The Effects of Fiscal Shocks on the Exchange Rate in the EMU and differences with the US [§]

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Abstract

We analyse the impact of government spending shocks on the real effective exchange rate and net exports in the Euro Area within a standard structural VAR framework. We employ a new database that contains quarterly fiscal variables for the Euro Area as a whole. We show that higher government spending leads to real exchange rate appreciation and to a fall of net exports, jointly with lower primary budgetary surpluses, which turns out to be fully consistent with the "twin deficits" hypothesis. The different components of public spending, namely wage and non-wage consumption expenditure, overall public consumption expenditure and public investment, bring about real appreciations. Our results are therefore also consistent both with the home-bias hypothesis of public expenditure and with public investment contributing to generating relative productivity gains in the traded goods sector. Contrary to what it is observed in the Euro Area, the real effective exchange rate depreciates in the US in response to higher government spending. Such discrepancy can ultimately by explained by the reaction of nominal interest rate spreads and the uncovered interest parity condition. The dissimilar reaction of short-term nominal interest rate spreads is attributed to concurrence of two factors, namely the leading role of the US dollar as a "safe haven" currency and the countercyclical behaviour of discretionary government spending in the US.

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1 Introduction

An increasing number of studies assessing the macroeconomic effects of fiscal shocks showed up in the last decade. While the most prominent papers have focused on the U.S. (Edelberg et al, 1999; Fatás and Mihov, 2001; Blanchard and Perotti, 2002; Perotti, 2004; Mountford and Uhlig, 2009, inter alia), growing evidence on other countries has arisen (Heppke-Falk et al., 2006, for Germany; De Castro, 2006, and De Castro and Hernández de Cos, 2008, for Spain; Giordano et al., 2007, for Italy; Marcellino, 2006, for the four largest countries of the Euro Area; Afonso and Sousa, 2009a, 2009b, for Germany, Italy and Portugal; Bénassy-Quéré and Cimadomo, 2006, for Germany, the U.K. and the U.S.; Burriel et al., 2010, for the whole Euro Area).

However, most of these studies fail to analyse in depth the implications of fiscal shocks on external competitiveness. On the theoretic side, real appreciation following government spending shocks is a robust prediction in most RBC and new-Keynesian DSGE models. This notwithstanding, most of the empirical evidence concerning the US yields the opposite result: the REER depreciates in response to higher public expenditure (Ravn et al.; 2007; Kim and Roubini, 2008; Corsetti et al., 2009; Monacelli and Perotti, 2010; Enders et al., 2011). In fact, Ravn et al. (2007) and Monacelli and Perotti (2010) also obtain this result for Australia, the U.K. and Canada. By contrast, Beetsma et al. (2008) and Bénétrix and Lane (2009b) for panels of EU and Euro Area countries, respectively, argue that government spending shocks lead to real appreciations,[1] in line with most theoretical predictions, and in sharp contrast to the US case. In turn, Froot and Rogoff (1991), De Gregorio et al. (1994) and Galstyan and Lane (2009b) observe long-run real appreciation in response to increases in government consumption. Notwithstanding the lack of agreement concerning the response of the real exchange rate, in all cases except Kim and Roubini (2008), fiscal expansions cause deterioration of trade balances.

Hence, the purpose of our paper is twofold: first, we aim to assess the effects of government spending shocks on the REER and the net exports in the Euro Area as a

[1] The same result is obtained by Lane and Milesi-Ferretti (2002), Bénétrix and Lane (2009a) or Galstyan and Lane (2009a) for Ireland and De Castro and Fernández (2011) for Spain.

whole, as there are very few studies that focus on this aggregate; second, we compare these effects with those observed in the US and provide potential explanations for the discrepancies between both geographical areas.

As far as the Euro Area is concerned, we allow for the different underlying transmission channels of fiscal shocks to the REER and the net exports in order to frame our results within possible theoretical benchmarks. Despite the fact that the Euro Area only traces back to 1999, the synchronization of monetary policies among core Euro Area countries dates from the beginning of the 1990s. Moreover, economic integration among most of them has been considerably high even well before. Hence, the aggregate analysis of fiscal policy shocks for the area as a whole is a pertinent endeavour. In this respect, the closest study to our paper is Beetsma et al. (2008), which analyses the effects of spending shocks on trade and budget balances in a panel of 14 EU countries. They find that government spending shocks lead to higher budget deficits, real appreciations and fall of trade balances, thereby their results being in line with the "twin deficits" hypothesis. In turn, Bénétrix and Lane (2009b) assess the effects of the composition of government spending on the behaviour of the real exchange rate in a panel with the Euro Area countries. They observe that higher government consumption leads to real appreciation, whereas public investment increases cause a decline in the relative price of non-tradables and may thereby lead to real depreciations.

However, our paper differs from Beetsma et al. (2008) and Bénétrix and Lane (2009b) in some important respects. From a purely methodological perspective, we focus on the Euro Area as a single entity, while the other two papers conduct a panel analysis with draws average responses across the countries considered. In practice, a panel analysis implies that intra-EU trade linkages have not been netted out. On the other hand, the real effective exchange rates of the different countries used in panel analyses are gauged, inter alia, with respect to rest of the Euro Area or EU countries.

Another important difference applies to the data. These two studies use annual data, whereas we employ quarterly figures. Annual data make some identifying assumptions more controversial, especially the assumption that fiscal variables do not react contemporaneously to other variables in the system. While it is true that most spending plans are already determined in the budget approved the previous year,

amendments in the course of the fiscal year are frequent. Hence, our paper contributes to complementing the analysis in Beetsma et al. (2008) and Bénétrix and Lane (2009b) in various important directions.

As for the comparison with the US, we do find dissimilar responses, in line with previous results in the literature. While the real effective exchange rate appreciates in response to government expenditure shocks in the EMU, the opposite happens in the US. In order to provide an explanation for these disparities, we analyse the reaction of the nominal effective exchange rate to spending shocks in both areas, the role of the uncovered interest parity condition and the cyclical behaviour of government spending shocks. Due to data availability for the Euro Area, we focus on the sample 1981-2007.

We base our conclusions on impulse response functions drawn from structural VARs, wherein discretionary fiscal shocks have been identified following the methodology proposed by Blanchard and Perotti (2002) and Perotti (2004). Our two main findings are that positive government expenditure shocks bring about real effective exchange rate (REER henceforth) appreciations and higher both budgetary primary and external deficits, in line with the "twin deficits" hypothesis. Likewise, the discrepancies observed in the reaction of the REER between the Euro Area and the US are related to the dissimilar reaction of short-term nominal interest rate spreads, which is ultimately attributed to the concurrence of three factors in the US: its leading role in the world business cycle, the role of "safe haven" currency of the US dollar and the countercyclical behaviour of government spending shocks.

The rest of the paper is organised as follows: section 2 explains how the real exchange rate reacts to public spending shocks in theoretical models, section 3 describes the data and section 4 the methodological issues. Section 5 shows the results for the Euro Area, while section 6 frames them in the theoretical literature. Section 7 compares these results with those obtained with US data. Finally, we present our conclusions in section 8.

2 The relationship between spending shocks, exchange rate movements and trade balances in theoretical models

On the theoretical field, although there is not full unanimity about the sign of the response of the exchange rate to public spending shocks, in most of the models fiscal expansions lead to real appreciation. The traditional Mundell-Fleming model, an open economy version of the Hicksian IS-LM framework, predicts that higher government spending would spur economic activity and hence private consumption. The resulting higher final demand would then provoke an upward reaction of nominal and real interest rates that would trigger capital inflows and entail nominal and real appreciation. Higher final demand and currency appreciation would lead to a fall of the trade balance.

Home bias is another usual argument behind spending shocks-led real appreciations in the literature. Insofar as government spending mostly concentrates on home-produced goods, fiscal expansions should make these goods relatively scarcer, thereby increasing their relative price with respect to imported goods and leading to real appreciation (see Frenkel and Razin, 1996).

Likewise, real appreciation is a robust theoretical prediction in most RBC and DSGE models. Under complete international markets for state-contingent assets, higher public expenditure results in a negative wealth effect that depresses private consumption. In this context, the usual consumption risk sharing condition implies that lower domestic private consumption calls for an appreciation of the real exchange rate.[2] However, the assumption of complete markets is not crucial for real appreciation. Galí et al. (2007) show that the introduction of Rule-of-Thumb consumers may bring about positive private consumption responses to government shocks provided that the share of these consumers is sufficiently high. In this connection, Erceg et al. (2005) allow for Rule-of-Thumb consumers in one version of their open macroeconomic model and obtain the positive private consumption responses to government shocks, jointly with real appreciation. The latter takes place because irrespective of the share of Rule-of-Thumb consumers, consumption by forward-looking agents still declines due to the

[2] Monacelli and Perotti (2010) make an interesting comparison of the effects of government spending shocks on private consumption and the real effective exchange rate across different theoretical frameworks.

negative wealth effect. As only these agents have access to complete international financial markets, their consumption behaviour determines exchange rate movements via the aforementioned usual consumption risk sharing condition.

Conversely, a number of possible explanations for real depreciations caused by government expenditure shocks have also been put forward. Obstfeld and Rogoff (1995), under the assumption that the government follows a balanced budget rule, predict that in a large economy, a fiscal expansion increases the real interest rate, thereby depressing private consumption. Since the demand for money is assumed to depend on private consumption, insofar as prices are sticky, a fall in consumption leads to a depreciation of the nominal and real exchange rate. The problem with this hypothesis is however that in most pieces of empirical evidence private consumption rises following government spending shocks. Corsetti et al. (2009) contribute an interesting result. They argue that the economy's response to a spending rise depends highly on agent's expectations of spending reversals in the future. Thus, if current deficits are expected to be at least partly offset in the future long-term interest rates might even go down. In this context, private consumption would increase jointly with a depreciation of the real exchange rate. In turn, Enders et al. (2011) justify real depreciations on the grounds of short run international price movements tending to amplify instead of mitigate country-specific consumption risk. Finally, Ravn et al. (2007) introduce deep habits in consumption in an open economy model. In this framework, an increase in public expenditure provokes a countercyclical reaction of equilibrium markups, a rise of wages and private consumption and a deterioration of the trade balance. Moreover, they argue that the decline of domestic markups makes the domestic economy relatively inexpensive with respect to the foreign one, thereby causing real exchange rate depreciation.

As regards the effects on the trade balance, non-Ricardian models tend to display a positive correlation between net exports and the change in the budgetary primary surplus in response to higher public expenditure. In other words, with some qualifications depending on the size and the openness of the economy at hand, predictions of non-Ricardian models lean towards the "twin deficits" hypothesis. Thus, higher domestic demand and the real appreciation caused by an increase in government

spending will stimulate imports, while exports may be negatively affected by the real appreciation. Thus, trade balances will fall jointly with governments' primary surpluses.

3 The data

The baseline VAR includes quarterly data on public expenditure (g_t), net taxes (t_t) and GDP (y_t), all in real terms,[3] the GDP deflator (p_t), the ten-year interest rate of government bonds (r_t)[4] and the CPI-based real effective exchange rate (REER) vis à vis the rest of the world. All variables are seasonally adjusted and enter in logs except the interest rate, which enters in levels.

The definition of fiscal variables follows Blanchard and Perotti (2002) and Perotti (2004). In particular, government spending (g_t) is defined as the sum of government consumption and investment, while net taxes (t_t) are defined as total government current receipts, less current transfers and interest payments on government debt.[5] The REER is the relative price of the similar a consumption basket in two different economies and is defined as:

$$REER_t = \frac{E_t P_t^*}{P_t} \qquad (1)$$

where E_t is the nominal effective exchange rate defined in terms of Euros per units of foreign currency, P_t is the level of home prices and P_t^* is the level of foreign prices. According to this definition decreases in E_t and $REER_t$ reflect a nominal and a real appreciation, respectively.

We try other VAR specifications aiming to better understand the responses of certain variables to fiscal shocks. In particular, we assess the reactions of nominal effective exchange rates, net exports or the role of relative prices, including relative

[3] In all cases the GDP deflator is employed so as to obtain the corresponding real values.

[4] The long-term interest rate is preferred to the short-term one because of its closer relationship with private consumption and investment decisions. However, this choice turned out to be immaterial to the results in that the inclusion of short-term rates in the VAR led to similar conclusions.

[5] More concretely, transfers include all expenditure items except public consumption, public investment and interest payments.

prices of non-tradables with respect to tradables. For this purpose, we make the following usual decomposition of the REER:

$$REER_t = \left(\frac{E_t P^*_{T,t}}{P_{T,t}} \right) \times \left(\frac{P_{T,t} / P_t}{P^*_{T,t} / P^*_t} \right) \quad (2)$$

Taking logs in (2) leads to the following expression:

$$reer_t = reer_{T,t} + reer_{NT,t} \quad (3)$$

where $reer_{T,t}$ denotes the real effective exchange rate of traded goods and $reer_{NT,t}$ the cross-country ratio of the relative price of traded with respect to non-traded goods (or relative price of non-traded goods). Following Burnstein et al. (2005) and Monacelli and Perotti (2010), we compute the index of traded goods prices as the arithmetic average of the import and export price index: $P_{T,t} = \frac{1}{2}\left(P_{m,,t} + P_{x,,t}\right)$ where p_{mt} and p_{xt} denote the import and export price indexes (all in logs). In turn, $P^*_{T,t}$ is obtained as the index of traded goods of the Euro Area trading partners, weighted by their bilateral trade share, which is taken from Eurostat (see table 1). Non-traded goods prices have been obtained as a residual.

On the other hand, as we are also interested in the analysis of exchange rate responses to different types of fiscal shocks we included non-wage government consumption, government spending on wages and salaries and public investment in turn as endogenous variables. As before, the GDP deflator was used to get their corresponding real values.

For our analysis, we use the quarterly fiscal database for the Euro Area aggregate for the period 1980Q1-2007Q4 compiled by Paredes et al. (2009).[6] The raw ingredients they use are closely linked to the ones used by national statistical agencies to provide their best estimates (intra-annual fiscal data, mostly on a cash basis) and preserve full coherence with official, annual data. Exchange rate data have been obtained from the IFS (IMF) database, and the imports and exports price deflators from

[6] This database is the same as that used in Burriel et al. (2010). Its main advantage is that it avoids the endogenous bias that arises if fiscal data interpolated on the basis of general macroeconomic indicators were used with macroeconomic variables to assess the impact of fiscal policies

the OECD. The rest of the data used in the paper are taken from ECB's Area Wide Model Database (see Fagan et al., 2005). For the US, both fiscal and national accounts data have been taken from the NIPA accounts from the Bureau of Economic Analysis.

Despite the obvious drawback of using estimated instead of raw data for the Euro Area, quarterly data are preferred to annual ones because they avoid the need of making too stringent identifying assumptions. Rather, quarterly data allow for within-year feedback responses among all the variables in the system, especially between fiscal variables and GDP.

4 Specification and identification of the (S)VAR model

The reduced-form VAR is specified in levels and can be written as

$$X_t = D(L)X_{t-1} + U_t \tag{4}$$

where $X_t \equiv (g_t, t_t, y_t, p_t, r_t, reer_t)$ is the vector of endogenous variables and $D(L)$ is an autoregressive lag-polynomial. The benchmark specification includes a constant, but no deterministic trends. The vector $U_t \equiv (u_t^g, u_t^t, u_t^y, u_t^p, u_t^r, u_t^{reer})$ contains the reduced-form residuals, which in general will present non-zero cross-correlations. The VAR includes two lags of each endogenous variable according to the information provided by LR tests, the Akaike, Schwarz and Hannan-Quinn information criteria and the final prediction error.[7]

We apply the identification strategy proposed by Blanchard and Perotti (2002) and Perotti (2004), which exploits decision lags in policy making and information about the elasticity of fiscal variables to economic activity. Their strategy relies on the assumption that the reduced-form residuals of the g_t and t_t equations, u_t^g and u_t^t, can be thought of as linear combinations of three types of shocks: a) the automatic responses of spending and net taxes to the rest of macroeconomic variables in the system, b) systematic discretionary responses of fiscal policy to the same set of macro variables

[7] In order to assess the robustness of our results to different specifications and transformations, we tried several alternatives, including estimating with variables in per capita terms, allowing for four lags instead of two, introducing a deterministic time trend and substituting the long-term interest rate by a short-term one. These different alternatives showed broadly the same qualitative results.

and c) random discretionary fiscal policy shocks, which are the truly uncorrelated structural fiscal policy shocks whose effects are the purpose of our analysis.

The innovations model can be written as $\Gamma U_t = \mathrm{B} V_t$, where $V_t \equiv (e_t^g, e_t^t, e_t^y, e_t^p, \mathrm{e}_t^r, e_t^{reer})$ is the vector containing the orthogonal structural shocks. Accordingly, the reduced-form residuals are linear combinations of the orthogonal structural shocks of the form $U_t = \Gamma^{-1}\mathrm{B} V_t$. The respective matrixes Γ and B can be written as:

$$\Gamma = \begin{pmatrix} 1 & 0 & -\alpha_{g,y} & -\alpha_{g,p} & -\alpha_{g,r} & -\alpha_{g,reer} \\ 0 & 1 & -\alpha_{t,y} & -\alpha_{t,p} & -\alpha_{t,r} & -\alpha_{t,reer} \\ -\gamma_{y,g} & -\gamma_{y,t} & 1 & 0 & 0 & 0 \\ -\gamma_{p,g} & -\gamma_{p,t} & -\gamma_{p,y} & 1 & 0 & 0 \\ -\gamma_{r,g} & -\gamma_{r,t} & -\gamma_{r,y} & -\gamma_{r,p} & 1 & 0 \\ -\gamma_{reer,g} & -\gamma_{reer,t} & -\gamma_{reer,y} & -\gamma_{reer,p} & -\gamma_{reer,r} & 1 \end{pmatrix} \tag{5}$$

$$\mathrm{B} = \begin{pmatrix} 1 & \beta_{g,t} & 0 & 0 & 0 & 0 \\ \beta_{t,g} & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

As we are interested in analysing the effects of "structural" discretionary fiscal shocks e_t^g and e_t^t on the rest of the variables of the system, estimations for the $\alpha_{i,j}$'s and $\beta_{i,j}$'s in (5) are needed. In general, approving and implementing new measures in response to specific economic circumstances typically take longer than three months. Hence, the use of quarterly data rules out contemporaneous discretionary responses of fiscal variables to changes in underlying macroeconomic conditions. Therefore, the coefficients $\alpha_{i,j}$'s in (5) only reflect the automatic responses of fiscal variables to the rest of the variables of the system, the first source of innovations aforementioned.

The way fiscal variables are defined allows to make further assumptions concerning the values of the $\alpha_{i,j}$'*s*. Specifically, the semi-elasticities of fiscal variables to interest rate innovations are set to zero given that given that interest payments on government debt are excluded from both definitions.[8] Moreover, the automatic responses of public expenditure to economic activity and the real exchange rate are also set to zero.[9] The case of the price elasticity is different because some share of purchases of goods and services is likely to respond to the price level. Thus, we set the price elasticity of government expenditure to -0.5.[10]

In order to calculate the output and price elasticities we basically follow the OECD methodology proposed in Giorno et al. (1995). Output and price elasticities of net taxes, $\alpha_{t,y}$ and $\alpha_{t,p}$, are obtained as weighted averages of the elasticities of the different net-tax components, including transfers, computed on the basis of information like statutory tax rates and estimations of the contemporaneous responses of the different tax-bases and, in the case of transfers, the relevant macroeconomic aggregate to GDP and price changes. Tax base elasticities of the different tax and transfer categories have been taken from van den Noord (2000) and Bouthevillain et al. (2001), whereas output elasticities of the relevant tax bases were, however, obtained from econometric estimation on a quarterly basis. According to our estimations, the output elasticity in the Euro Area is 1.54, whereas the price elasticity amounts to 1.14.[11]

Furthermore, given that our main interest lies on spending shocks we assume that expenditure decisions are prior to tax ones, which implies a zero value for $\beta_{g,t}$. This allows us to retrieve e_t^g directly and to use it to estimate $\beta_{t,g}$ by OLS, which completes the identification of the first two equations. Since we are interested in studying the effects of fiscal policy shocks, the ordering of the remaining variables is immaterial to

[8] In many cases, the income tax base includes interest income as well as dividends, which in general co-vary negatively with interest rates. Nevertheless, the full set of effects of interest rate innovations on the different tax categories are very complex to analyse, especially in the euro area, and, on the other hand, their contemporaneous effects are deemed to be very small.

[9] The absence of contemporaneous response to real exchange rate innovations is justified on the grounds of the home bias of public expenditure items, especially public consumption.

[10] We took this assumption from Perotti (2004), which Burrriel et al. (2010) show that is immaterial for the EMU results.

[11] In the case of the US output and price elasticities amount to 1.94 and to 1.15, respectively. See Burrriel et al. (2010) for further details.

the results. Therefore, the sequential ordering for the remaining shocks u_t^y , u_t^p , u_t^r and u_t^{reer} is imposed. The corresponding structural shocks are estimated by instrumental variables in turn, using e_t^g and e_t^t as instruments for u_t^g and u_t^t, respectively. In what follows we present our results in terms of impulse response functions. As usual, these are reported jointly with 68% confidence bands[12] obtained by Monte Carlo integration methods with 1000 replications.

One usual criticism to this methodology is whether VAR shocks are truly exogenous and unpredictable. While legislative and implementation lags make that changes in government spending and taxes can be anticipated, it is often claimed that VARs cannot properly account for such anticipation effects (see Leeper, et al., 2008). If agents are forward looking SVAR may fail to correctly estimate fiscal shocks, thereby leading to biased estimates of their effects. In this regard, Ramey (2011) provides evidence that SVAR-based innovations in the US as identified in Blanchard and Perotti (2002) can be anticipated and Granger caused by Ramey and Shapiro (1998) war episodes. However, Perotti (2004) finds little evidence that SVAR-based innovations are predictable. In turn, Bouakez et al. (2010) show that Ramey's results are most likely driven by the Korean War episode and thus the fiscal foresight problem is not severe enough to preclude the use of SVAR innovations as correct measures of unanticipated fiscal shocks.[13]

[12] Edelberg et al. (1999), Fatás and Mihov (2001), Blanchard and Perotti (2002) or Perotti (2004) among others, also choose this bandwidth to present their results.

[13] We performed Granger causality tests between our estimated government spending structural shocks and changes in the output gap with different lags. In no case was the null hypothesis that changes in the output gap do not G-cause spending shocks rejected.

5 The effects of government spending shocks

5.1 The baseline VAR

Figure 1 displays the responses of the endogenous variables to a positive expenditure shock in the EMU.[14] The government spending shock takes 12 quarters to fade out. In turn, net taxes increase on impact although quickly, after four quarters, become non-significant. As expected, spending shocks bring about a deterioration of the general government primary balance, especially due to the higher persistence of the response of government spending.

The increased public spending leads GDP to rise on impact and to display a significant positive response for 5 quarters. The impact output multiplier is gauged at 0.85, whereas the cumulative output multiplier[15] after one year amounts to some 0.97 and to some 0.87 eight quarters after the shock (see table 2). These values are significant within a 68% confidence interval and are within range of most of the empirical evidence available.[16]

Private consumption and private investment were included in turn in the VAR replacing GDP.[17] In both cases, their impulse responses display a similar pattern to that of GDP. Private consumption increases on impact and remains significant for around four quarters, phasing out thereafter. Private investment rises on impact as well, in line with the accelerator hypothesis, although such increase is only marginally significant. This positive response fades away rather quickly.

[14] Impulse responses show deviations with respect to the baseline to a one-percent shock of the relevant fiscal variable. Hence, GDP responses cannot be directly interpreted as output multipliers.

[15] The cumulative multiplier at a given quarter is obtained as the ratio of the cumulative response of GDP and the cumulative response of government expenditure at that quarter.

[16] See Burriel et.al (2010). Specifically, focusing on Germany, Perotti (2004) gauges a short-term multiplier of around 0.5, whereas Heppke-Falk et al. (2006) obtain an impact multiplier around one. In turn, Baum and Koester (2011) get a cumulative output multiplier of 0.7 at the fourth quarter after the shock in their linear specification. De Castro (2006) and De Castro and Hernández de Cos (2008) estimate multipliers around 1.3 after one year for Spain, while Giordano et al. (2007) obtain much higher values, around 1.2 and 2.4 on impact and after four quarters, respectively, for Italy, although in this latter case multipliers only apply to a shock to purchases of goods and services.

[17] To identify the fiscal shocks, we need to compute the elasticities of fiscal variables to private consumption and investment. They are gauged by multiplying the GDP elasticities by the inverse of the output elasticities of private consumption and investment, respectively.

Prices start rising one quarter after the shock and display a hump-shaped response. Accordingly to this pattern, government spending shocks entail persistent and significant inflation increases in the Euro Area for around two years. Likewise, the (nominal and real) long-term interest rate shows a hump-shaped rise in reaction to the shock.

Government spending shocks lead to a fairly persistent real appreciation in the Euro Area. This result is fully consistent with Bénétrix and Lane (2009b), who use a panel with the Euro Area countries and with Beetsma et al. (2008) for a panel of EU countries. Moreover, our result is also in line with other pieces of evidence on some individual countries such as Bénétrix and Lane (2009a) and Galstyan and Lane (2009a) for Ireland or De Castro and Fernández (2011) for Spain. However, such real appreciation to public spending shocks contrasts sharply with the results obtained in other studies for some other countries. Specifically, Kim and Roubini (2008) and Enders et al. (2011) for the U.S., Monacelli and Perotti (2010) for Australia, the U.S. and the U.K. and Ravn et al. (2007) for a pool of Australia, Canada, the U.S. and the U.K., find that higher government expenditure yields real depreciations.

In order to deepen the understanding of real exchange rate responses, we replaced the REER in our VAR by its two main components, notably the nominal effective exchange rate and relative prices. In the case of the EMU as a whole, the increase in home prices can only be considered as an imperfect proxy for the rise in relative prices. Due to its considerable size, fiscal shocks in the Euro Area may imply non-negligible effects on international prices. Figure 2 presents the corresponding impulse responses. The observed real appreciation stems from both a nominal appreciation (e.g. appreciation of the nominal effective exchange rate, NEER) and an increase of relative prices, with the appreciation of the NEER being far more persistent.

5.2 Sectoral effects

The baseline VAR was also re-specified by replacing the REER by both the real exchange rates of traded and non-traded goods as shown in equation (3). Figure 3 shows that the real exchange rates of traded goods and the relative price of non-traded goods

appreciate after a shock to government spending.[18] Although the appreciation appears more intense in the former case, it is only significant in the case of non-traded goods, which is consistent with the home-bias view on government spending. Insofar as it concentrates mostly on home-produced goods, mainly non-tradables, fiscal expansions contribute to increasing their relative price with respect to traded goods and to imported goods. In this sense, the bottom graph of the Figure 3 shows that import prices fall relative to export prices.

5.3 Productivity, unit labour costs and markups

The responses of productivity, real wages and markups are important to understand in depth the channels through which fiscal shocks affect the real effective exchange rate. An increase in government spending stimulates both nominal and real wages (see Figure 4) which is in line with other empirical studies for the US (see Perotti, 2007), as well as with the predictions by a number of new-Keynesian models (e.g. Galí et al., 2007). At the same time, labour productivity shows a temporary spike but to a lower extent than nominal wages and rapidly fades away, thereby raising unit labour costs of the economy.

In turn, as we have previously shown, prices also rise, although less than unit labour costs. Although there is not a direct measure of markups, they can reasonably be approximated by the gap between prices and unit labour costs. Hence, on the basis of this assumption, government spending shocks entail a countercyclical reaction of markups.

5.4 The effects of government spending on the external sector

To assess the effect of spending on the external sector of the economy we estimate a 7-variable VAR model that include net exports in addition to the 6 endogenous variables of the baseline specification. Moreover, we also try an alternative model that includes exports and imports of goods and services instead of net exports as such. Both specifications are formally equivalent, although the latter allows us to better understand

[18] Monacelli and Perotti (2010) find that both components, traded and non-traded, depreciate in response to an increase in public spending.

the driving forces behind the reaction of net foreign demand. The corresponding impulse responses are presented in Figure 5.

A 1% of GDP rise in government expenditure brings about a deterioration of net exports in the EMU of 0.3% of GDP two quarters after the shock. Such fall of net exports is mainly explained by an upward reaction of imports of 0.21% in that quarter fuelled by higher final demand and the real appreciation. In turn, despite the real appreciation, exports show a positive reaction of 0.18%, though not significant. Likewise, as the increase in public spending leads simultaneously to a deterioration of the trade balance and a reduction of primary budget surpluses, our results are consistent with the "twin deficits" hypothesis. This finding is in line with Beetsma et al. (2008) for the EU or Ravn et al. (2007) and Monacelli and Perotti (2010) for the US.

The current account balance (which is the sum of the trade balance, the income balance and the transfers balance) follows the same pattern as the trade balance, deteriorating after an expansionary shock. As Figure 5 shows, a 1% of GDP increase of government spending leads to a peak deterioration of the current account balance of some 0.3% of GDP in the second quarter after the shock. The observed worsening of the external balance stems from the deterioration of the public saving, offset by the increase in private saving only in part, which turns out to be consistent with the rejection of the Ricardian hypothesis.

5.5 The effects of different expenditure components

Government consumption and government investment may be expected to have different effects on relative prices.[19] To assess their effects, we replaced government expenditure by public consumption and public investment in turn in our baseline VAR. Figure 6 shows the responses of the REER to shocks to different government spending items. As expected, an increase in government consumption entails a real appreciation as a result of higher relative demand for non-tradables in the Euro Area. While this is true for shocks to government's purchases of goods and services and to overall public consumption, expansions of government's personnel expenditure lead to non-significant,

[19] Ricci et al. (2008) and Lee et al. (2008) highlight the empirical role of government consumption as an important driver of medium-term real exchange rate movements for a large panel of countries.

though still negative, responses of the REER. These results are broadly in line with the findings in Froot and Rogoff (1991), De Gregorio et al. (1994) and Galstyan and Lane (2009b).

Public investment in the literature is deemed to have an ambiguous impact on the real exchange rate depending on how it affects the relative productivity of traded vs. non-traded goods. Thus, an increase in public investment that enhances productivity in the tradables sector may generate real appreciation through the Balassa-Samuelson mechanism, whereas if such productivity gains take place fundamentally in the non-tradables sector, it may actually lead to real depreciation caused by a decline in the relative price of non-tradables.

Figure 6 shows that the real exchange rate in the EMU appreciates significantly. Accordingly, public investment shocks in the Euro Area do not seem to have entailed a relative increase of the productivity in the non-traded goods sector. Rather, it seems that public investment may have contributed to generating productivity gains in traded goods. This result is consistent with the observed decline of the price of traded goods relative to non-traded goods. However, it contrasts with the findings in Galstyan and Lane (2009b), who detect no significant long-term impact on the real exchange rate for the EMU countries.

6 Framing the results in theoretical models

US data usually show that public spending increases lead to positive private consumption responses and real exchange rate depreciation. While finding models able to reconcile both facts can be a challenging endeavour[20] (as acknowledged by Monacelli and Perotti, 2010), our results so far can easily be accommodated to some theoretical frameworks. In principle, our results can fit well basic predictions by the conventional Mundell-Fleming model as well by some New Keynesian formulations.

[20] Ravn et al. (2007) find that the presence of deep habits is able to lead to a countercyclical reaction of equilibrium markups. Thus, an increase in government spending would entail a generalized decline of markups in domestic markets with respect to foreign markets, thereby making the domestic economy relatively inexpensive. Hence, the real exchange rate would depreciate.

Firstly, the positive responses of output, private consumption, prices and nominal and real interest rates, jointly with the observed nominal and real appreciation are consistent with the traditional Mundell-Fleming setting. The increase in public spending would spur economic activity and hence private consumption. Likewise, the resulting higher final demand would provoke an upward reaction of nominal and real interest rates, thereby triggering capital inflows and nominal (and real) appreciation.

Secondly, consistency with Balassa-Samuleson arguments is also found, as we observe both increases in relative home prices and in the relative price of non-traded with respect to traded goods. If government spending mostly concentrates on home-produced, mainly non-traded goods, fiscal expansions should make them relatively scarcer, thereby increasing their relative price with respect to imported goods and leading to real appreciation (Frenkel and Razin, 1996).

Thirdly, higher private consumption, coupled with countercyclical markups and real appreciation following an increase in public spending can be accommodated to theoretical predictions by a number of DSGE models wherein firms develop their activity in a monopolistic competition environment and in absence of complete markets. In particular, positive responses of private consumption, jointly with countercyclical markups are in accordance with the predictions in Galí et al. (2007). Moreover, the open economy version of this model in Erceg et al. (2005) also fits the observed real appreciation caused by government spending shocks well. Despite the observed aggregate increase of private consumption, fully Ricardian agents would consume less due to the negative wealth effect. As only forward-looking consumers would have access to complete international financial markets, lower consumption by this group of consumers would lead to real appreciation. Our impulse-responses are consistent with this channel.

Finally, in these alternative theoretical frameworks public expenditure expansions entail higher domestic demand, real appreciation, a fall of the trade balance and a reduction of the budgetary primary surplus. The empirical evidence provided in this paper is also in accordance with these predictions. Consequently, as far as government expenditure shocks are concerned, our results are consistent with the "twin deficits" hypothesis. In this regard, they are also in line with the evidence presented in

Beetsma et al. (2008) for the EU and in Ravn et al. (2007) or Monacelli and Perotti (2010) for the US.

7 Comparing the Euro Area with the US: are they different?

The most prominent empirical papers that analyze the effects of fiscal shocks on variables characterizing the external sector and focus on the US (Ravn et al.; 2007; Kim and Roubini, 2008; Corsetti et al., 2009; Monacelli and Perotti, 2010) show that government spending brings about exchange rate depreciation, in contrast with the evidence provided in the previous sections for the Euro Area. The question is why the real effective exchange rate behaves so differently in these two areas of a very similar size. In order to provide some explanation, we estimated similar SVAR models to those used for the Euro Area for the US.

Figure 7 shows that the responses of the main macroeconomic variables to a government spending shock. Despite some differences in terms of the shape of the responses and their timing, they are qualitatively similar to the Euro Area. Higher government spending brings about increases in GDP and private consumption in the first three quarters after the shock. Government expenditure also entails higher prices and interest rates, jointly with a deterioration of primary balances.

When comparing the responses in Figure 1 and 7 we observe that the real effective exchange rate does react differently in the two areas. While government spending shocks lead to a real appreciation in the Euro Area, the REER in the United States depreciates on impact and in the medium term, with the response being non-significant between the 2nd and 8th quarters after the shock. This finding is in line with Kim and Roubini (2008), Monacelli and Perotti (2010), Ravn et al. (2007) or Enders et al. (2011). In any case, it is surprising that the REER displays such a different behaviour between both areas.

Theoretical models can be found to fit any of both sets of results separately. On the one hand, the responses of GDP, consumption, interest rates and the REER in the Euro Area seem to fit well the basic predictions of the conventional Mundell-Fleming as

well of some New Keynesian formulations that incorporate rule-of-thumb consumers[21] and some degree of price stickiness (Erceg et al., 2005). On the other hand, while positive private consumption responses appear difficult to reconcile with real depreciation in the US (Monacelli and Perotti, 2010), Ravn et al. (2007) and Corsetti et al. (2009) propose promising alternative framework that are able to accommodate both stylised facts. In this paper though, the most challenging task is to explain why the real effective exchange rate behaves so differently in these two areas of a very similar size.

It appears very unconvincing that the transmission channels differ significantly between both areas. Figure 8 shows that the REER appreciates in response to both public consumption and public investment shocks in the US, contrary to what happens in the Euro Area (Figure 6). Therefore, the different reaction of real exchange rates seems difficult to attribute to dissimilar effects of public investment on the productivity of non-traded relative to traded goods. Actually, the depreciation of the REER in the US to public consumption shocks resembles largely the observed one following shocks to total government spending.

The alternative decompositions of the REER offer interesting information. Figure 9 reveals that the observed real depreciation stemming from higher expenditure in the US is entirely due to the depreciation of the NEER, whereas home relative prices rise (implying that the impact increase on local prices is more sizeable than on foreign prices).[22] Hence, the depreciation of the NEER in the US more than offsets the appreciation that would take place via relative prices.

The responses of the real exchange rate of traded and non-traded goods also differ between both areas. While non-traded goods appreciate in the US, traded goods show the opposite behaviour due to the depreciation of the nominal effective exchange rate (Figure 9). Accordingly, the overall depreciation of the real exchange rate is explained by the depreciation of tradables outweighing the appreciation of non-tradables. This different reaction contrasts with the Euro Area, where both the real

[21] See Galí et al. (2007).
[22] In none of both cases can the increase in home prices be taken as a good proxy for the increase in relative prices, given that both areas are fairly big and their shocks may have non-negligible effects on international prices.

exchange rates traded goods and the relative price of non-traded goods appreciate in response to a shock to government spending.

These results are consistent with the view that government spending mostly concentrates on home-produced goods, mainly non-tradables. Fiscal expansions contribute to making these goods relatively scarcer, thereby increasing their relative price with respect to imported goods, thereby tending to appreciate the real exchange rate of non-tradables regardless the area (Frenkel and Razin, 1996). The final effect on the real effective exchange rate is thus determined by the reaction of the nominal effective exchange rate.

But the main question remains open: why nominal effective exchange rates react to spending shocks so differently in both geographical areas? Amid other factors such as changes in economic prospects or the evolution of risk premia, short-term shifts in nominal effective exchange rates are deemed to be determined by the spreads between home and foreign short-term nominal interest rates, i.e. the uncovered interest parity. Thus, in order to understand the reaction of the NEER to government spending shocks, it seems crucial to assess how such shocks affect interest rate spreads.

As we aim to assess the effects on effective exchange rates vis-à-vis the rest of the world the relevant spreads should be gauged with respect to a "world" interest rate excluding the Euro Area or the US. Given that such variables do not exist we have calculated a proxy in each case. Thus, the relevant foreign short-term nominal interest rate for the Euro Area has been gauged as a weighted average of the short-term interest rates of the main OECD countries excluding the Euro Area.[23] For the US, the relevant foreign short-term interest rate is obtained in a similar way, replacing the US short-term rate by the Euro Area one. As in the case of prices of traded goods, we use the weights of trading partners, taken from Eurostat in the case of the EMU and US Census Bureau for the USA. (see Table 1).

In addition to the baseline variables, we include the relevant interest rate spreads in our VAR. Figure 10 seems to confirm our intuition. Short-term nominal interest rate spreads move in opposite directions to government spending shocks; higher government

[23] These countries are Australia, Canada Denmark, Japan, Korea, New Zealand, Norway, Sweden, Switzerland and the UK.

spending widens the spread in the case of the EMU, while narrows it in the US. Thus, according to the uncovered interest parity condition, the NEER should appreciate in the Euro Area and depreciate in the US, just exactly what VAR responses show.

The dissimilar reaction of short-term nominal interest rate spreads is probably determined by the leading role of the US dollar as a "safe haven" currency in slowdowns. Figure 11 compares our estimated structural government spending shocks from the baseline VAR with the change in the output gap in both areas.[24] Public spending in the US displays a broadly countercyclical behaviour; positive shocks tend to pervade with negative output gap changes. Given the leading role of the US in the world business cycle downturns would be accompanied by raising overall risk aversion. In this context, our results suggest that interest rate increases due to higher public spending in the US would call for even more elevated ones in the rest of the world.

By contrast, as there has not been a single currency until 1999, no such "safe haven" role can be attributed to the EMU as a whole during most of the time span covered by the dataset.[25] Until that date, the NEER is derived form a basket of currencies with different risk perceptions. Hence, interest rate movements were not matched by shifts of similar magnitude abroad. On the other hand, as of the introduction of the euro in 1999, the Stability and Growth pact has compelled a number of Member States to adopt pro-cyclical fiscal policies in the context of the crisis in the early 2000s, as opposed to what it is observed in the US. As Member States failed to consolidate sufficiently in good times, the 3% of GDP deficit threshold was breached in many cases. Thus, countries had to adopt consolidation programmes to restore fiscal positions.

8 Conclusions

This paper assesses the effects of public spending shocks on the exchange rate and the trade balance in the Euro Area. We base our analysis on impulse responses derived from SVARs identified according to the methodology sketched in Blanchard and Perotti

[24] The change in the output gap as opposed to its level to assess the fiscal policy stance is currently preferred both in the European Commission and the IMF.
[25] Even after the adoption of the euro, such safe heaven role cannot be advocated either as the current sovereign debt crisis shows.

(2002). For this purpose, we employ a new database that contains quarterly fiscal variables for the Euro Area as a whole.

Our analysis shows that government spending brings about positive output responses, with output multipliers somewhat below one. In turn, higher government spending leads to positive responses of private consumption, real exchange rate appreciation and a fall of net exports, coupled with lower primary surpluses. Hence, our results in this regard are fully consistent with the "twin deficits" hypothesis.

Likewise, government spending shocks in the Euro Area bring about a rise in home relative prices and in the relative prices of non-traded with respect to traded goods. Moreover, we find that public spending build-ups entail upward responses of labour costs that outweigh the increase in prices, thereby leading to a countercyclical reaction of markups, in line with a number of new-Keynesian theoretical models.

Expansion in all analysed components of public spending, namely wage and non-wage consumption expenditure, overall public consumption expenditure and public investment, bring about real appreciations. Our results are therefore also consistent both with the home-bias hypothesis of public expenditure and with public investment contributing to generating relative productivity gains in the traded goods sector.

Finally, the comparison with the US reveals a different pattern of response of the REER to government spending shocks in both geographical areas. The real exchange rate appreciation in the EMU contrasts with the depreciation observed in the US. This difference is explained by the reaction of the nominal effective exchange rate in each case, as the relative price of non-traded goods behaves in a similar way.

The reason for such an opposite behaviour is found in the reaction of nominal interest rate spreads. The short-term nominal interest rate spread following government spending shocks widens in the EMU while narrows it in the US. According to the uncovered interest parity condition, the NEER should appreciate in the Euro Area and depreciate in the US, just exactly what VAR responses show. The dissimilar reaction of short-term nominal interest rate spreads is attributed to the leading role of the US dollar as a "safe haven" currency, especially in slowdowns, jointly with its broadly countercyclical behaviour of public spending. Accordingly, interest rate increases in the

US due to higher public spending in troughs coupled with higher overall risk aversion, would lead to even more elevated foreign sovereign bond rates.

References

Afonso, A. and R. M. Sousa (2009a). *The macroeconomic effects of fiscal policy*. ECB Working Paper Series No. 991, January.

Afonso, A. and R. M. Sousa (2009b). *The macroeconomic effects of fiscal policy in Portugal: a Bayesian SVAR analysis*. School of Economics and Management, Working Papers Nº 09/2009/DE/UECE.

Baum, A. and G.B. Koester (2011). *The impact of fiscal policy on economic activity over the business cycle – evidence from a threshold VAR analysis*. Deutsche Bundesbank. Discussion Paper Series 1: Economic Studies No 3/2011.

Beetsma, R., M. Giuliodori and F. Klaassen (2008). The Effects of Public Spending Shocks on Trade Balances and Budget Deficits in the European Union. *Journal of the European Economic Association*, 6(2-3), pp. 414-423.

Bénassy-Quéré, A. and J. Cimadomo (2006). *Changing patterns of domestic and cross-border fiscal policy multipliers in Europe and the US*. CEPII WP #2006-24.

Bénétrix, A. S. and Lane, P.R. (2009a). The impact of fiscal shocks on the Irish economy. *The Economic and Social Review*, 40(4), pp. 407-434.

Bénétrix, A. S. and Lane, P.R. (2009b). *Fiscal shocks and the real exchange rate*. IIIS Discussion Paper No. 286, March.

Blanchard, O. J. and R. Perotti (2002). An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. *Quarterly Journal of Economics*, 117, pp. 1329-1368.

Bouakez, H., F. Chihi and M. Normandin (2010). *Measuring the effects of fiscal policy*. Centre Interuniversitaire sur le Risque, les Politiques Économiques et l'Emploi, Working Paper 10-16, May.

Bouthevillain, C., Cour-Thimann, P., van den Dool, G., Hernández de Cos, P., Langenus, G., Mohr, M., Momigliano, S., Tujula, M., 2001. *Cyclically adjusted budget balances: An alternative approach*. ECB Working Paper Series No. 77.

Burriel, P., F. de Castro, D. Garrote, E. Gordo, J. Paredes and J. J. Pérez (2010). Fiscal policy shocks in the euro area and the US: an empirical assessment. *Fiscal Studies* 31 (2), pp. 251-285.

Burstein, A., M. Eichenbaum and S. Rebelo (2005). Large Devaluations and the Real Exchange Rate. *Journal of Political Economy,* 113(4), pp. 742-784.

Corsetti, G., A. Meier and G. Müller (2009). *Fiscal Stimulus with Spending Reversals*, IMF Working Paper WP/097106.

de Castro, F. (2006). The macroeconomic effects of fiscal policy in Spain. *Applied Economics*, 38, pp. 913-924.

de Castro, F and P. Hernández de Cos (2008). The economic effects of fiscal policy: the case of Spain. *Journal of Macroeconomics*, 30, pp. 1005-1028.

de Castro, F and L. Fernández (2011). The Effects of Fiscal Shocks on the Exchange Rate in Spain. Banco de España Working Paper No. 1121.

De Gregorio, J., A. Giovannini and H. Wolf (1994). International Evidence on Tradables and Nontradables Inflation. *European Economic Review*, 38, pp. 1225-1244.

Edelberg, W., M. Eichenbaum, and J.D.M. Fisher (1999). Understanding the Effects of a Shock to Government Purchases. *Review of Economic Dynamics*, 2, pp. 166-206.

Enders, Z., G. Müller and A. Scholl (2011). How do Fiscal and Technology Shocks affect Real Exchange Rates? New Evidence for the United States. *Journal of International Economics* 83(1), pp. 53-69.

Erceg, C.J., L. Guerrieri and C. Gust (2005). Expansionary Fiscal Shocks and the US Trade Deficit. *International Finance*, 8 (3), pp 363–397.

Fatás, A. and I. Mihov (2001). *The effects of fiscal policy on consumption and employment: theory and evidence*. CEPR Discussion Paper Series No. 2760.

Fagan, G., J. Henry and R. Mestre (2005). An area-wide model (AWM) for the euro area. *Economic Modelling*, 22, pp. 39-59.

Frenkel, J.A. and A. Razin (1996). *Fiscal Policies and Growth in the World Economy*, Third Edition. MIT Press, Cambridge, MA.

Froot, K. and K. Rogoff (1991). The EMS, the EMU, and the Transition to a Common Currency. *NBER Macroeconomics Annual*, Vol. 6, pp. 269-317.

Galí, J., D. López-Salido and J. Vallés (2007). Understanding the effects of government spending on consumption. *Journal of the European Economic Association*, 5, pp. 227-270.

Galstyan, V. and P.R. Lane (2009a). Fiscal policy and international competitiveness: evidence for Ireland. *The Economic and Social Review*, 40(3), pp. 299–315.

Galstyan, V. and P.R. Lane (2009b). The Composition of Government Spending and the Real Exchange Rate. *Journal of Money Credit and Banking*, 41(6), pp. 1233–1249.

Giordano, R., S. Momigliano, S. Neri and R. Perotti (2007). The effects of fiscal policy in Italy: Evidence from a VAR model. *European Journal of Political Economy*, 23, pp. 707–733.

Giorno, C., P. Richardson, D. Roseveare and P. van den Noord (1995). *Potential output, output gaps and structural budget balances*. OECD Economic Studies 24.

Golinelli, R. and S. Momigliano (2009). The cyclical reaction of fiscal policies in the euro area: the role of modelling choices and data vintages. *Fiscal Studies*, 30, pp. 39-72.

Heppke-Falk, K.H., J. Tenhofen and G.B. Wolff (2006). *The macroeconomic effects of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis*. Deutsche Bundesbank. Discussion Paper Series 1: Economic Studies No 41/2006.

Kim, S., and N. Roubini (2008). Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the U.S. *Journal of International Economics*, 74(2), pp. 362–383.

Lane, P.R. and G. M. Milesi-Ferretti (2002). Long-Run determinants of the Irish real exchange rate. *Applied Economics*, 34(5), pp. 549-55.

Lee, J., G. M. Milesi-Ferretti, J. Ostry, A. Prati and L. Ricci (2008). *Exchange Rate Assessments: CGER Methodologies*. IMF Occasional Paper No. 261.

Leeper, E.M.. T.B. Walker and S.S. Yang (2008). *Fiscal foresight: analytics and econometrics*. NBER Working Paper Series No. 14028.

Marcellino, M. (2006). Some stylized facts on non-systematic fiscal policy in the euro area. *Journal of Macroeconomics*, 28, pp. 461-479.

Monacelli, T. and R. Perotti (2010). Fiscal Policy, the Real Exchange Rate and Traded Goods. *The Economic Journal,* 120, pp 437–461.

Mountford, A. and H. Uhlig (2009). *What are the effects of fiscal policy shocks? Journal of Applied Econometrics*, 24(6), pp 960-992.

Obstfeld, M. and K. Rogoff (1995). Exchange rate dynamics redux. *Journal of Political Economy*, 103, pp. 624–660.

Paredes, J., D. J. Pedregal and J. J. Pérez (2009). *A quarterly fiscal database for the euro area based on intra-annual fiscal indicators.* ECB Working Paper Series No 1132.

Perotti, R. (2004). *Estimating the effects of fiscal policy in OECD countries*. Proceedings, Federal Reserve Bank of San Francisco.

Perotti, R. (2007). *In search of the transmission mechanism of fiscal policy*. NBER Working Paper Series No. 15464.

Ramey, V. (2011). Identifying Government Spending Shocks: It's all in the Timing. *The Quarterly Journal of Economics*, 126(1), pp. 1-50. doi: 10.1093/qje/qjq008.

Ramey, V. and M.D. Shapiro (1998). Costly Capital Reallocation and the Effects of Government Spending. *Carnegie Rochester Conference Series on Public Policy* 48, pp. 145-194.

Ravn, M.O., S. Schmitt-Grohé and M. Uribe (2007). *Explaining the effects of government spending on consumption and the real exchange rate*. NBER Working Paper Series No. 13328.

Ricci, L., G. M. Milesi-Ferretti and J. Lee (2008). *Real Exchange Rates and Fundamentals: A Cross-Country Perspective*. IMF Working Paper No. 08/13.

van den Noord, P. (2000). *The size and role of automatic fiscal stabilizers in the 1990s and beyond*. OECD Working Paper No. 230.

Table 1. Bilateral and total trade share

	Euro area	US
Australia	0.8	0.6
Canada	1.3	18.3
Denmark	2.5	0.3
Euro area		14.0
Japan	5.2	12.7
Korea	1.4	0.0
New Zealand	0.2	0.2
Norway	1.8	0.4
Sweden	4.2	0.9
Switzerland	6.3	0.9
United Kingdom	18.5	3.6
United States	15.7	
Total trade share	57.6	51.7

Table 2. Cumulative output multipliers in EMU

	Quarters					
	1	4	8	12	16	20
Baseline model	0.85*	0.98*	0.87*	0.60	0.27	-0.04

Note: The asterisk indicates significance within one-standard deviation band-width.

Figure 1. Responses to an increase in government spending in EMU: Baseline VAR

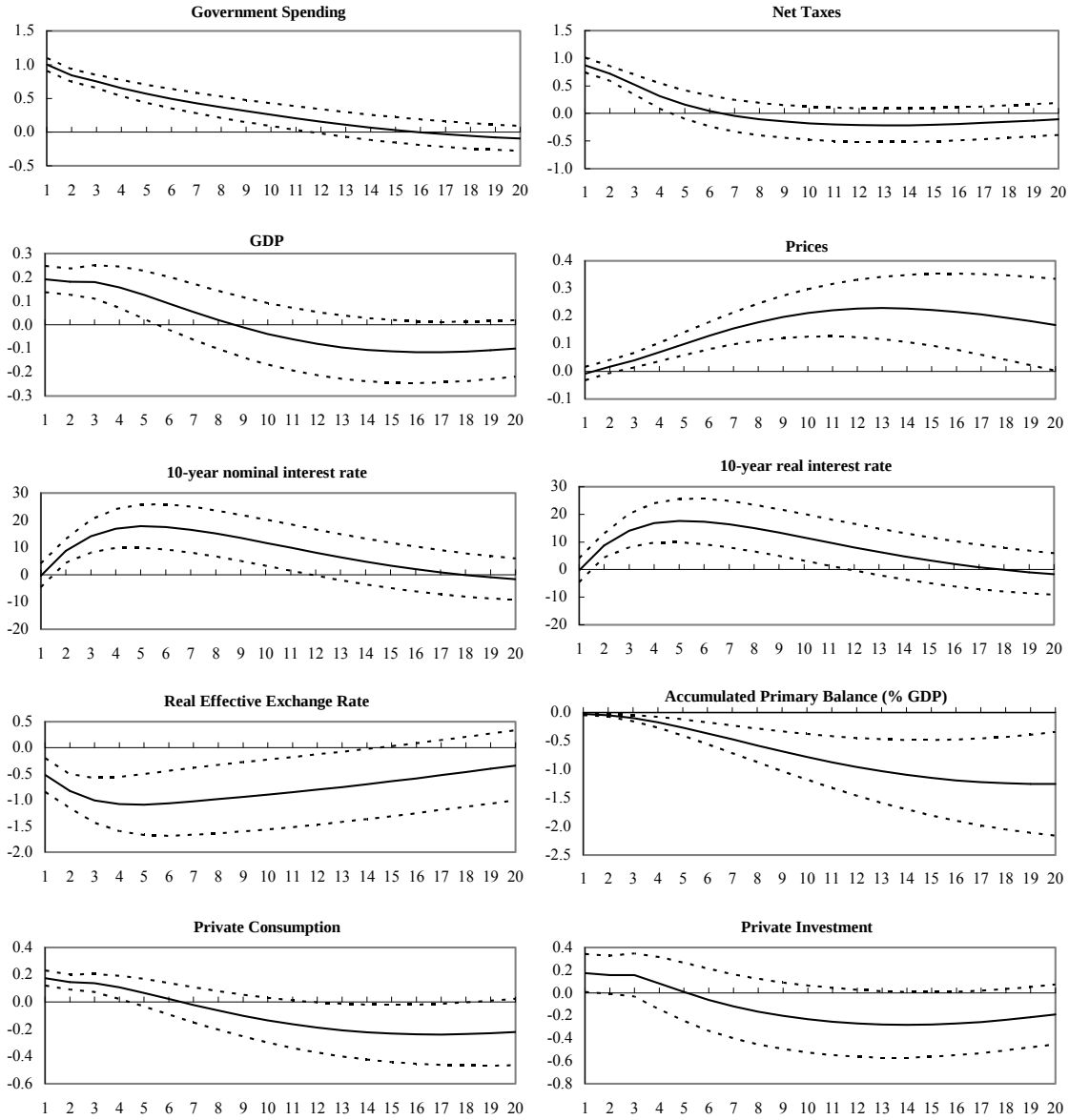

Figure 2. Responses to an increase in government spending in EMU: VAR with nominal effective exchange rates and relative prices

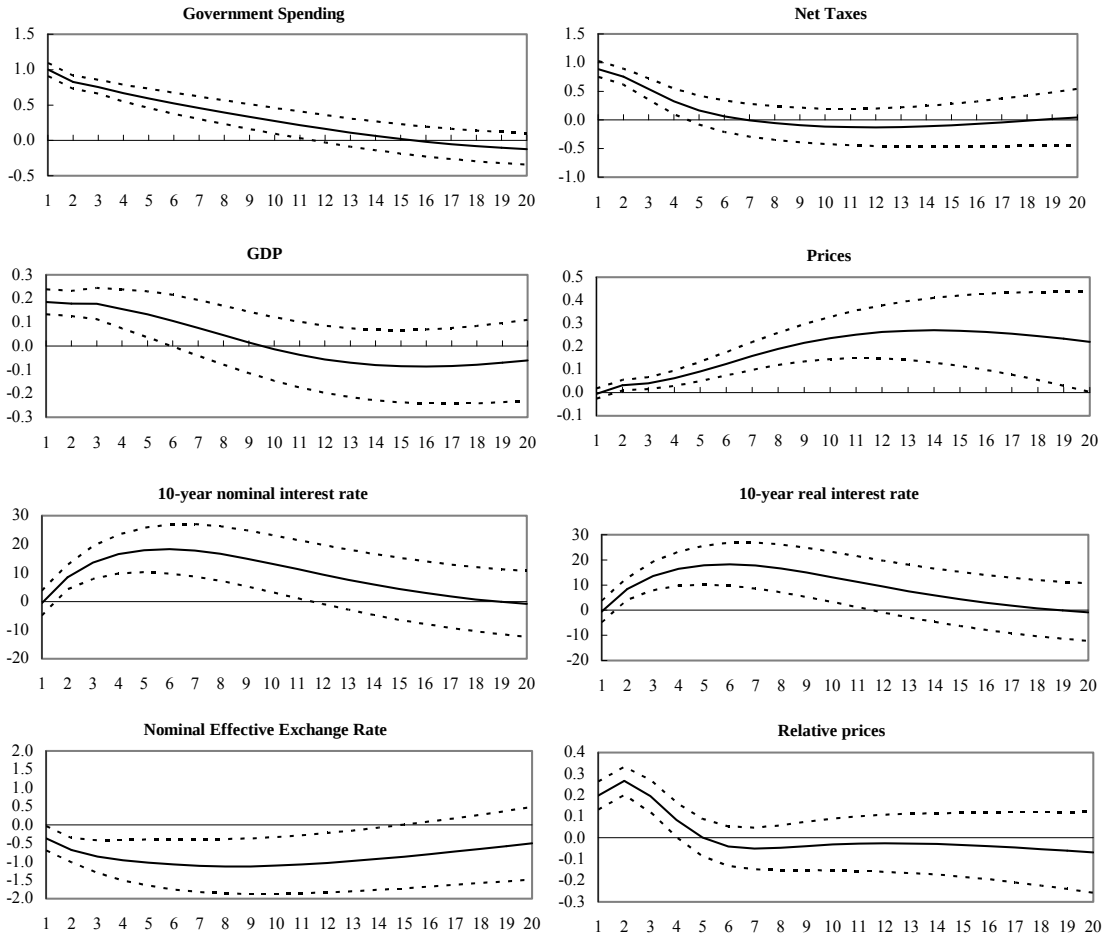

Figure 3. Responses of real exchange rates of traded and non-traded goods to a spending shock in EMU

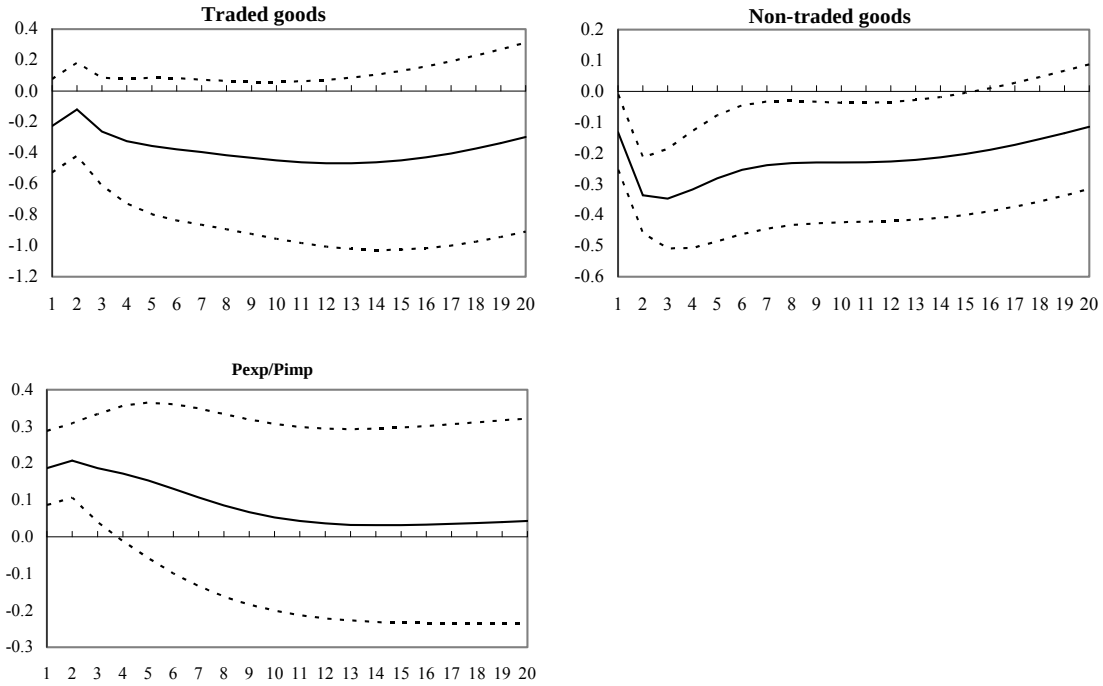

Figure 4. Effects of government spending on costs, productivity and markups in EMU

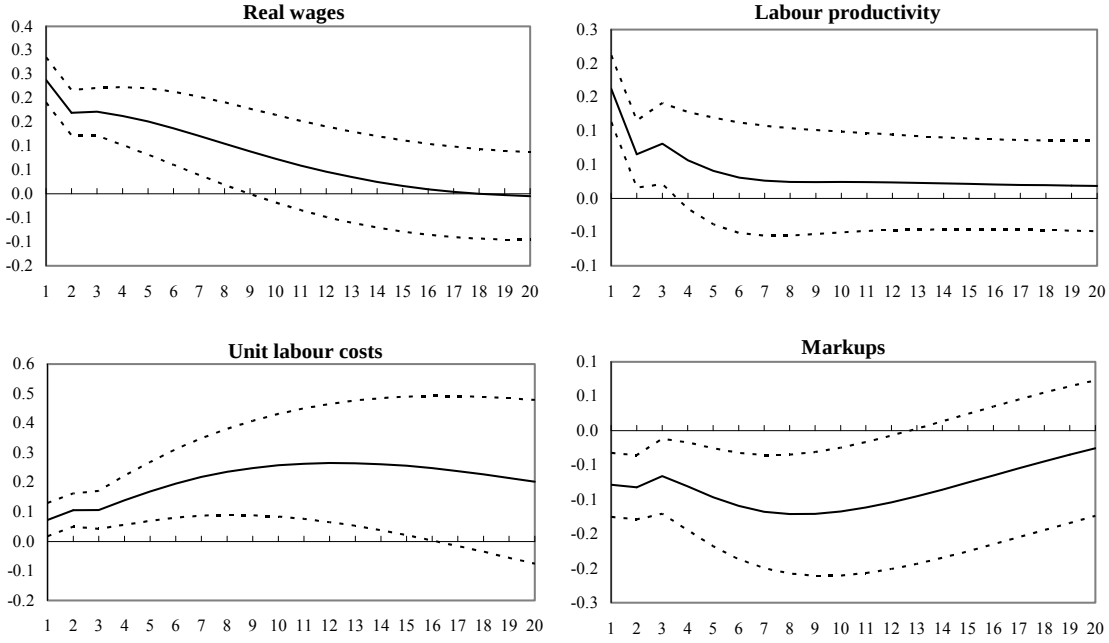

Figure 5. Effects of government spending on net exports in EMU

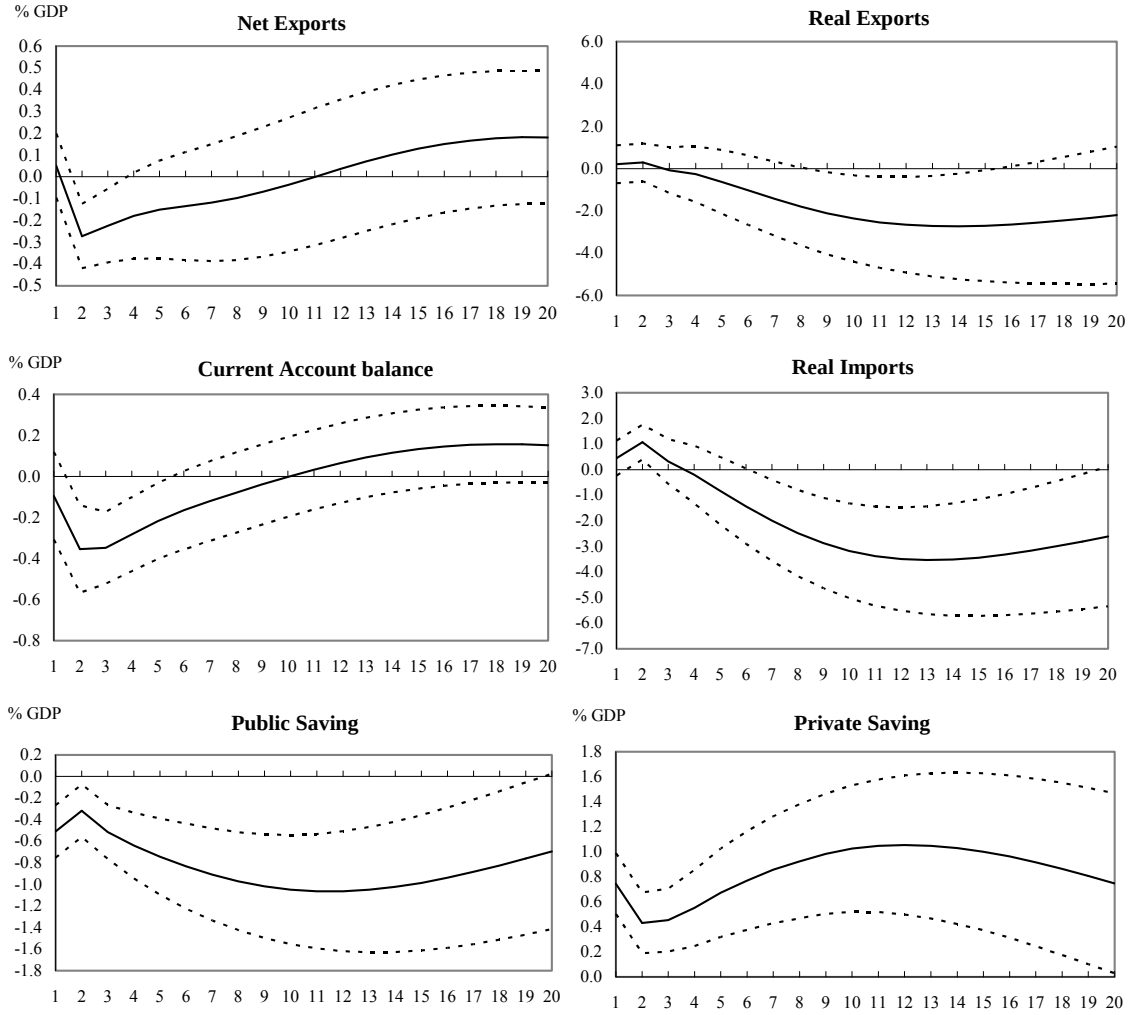

Figure 6. Responses of the real effective exchange rate to shocks to different government spending components in EMU

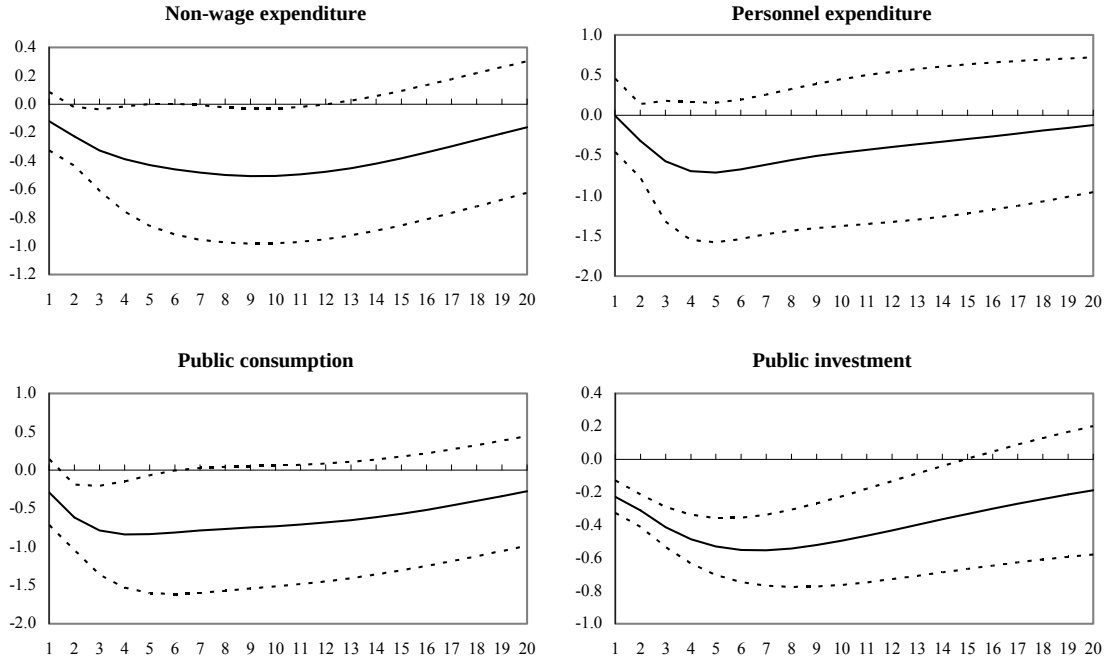

Figure 7. Responses to an increase in government spending in the US

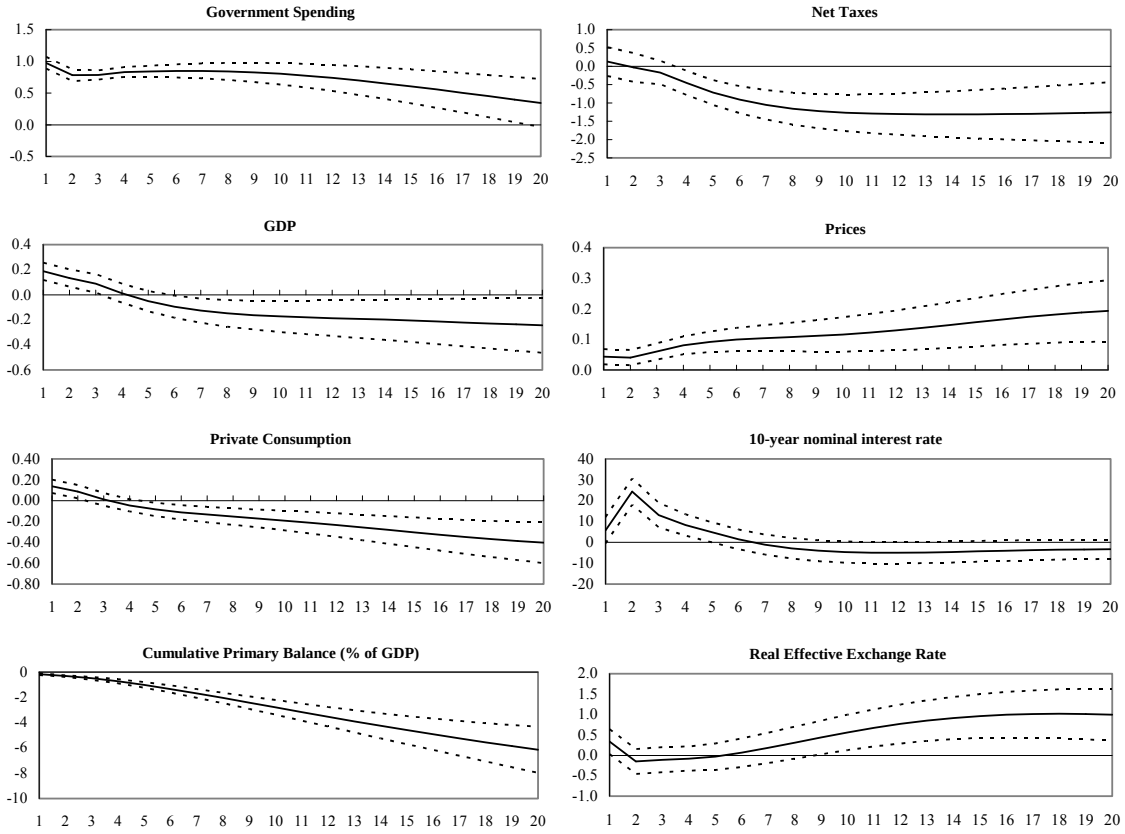

Figure 8. Responses of the REER to different government spending components in the US.

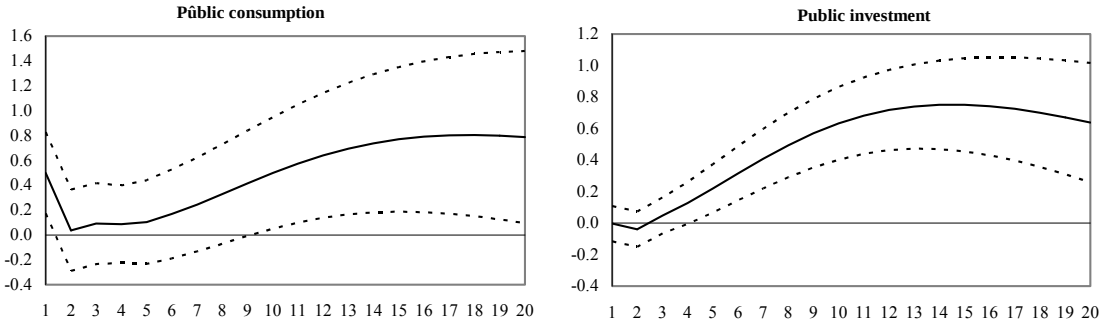

Figure 9. Decomposition of the REER in the US

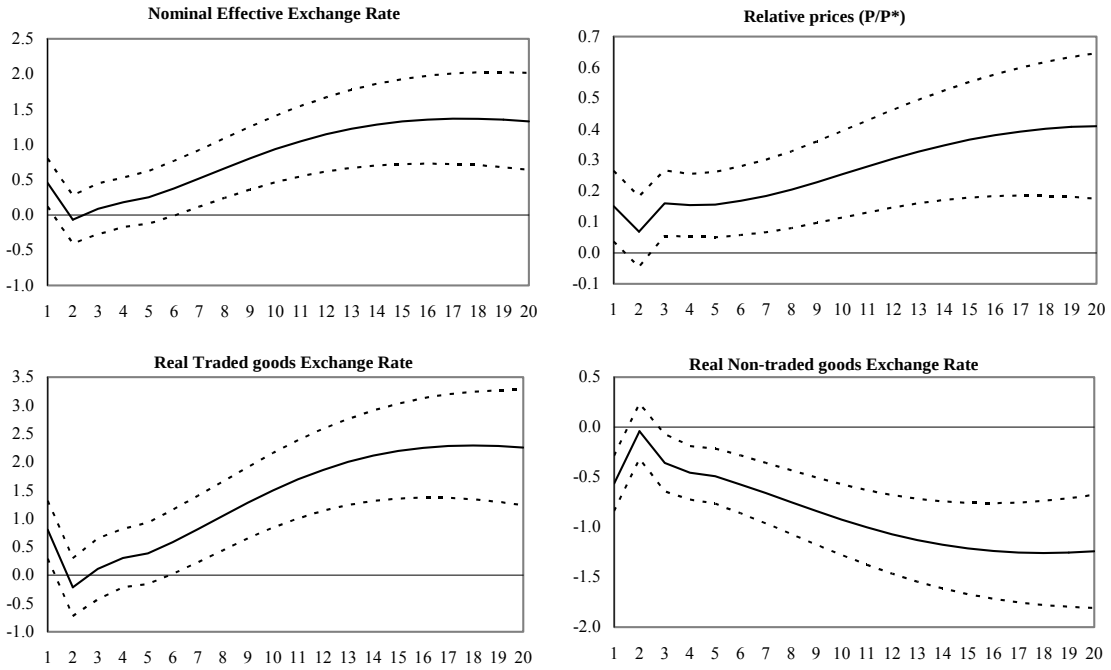

Figure 10. Effects of government spending on the short-term nominal interest rate spreads

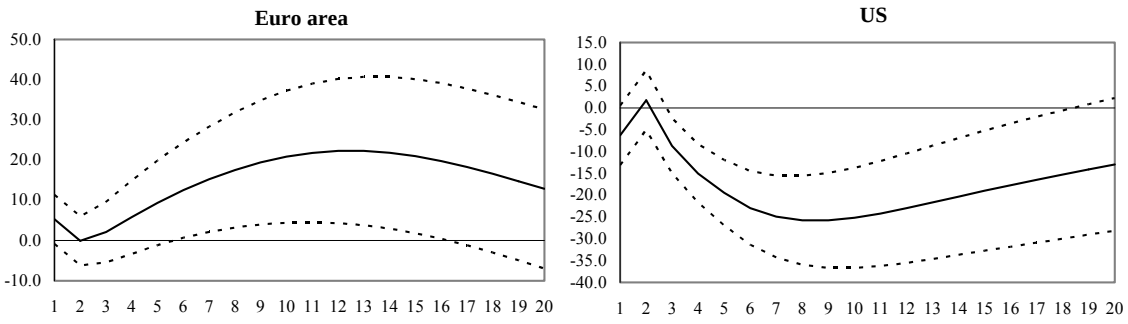

Figure 11. Fiscal stance and short-term interest rate spreads