contradiction with the predictions of their theoretical model.

Our model indicates that, under normal circumstances, demand shocks appreciate the nominal value of the domestic currency in both the short and long run. In the long run, however, the depreciating result cannot be discarded when demand shocks considerably deteriorate the quality of domestic assets and/or that part of the demand expansion is monetized and leads to increases in the domestic price level[8]. The impulse response functions presented in Figure 3 are consistent with all of these results: the nominal exchange rate depreciates in some countries, Canada, France, Germany, Japan and the UK, and appreciates others: Italy, Spain and the US.

Theory indicates that nominal shocks depreciate the nominal exchange rate in both time horizons. In the short run, however, the impact should be stronger due to overshooting reactions in the nominal exchange rate. The impulse response functions confirm these predictions: since the flow responses of the exchange rate are added to obtain the level responses of this variable, the normal response of the nominal exchange rate to positive nominal shocks is positively sloped, exhibiting a concave trajectory with time. Note, however, that in the long run the response of the nominal exchange rate should be proportional to the nominal shock, since the real exchange rate is not affected by this kind of disturbances. The effects of demand and nominal shocks on the real exchange rate are in the same vein as those of Clarida and Galí (1994), Chadha and Prasad (1997) and Prasad (1999).

The variance decomposition analysis reveals that the main determinants of exchange rate variations are nominal shocks in both time horizons (see Table 4). In fact, the share of short-run exchange rate variability that is explained by nominal shocks goes from 55% in Italy to 95% in Canada. In general, the impact of nominal shocks on the variability of the exchange rate decreases over time in all countries of the sample, confirming again the predictions of the model. This result complies with the disequilibrium theory of exchange rate determination, a natural result given that in our model prices are sluggish in the short-run. The small aggregate supply component of exchange rate fluctuations has become something of a stylised fact in the literature on the economics of real exchange rates.

[8]The negative impact of demand shocks on the quality of domestic assets takes place when demand shocks are associated with increases in international indebtedness of public and/or private domestic agents -for instance, when they are akin to fiscal deficits-, but not when they reflect permanent improvements in foreign preferences for domestic goods.

[Insert Table 4 and Figure 3 here]

5 Robustness of the results

It is interesting to analyze the extent to which the impulse responses to shocks are compatible with some macroeconomic regularities observed in developed countries. The first one is the countercyclical behavior of the trade balance, that is, a negative correlation between short-run variations in output and the trade balance. Table 5 collects the cross correlation of cyclical output with contemporaneous, lagged and leading components of the cyclical trade balance, as estimated by a Hodrick-Prescott filter. With the exception of Canada, where output and the trade balance appear acyclical, in the rest of countries the relation is (weakly) countercyclical. The strongest negative correlation corresponds to the US, where the trade balance is also a clear leading indicator. The results of this paper are consistent with the negative unconditional correlations between output and the trade balance found in the data when the underlying forces are permanent supply and demand shocks, since both shocks increase output and deteriorate the trade balance in most countries of the sample.

[Insert Table 5 here]

Furthermore, if the nominal shock were the main leading force of the trade balance, it would have evinced a procyclical dynamic with output (see Prasad, 1999; Lee and Chinn, 2006). Provided that our model is written in relative terms, most of these nominal shocks would have vanished under the EMU. Table 6 presents the correlation coefficients between the identified nominal shocks in three periods: the complete period of observations 1975:Q4-2005:Q2; the period prior to the EMU 1975:Q4-1998:Q4; and the EMU period 1999:Q1-2005:Q2. Correlations between nominal shocks are weak across the entire period and the period previous to the EMU. Interestingly, after the EMU took place correlation coefficients have sensibly increased among its participating countries, mainly between Germany and France, where such a correlation doubles from 0.42 to 0.82. It is also worthnoticing how these correlation increase in Spain and Italy for the EMU period. At the same time, these coefficients are reasonably stable in the UK case, a European country that remained outside the EMU. The correlation coefficient of nominal shocks between the UK and Germany is -0.43 for the first period and -0.53 for the second one. Such a negative sign could indicate that the UK is actively using its monetary independence to accommodate the monetary variable according to its domestic market conditions.

[Insert Table 6 here]

In summary, these structural monetary shocks seem to be properly identified. Hence, if the trade balance were mainly governed by monetary shocks, its variability would have specially decreased after 1998:Q4 for those countries participating in the EMU, given that all shocks considered are country-specific shocks as we use relative variables. Table 7 shows some descriptive statistics for the trade balance: the mean, the median and the standard deviation. Again, we divide the table in the same three periods specified in table 6. Means and medians evince an absolute increase in the second period. This implies that countries that suffered trade deficits during the first period, also did a higher deficit in the second one (i.e. Spain, the UK and the US), and countries that enjoyed trade superavits during the first period, also did a higher superavit in the second one (i.e. Canada, Germany, Italy and Japan). The only change in sign corresponds to the French case, that moved from -0.26% to +1.06%. As long as this statistical structure has consolidated in the last part of our sample, this might indicate that sources of trade balance dynamics should be found in permanent rather than transitory shocks. Unconditional standard deviations are smaller in the second period, and such a decrease is not particularly associated to EMU countries.

[**Insert Table 7 here**]

The second regularity is the comovement between the trade balance and the real exchange rate. Our empirical findings reveal that negative effects on the trade balance may be associated with appreciations in the real exchange rate when the source of these movements are permanent demand shocks. By recognizing the different roles of three shocks, our analysis offer some explanations for the difficulty in empirical attempts to uncover the relationship between the exchange rate and the trade balance. Lee and Chinn (2006), for instance, cannot solve the abnormal correlation between the real exchange rate and the current account, detected in their empirical analysis, because they use an aggregate permanent shock unable to capture the specificities of demand and supply channels.

6 Summary and concluding remarks

In this paper we have developed a stochastic general equilibrium model for an open economy that illustrates how permanent and temporary external shocks affect the dynamics of three important macroeconomic variables, such as the relative domestic output, the trade balance and the nominal exchange rate in eight OECD countries. An important feature of our model is that monetary authorities minimize a social loss function: after observing supply shocks, they determine the optimal combination of output gap and inflation differential, taking into account that firms adjust gradually their prices and that all private agents make rational expectations on output and inflation.

Once the optimal combination $(\widetilde{y}, \pi)$ is derived, the authorities set the interest rate at the level permitting to achieve the desired output gap, and let the nominal exchange rate to adjust endogenously.

In the empirical part, we constructed and implemented a structural VAR that incorporates the long-run restrictions derived from the theoretical model. This VAR was used to obtain impulse responses functions and quantitative estimates of the relative importance of these shocks for fluctuations of the three endogenous variables. Our main results may be summarized as follows: *i*) supply shocks are the most important determinants of output fluctuations in all countries; they account for more than 80% of the long-horizon forecast error variance in Canada, France, Japan, Spain and the US and between 55% and 75% in the remaining countries; demand shocks are also an important source of output variations at short horizons. *ii*) Demand shocks appear to play a prominent role in trade balance fluctuations at short and long forecast horizons; they account for more than 90% of the long term forecast error variance in France, Germany and Japan, and between 70 % and 85% in the remaining countries. In general, the relevance of supply shocks for trade balance fluctuations increases with time, and nominal shocks are completely insignificant in all cases. The last result contrasts sharply with those of Prasad (1999). However, *iii*) nominal shocks are especially important to explain the short and long run fluctuations of the nominal exchange rate: in most countries, except Italy, they explain about 90% of the short run forecast error variance of the nominal exchange rate, and more that 80% in the long run variability of this variable. In Italy, nominal shocks account for a 55% of total exchange rate variability. This finding fully agrees with the recent results of Álvarez, Atkenson and Kehoe (2003) and Giuliodori (2004), according to which the variability of both nominal exchange rates and interest rate differentials in developed countries are determined by changes in risk premia and/or nominal disturbances, but they contradict the findings of Lee and Chinn (2006), where the movements of the exchange rate are attributed largely to permanent shocks.

Our findings may be applied to understand two important macroeconomic results in Spain and the US since the late nineties. These countries show impressive rates of output growth and unprecedented huge deficits in the trade balance. As far as output growth is concerned, supply shocks are the almost exclusively steering forces in the US, probably triggered by the information and communication technologies. In Spain, supply shocks play a predominant role in output growth as well. As regards the trade balance, demand shocks are clearly the main determinant in both countries, accounting a 83% of its variability in both the short run and the long run. These results support the view that in both countries measures to restrain demand impulses (private and/or public) are strongly recommended to equilibrate the trade balance.

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Table 1: Unit Root Tests

	Canada			France			Germany			Italy		
	ADF	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**
s_t	-2,34	-1,70	0,08	-1,56	-1,53	0,22***	-1,57	-1,92	0,27***	-1,90	-1,97	0,22***
Δs_t	-7,84***	-7,82***	0,24	-8,59***	-8,76***	0,13	-8,96***	-9,18***	0,35	-8,06***	-8***	0,58**
y_t	-1,61	-1,96	0,15**	-2,06	-2,10	0,15**	-0,83	-0,95	0,13*	-0,87	-0,50	0,29***
Δy_t	-10,45***	-10,56***	0,10	-13,75***	-13,45***	0,13	-12,43***	-12,34***	0,12	-12,03***	-11,71***	0,36*
tb_t	-2,33	-2,40	0,15**	-2,50	-2,34	0,15**	-2,29	-2,25	0,09	-3,12	-3,18	0,09
Δtb_t	-11,35***	-11,35***	0,06	-6,83***	-10,28***	0,07	-11,28***	-11,3***	0,09	-12,18***	-12,18***	0,11

	Japan			Spain			U.K.			U.S.		
	ADF	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**
s_t	-1,99	-1,79	0,23***	-1,97	-1,84	0,19**	-2,80	-2,28	0,16**	-2,60	-2,13	0,09
Δs_t	-8,11***	-8,09***	0,11	-9,06***	-9,07***	0,29	-9,15***	-9,13***	0,14	-8,64***	-8,91***	0,08
y_t	-0,82	-1,07	0,29***	0,37	0,48	0,29***	-22,35	-1,35	0,21**	-0,98	-1,16	0,23***
Δy_t	-10,83***	-10,59***	0,6**	-12,34***	-12,35***	0,9***	-13,03***	-12,41***	0,18	-10,4***	-10,68***	0,31
tb_t	-3,02	-3,37	0,16**	-1,98	-2,44	0,11	-3,57	-3,49	0,10	-1,15	-1,63	0,14*
Δtb_t	-6***	-9,24***	0,13	-14,74***	-14,43***	0,11	-12,46***	-12,5***	0,26	-9,73***	-9,76***	0,17

The number of lags used in the ADF test are determined by selecting the highest lag with a significant t-value on the last lag. A constant and a time trend are included in the regression for levels. A constant is included when testing first differences. Critical values (1%, 5% and 10%) taken from MacKinnon (1996): Dickey-Fuller and Phillips-Perron without trend (-3.47, -2.88, -2.57); Dickey-Fuller and Phillips-Perron with trend (-4.02, -3.44, -3.14); Kwiatskowski, Phillips Schmidt, Shin with trend (0,216, 0,146, 0,119) and without trend (0,739, 0,463, 0,374). In the case of the KPSS the null is that the series is stationary.

* Rejection of the unit root hypothesis at the 10 percent level.

** Rejection of the unit root hypothesis at the 5 percent level.

*** Rejection of the unit root hypothesis at the 1 percent level.

Table 2. Output Variance Decomposition

	Canada			France			Germany			Italy		
Time	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**
1	82,39%	15,84%	1,77%	92,92%	0,55%	6,53%	78,62%	19,79%	1,59%	64,98%	0,31%	34,71%
4	80,97%	16,08%	2,95%	83,57%	0,57%	15,87%	75,58%	21,23%	3,19%	54,70%	3,75%	41,55%
8	80,86%	16,19%	2,95%	83,51%	0,59%	15,91%	75,48%	21,33%	3,19%	54,61%	3,86%	41,53%
16	80,75%	16,30%	2,95%	83,48%	0,61%	15,91%	75,41%	21,40%	3,19%	54,59%	3,92%	41,50%
24	80,71%	16,35%	2,94%	83,48%	0,61%	15,91%	75,39%	21,42%	3,19%	54,58%	3,92%	41,49%
	Japan			**Spain**			**UK**			**USA**		
Time	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**
1	99,80%	0,15%	0,05%	90,72%	3,39%	5,90%	73,42%	24,80%	1,78%	93,34%	6,03%	0,64%
4	97,59%	1,31%	1,09%	87,32%	5,72%	6,97%	70,59%	26,10%	3,31%	90,65%	7,58%	1,78%
8	97,46%	1,43%	1,11%	87,28%	5,72%	7,00%	70,37%	26,27%	3,36%	89,71%	7,84%	2,45%
16	97,06%	1,83%	1,11%	87,28%	5,72%	7,00%	69,38%	27,32%	3,30%	89,61%	7,89%	2,51%
24	97,01%	1,88%	1,11%	87,28%	5,72%	7,00%	69,15%	27,56%	3,29%	89,58%	7,91%	2,51%

Table 3. Trade Balance Variance Decomposition

	Canada			France			Germany			Italy		
Time	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**
1	30,72%	69,26%	0,03%	0,00%	98,69%	1,31%	12,05%	87,33%	0,63%	7,30%	75,34%	17,35%
4	27,49%	72,40%	0,11%	1,12%	98,39%	0,49%	3,79%	95,78%	0,43%	17,39%	76,63%	5,99%
8	28,08%	71,86%	0,07%	2,86%	96,79%	0,35%	2,56%	97,16%	0,29%	20,90%	74,99%	4,11%
16	28,34%	71,61%	0,05%	3,87%	95,85%	0,28%	2,09%	97,68%	0,24%	22,22%	74,22%	3,56%
24	28,41%	71,55%	0,04%	4,04%	95,68%	0,27%	2,01%	97,76%	0,23%	22,37%	74,13%	3,50%
	Japan			**Spain**			**UK**			**USA**		
Time	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**
1	1,03%	98,10%	0,87%	0,58%	82,99%	16,42%	25,74%	73,28%	0,97%	6,06%	83,24%	10,69%
4	1,12%	98,21%	0,68%	9,83%	82,13%	8,04%	21,25%	77,28%	1,47%	4,31%	88,69%	7,00%
8	3,91%	95,70%	0,39%	13,30%	81,38%	5,33%	19,41%	79,54%	1,05%	10,75%	85,59%	3,66%
16	6,01%	93,65%	0,34%	14,57%	80,95%	4,48%	18,42%	80,67%	0,91%	15,56%	82,52%	1,92%
24	6,09%	93,57%	0,34%	14,76%	80,89%	4,35%	18,27%	80,84%	0,89%	16,90%	81,62%	1,48%

Table 4. Exchange Rate Variance Decomposition

	Canada			France			Germany			Italy		
Time	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**
1	0,60%	0,14%	99,26%	5,73%	0,71%	93,57%	0,42%	1,88%	97,70%	26,05%	19,02%	54,93%
4	1,85%	1,43%	96,72%	8,45%	1,66%	89,89%	0,63%	6,41%	92,96%	24,88%	18,96%	56,16%
8	2,00%	1,89%	96,11%	8,90%	2,56%	88,54%	0,62%	7,35%	92,02%	25,44%	19,27%	55,29%
16	2,19%	2,36%	95,44%	8,97%	3,11%	87,92%	0,62%	7,98%	91,40%	25,47%	19,46%	55,08%
24	2,26%	2,55%	95,19%	8,97%	3,22%	87,81%	0,62%	8,11%	91,27%	25,47%	19,47%	55,06%

	Japan			Spain			UK			USA		
Time	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**	**Supply**	**Demand**	**Nominal**
1	0,31%	7,12%	92,57%	1,92%	8,73%	89,35%	0,53%	4,87%	94,61%	0,86%	6,88%	92,26%
4	1,36%	17,08%	81,55%	2,32%	11,47%	86,21%	2,59%	4,71%	92,71%	2,42%	8,51%	89,07%
8	1,55%	18,13%	80,33%	2,40%	12,00%	85,60%	2,66%	4,72%	92,62%	2,41%	9,41%	88,17%
16	1,60%	18,14%	80,25%	2,52%	12,47%	85,01%	2,67%	4,77%	92,55%	2,82%	10,75%	86,43%
24	1,61%	18,15%	80,24%	2,55%	12,56%	84,89%	2,68%	4,79%	92,54%	3,03%	11,49%	85,48%

Table 5. Cross correlation of GDP with trade balance

	tb_{t-5}	tb_{t-4}	tb_{t-3}	tb_{t-2}	tb_{t-1}	tb_{t}	tb_{t+1}	tb_{t+2}	tb_{t+3}	tb_{t+4}	tb_{t+5}
Canadá	-0,01	-0,02	-0,04	-0,04	-0,01	0,05	0,07	0,15	0,20	0,26	0,32
France	-0,37	-0,35	-0,35	-0,28	-0,26	-0,20	-0,15	-0,07	0,02	0,13	0,19
Germany	-0,06	-0,15	-0,25	-0,25	-0,25	-0,35	-0,47	-0,42	-0,33	-0,30	-0,20
Italy	0,15	-0,03	-0,16	-0,33	-0,47	-0,44	-0,44	-0,27	-0,08	0,11	0,14
Japan	-0,38	-0,38	-0,43	-0,41	-0,36	-0,25	-0,22	-0,16	-0,11	-0,02	0,08
Spain	-0,31	-0,31	-0,39	-0,40	-0,38	-0,28	-0,21	-0,07	0,02	0,04	0,11
UK	0,00	-0,08	-0,22	-0,37	-0,44	-0,29	-0,23	-0,22	-0,23	-0,24	-0,20
USA	-0,15	-0,18	-0,25	-0,35	-0,44	-0,52	-0,64	-0,61	-0,49	-0,39	-0,24

Table 6: Correlation of Nominal Shocks

Total period, 1975:Q4-2005:Q2	Canada	France	Germany	Italy	Japan	Spain	UK	USA
Canada	1,00							
France	-0,18	1,00						
Germany	-0,19	0,46	1,00					
Italy	-0,09	0,22	0,00	1,00				
Japan	-0,18	0,01	-0,02	-0,20	1,00			
Spain	0,03	-0,09	-0,10	0,12	-0,23	1,00		
UK	0,08	-0,39	-0,45	0,03	-0,04	0,18	1,00	
USA	0,15	-0,43	-0,52	-0,16	-0,37	-0,02	-0,08	1,00

First period, 1975:Q4-1998:Q4	Canada	France	Germany	Italy	Japan	Spain	UK	USA
Canada	1,00							
France	-0,27	1,00						
Germany	-0,28	0,42	1,00					
Italy	-0,16	0,19	-0,07	1,00				
Japan	-0,19	0,06	0,02	-0,14	1,00			
Spain	0,06	-0,14	-0,16	0,09	-0,21	1,00		
UK	0,13	-0,39	-0,43	0,06	-0,06	0,20	1,00	
USA	0,32	-0,39	-0,49	-0,15	-0,43	0,01	-0,14	1,00

Second period, 1999:Q1-2005:Q2	Canada	France	Germany	Italy	Japan	Spain	UK	USA
Canada	1,00							
France	0,17	1,00						
Germany	0,17	0,82	1,00					
Italy	0,14	0,52	0,59	1,00				
Japan	-0,13	-0,38	-0,32	-0,59	1,00			
Spain	-0,17	0,55	0,68	0,62	-0,41	1,00		
UK	-0,18	-0,51	-0,53	-0,30	0,13	-0,24	1,00	
USA	-0,37	-0,70	-0,68	-0,25	-0,07	-0,37	0,31	1,00

Table 7. Descriptive Statistics for the Trade Balance

	Canadá	France	Germany	Italy	Japan	Spain	UK	USA
Total period, 1975:Q4-2005:Q2								
Mean	1,73%	0,01%	2,50%	0,74%	1,41%	-1,51%	-1,03%	-1,83%
Median	1,43%	-0,12%	2,35%	0,54%	1,52%	-1,63%	-0,99%	-1,40%
Std. Dev.	2,08%	1,48%	2,08%	2,11%	1,17%	2,05%	1,96%	1,54%
First period, 1975:Q4-1998:Q4								
Mean	1,01%	-0,26%	2,37%	0,65%	1,41%	-1,19%	-0,60%	-1,22%
Median	0,83%	-0,46%	2,15%	0,37%	1,60%	-0,95%	-0,73%	-1,10%
Std. Dev.	1,62%	1,49%	2,10%	2,34%	1,30%	2,11%	1,96%	0,98%
Second period, 1999:Q1-2005:Q2								
Mean	4,48%	1,06%	2,98%	1,06%	1,40%	-2,77%	-2,66%	-4,16%
Median	4,20%	1,17%	3,48%	1,07%	1,48%	-2,65%	-2,72%	-4,06%
Std. Dev.	1,12%	0,86%	1,98%	0,70%	0,43%	1,17%	0,70%	0,91%

Figure 1: Impulse-Response Functions for Output

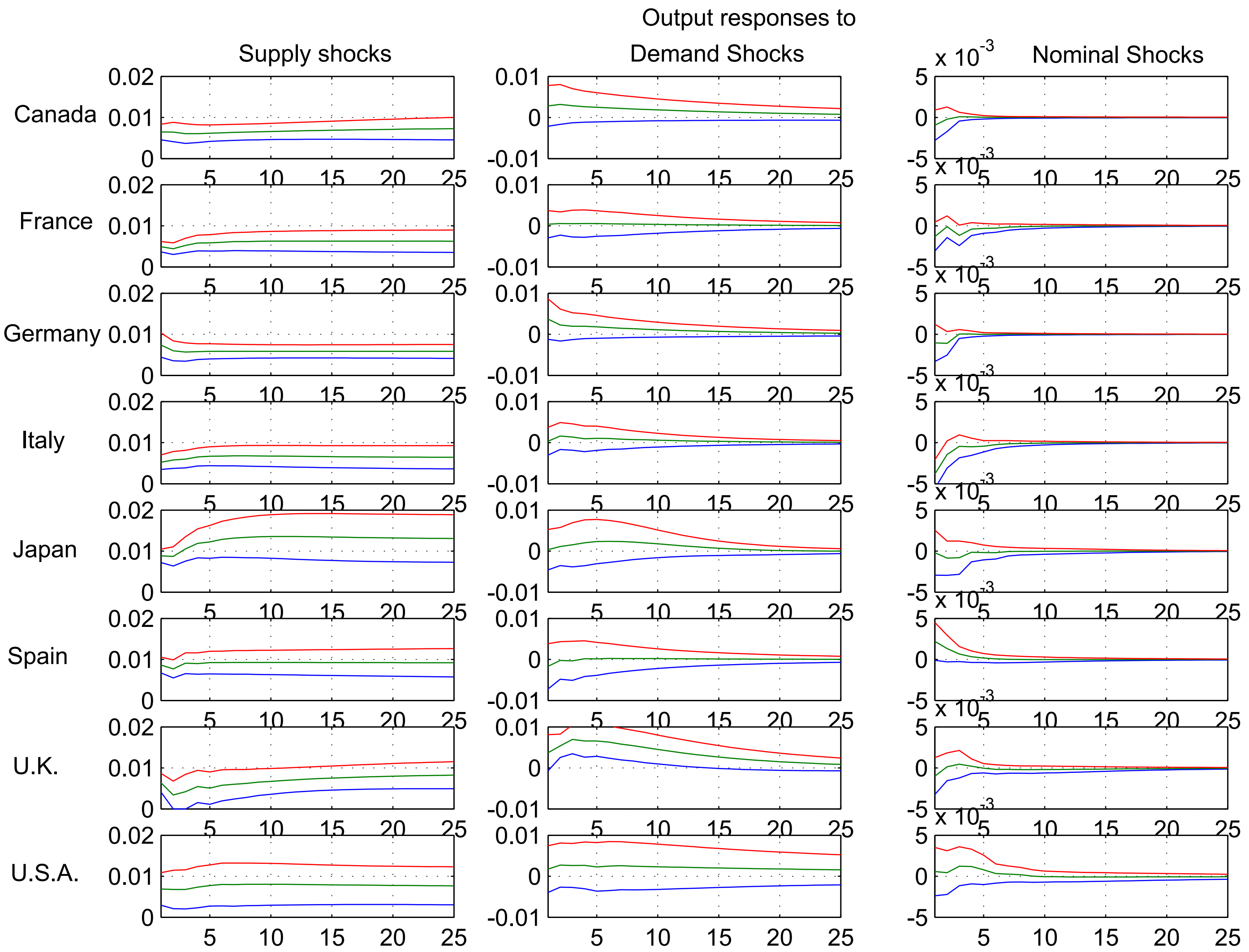

Figure 2: Impulse-Response Funtions for the Current Account

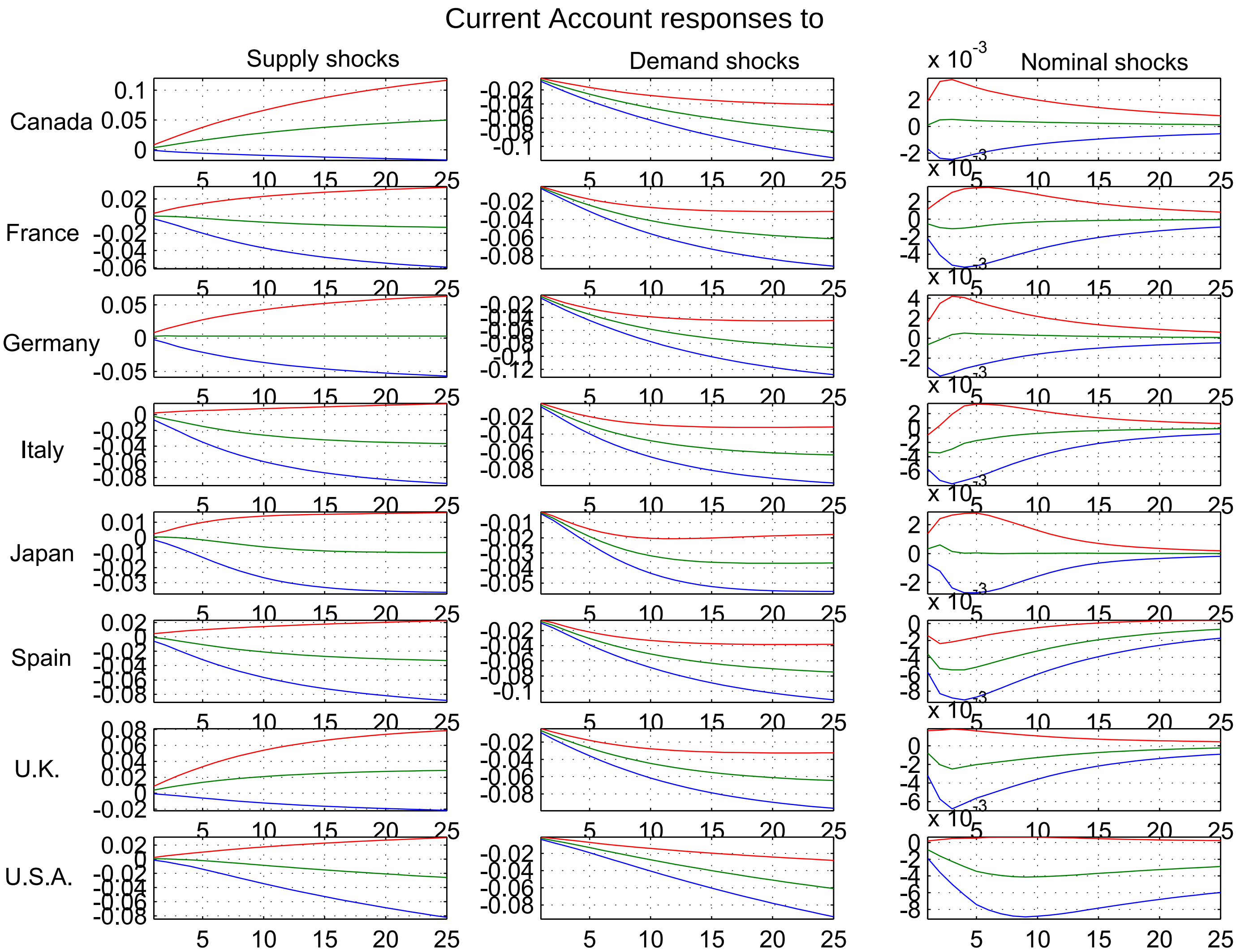

Figure 3: Impulse-Response Functions for the Nominal Exchange Rate