Spillover of fiscal shocks in the euro area

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Abstract

This paper studies empirically the importance of spillovers in the transmission of fiscal shocks in the euro area and measures the internationally generated multipliers. In particular, the paper answers the following questions: (i) What is the international fiscal stance? (ii) What is the size of international multipliers relative to domestic ones? (iii) Are the effects of coordinated changes larger than the sum of effects induced by individual changes? (iv) Are fiscal contractions likely to have larger effects in the recent sample than in the past?

JEL classification: C11; C33; E62.
Key words: Bayesian Methods; Fiscal multipliers; Fiscal shock

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1 Introduction

The global financial crisis and the events that followed have put fiscal policy in the spotlight of academic and policy circles (see, inter alia, Canova and Pappa, 2011; Auerbach and Gorodnichenko, 2012; IMF, 2012; Mertens and Ravn 2012). The crisis has also shown how interconnected the world is, with shocks to one country or one economic area spreading rapidly across borders with sizeable international effects. Hence, there is a need for policy makers to better understand the impact of fiscal policy and the effects of coordinated policies in an international environment where public debt is high and the vulnerability to fiscal and financial crisis rapidly increasing. Furthermore, the renewed fiscal multiplier debate (e.g. IMF, 2012; Blanchard and Leigh, 2103; Mertens and Ravn 2012) indicates that a reassessment of the size of the fiscal multipliers in the current environment of continued consolidation needs amidst the sovereign debt crisis in the euro area is needed. The fiscal position of many countries, in fact, has deteriorated sharply since the onset of the financial crisis. The crisis triggered the introduction of fiscal stimulus packages that added to deficits at a time when automatic fiscal stabilizers were already exerting pressure on fiscal positions. In some notable cases, the situation was compounded by the high levels of debt existing before the crisis, which were themselves a drag on fiscal balances as they needed considerable interest payments.

Against this background, this paper empirically studies questions concerning the transmission of fiscal shocks in the euro area and measures the multipliers that are generated. In particular, the paper addresses a number of questions which are key to understand the medium term consequences of the current expenditure cuts. What are the domestic effects of fiscal shocks designed to improve the deficit position of country? Is it possible that these contractions generate virtuous output effects? What is the medium-long run effects on the debt and long term interest rates? What kind of cross-country spillover should we see and how large are international output multipliers? What are the channels of transmission? Are the effects of coordinated expenditure

contractions larger than the sum of effects induced by contractions designed in each individual country? What if expenditure cuts are combined with tax increases? Are there differences now relative to, say, what happened before the crisis?

To answer these questions, the paper uses a semi-structural empirical model where real, trade, financial and fiscal variables are jointly considered for a set of periphery (Greece, Italy, Spain and Portugal) and core (Germany, France and Netherlands) countries in the euro area. A panel VAR model of the type developed in Canova and Ciccarelli (2009) is used to study the domestic and international interdependences and the output effects of fiscal shocks individually or simultaneously generated in the periphery. The panel VAR methodology has a number of advantages over competitors (e.g. Factor models, GVARs, spatial models), and is particularly suited for our purposes because it allows us to construct indicators of the fiscal stance – both at Euro area and at country level – and to examine their evolution over time in an integrated framework that takes into account macroeconomic, monetary policy and financial linkages across countries. The scope of the paper is descriptive: we wish to contribute to the ongoing debate on fiscal policy with new evidence, whose expected (and desired) impact is high on the agenda of international policy discussions.

The main findings of the paper can be summarized as follows. Contractionary expenditure shocks in the periphery of the Euro have quite heterogeneous domestic effects. For example, the output effects could be negative, insignificant or positive in the short run and the key to understand the sign of the effect is the dynamics of the trade balance that these shocks generate. The short term effect on total debt and long term interest rates are not sizeable, suggesting that the signalling effects that contractionary expenditure measures generate in financial markets are quite limited. The spillover effects are also quite heterogenous and depend very much both on the (periphery) country where the expenditure contraction is designed and on the (core) country whose response is considered. In general, while trade effects are important, capital movements appear to be limited and the effects on sovereign spreads at time perverse. On average, a contractionary expenditure shock

in the periphery has similar domestic and international output effects before 2007, suggesting that the international repercussions of fiscal changes where important also before the crisis. Furthermore, a simultaneous effort in the periphery to improve the fiscal balance results in output effects in the core which are not much larger than the largest output effect originated by a contractionary shocks in a peripheral country. Finally, as expected, the magnitude of the spillovers changes after 2007 but, perhaps surprisingly, the virtuous effects of contractionary expenditure shocks tend to disappear, dragging all countries in the area in the same recessionary spiral.

The rest of paper is organized as follows. The next section describes the empirical model and section 3 the data. Section 4 presents the results, section 5 concludes and discusses policy implications.

2 The empirical model

To examine the questions of interest we employ the following model:

$$y_{it} = D_i(L)Y_{t-1} + F_i(L)W_{it-1} + e_{it} \tag{1}$$

where $i = 1, ..., N$ stands for countries, $t = 1, ..., T$ for time, and L is the lag operator; y_{it} is a $G \times 1$ vector for each i and $Y_t = (y'_{1t}, \dots y'_{Nt})'$; $D_{i,j}$ are $G \times NG$ matrices for each lag $j = 1, \dots, p$, $F_{i,j}$ are $G \times M$ matrices each lag $j = 1, \dots, q$; W_{it} is a $M \times 1$ vector of predetermined variables, $e_{it} \sim N(0, \Sigma_i)$ is a $G \times 1$ vector of disturbances. Since the variables we use are all demeaned and standardized, no deterministic variables are included in (1).

Models of this type have been extensively used in literature to address a variety of issues of interest to applied macroeconomists and policymakers (see e.g. Canova et al., 2007, and Canova and Ciccarelli, 2012, among others). Two important features make the model particularly suited for our study. First, the dynamic relationships and the variance of the error term are allowed to be unit specific. This feature is necessary since the units we are considering are likely to be heterogeneous in a number of dimensions. Since no constant is present, our model allows for heterogeneities

in the dynamics in response to shocks and in the volatility of the shocks. Without these features, heterogeneity biases of the type discussed in Pesaran and Smith (1996), may distort economic inference. Second, whenever the $NG \times NG$ matrix $D(L) = [D_1(L), \ldots, D_N(L)]'$, is not block diagonal for some L, cross-unit lagged interdependencies matter. Thus, dynamic feedback across countries are possible and this greatly expands the type of interactions our empirical model can account for. Both features add realism to the model and avoid important specification errors (see Canova and Ciccarelli, 2013, for a discussion), but greatly increase the number of parameters to be estimated. To see this rewrite (1) in regression format as:

$$Y_t = Z_t\delta + E_t \qquad E_t \sim N(0, \Omega) \tag{2}$$

where $Z_t = I_{NG} \otimes X_t'$; $X_t' = (Y_{t-1}', Y_{t-2}', \ldots, Y_{t-p}', W_{t-1}', \ldots, W_{t-q}')$, $\delta = (\delta_1', \ldots, \delta_N')'$ and δ_i are $Gk \times 1$ vectors containing, stacked, the G rows of the matrix D_i and F_i, while Y_t and E_t are $NG \times 1$ vectors of endogenous variables and of random disturbances, $k = NGp + Mq$ and Ω is, in general, a full matrix. For example, in a model with 10 countries, 5 variables, 2 lags and no predetermined variables, δ is 5000×1 vector and Ω has $(NG \times (NG-1))/2 = 1125$ free parameters. Thus, the sheer dimensionality of the problem prevents any meaningful unconstrained estimation of the model.

For this reason we assume that the vector δ is a function of a lower dimensional vector θ, and rather than estimating δ we estimate its vector of determinants. Let

$$\delta = \Xi\theta + u \qquad\qquad u \sim N(0, \Omega \otimes V) \tag{3}$$

where Ξ is a matrix of zeros and ones, $dim(\theta) << dim(\delta)$, and u is a vector of disturbances capturing unmodelled features in the coefficient vector δ. As suggested by Del Negro and Schorfheide (2010), (3) can be interpreted as a shrinkage prior, much in the same spirit as the standard Litterman prior imposed on VARs. The main difference is that while the Litterman prior is designed for forecasting purposes, our prior is instead designed to capture the panel nature of the available data. For those who prefer a classical approach, factoring δ as in (3) is advantageous since it

reduces the problem of estimating NGk coefficients to the one of estimating a reduced number of factors characterizing their dynamics. In fact, substituting (3) into (2) one obtains

$$Y_t = \sum_{j=1}^{r} \mathcal{Z}_{jt}\theta_j + v_t \tag{4}$$

where $\mathcal{Z}_{jt} = Z_t\Xi_j$ and $v_t = E_t + Z_t u_t$. Thus, the factorization (3) transforms an overparametrized panel VAR into a parsimonious SUR model, where the regressors are averages of certain right-hand side VAR variables. Notice also that this is different from the strategy used in global VARs, where a factor capturing international spillovers it tagged on to country specific VARs, since the latter implies proportionality restrictions on the spillovers across all countries (see Canova and Ciccarelli, 2013), while (4) simply reparametrize the original panel VAR model so as to make it estimable.

It should be clear that our reparametrization strategy is also preferable to the one used with a collection of VARs or with bilateral VARs. On the one hand, the random pooling of cross sectional information in (3) helps to get more accurate estimates of the parameters and to reduce standard errors. On the other hand, if the momentum that the shocks induce across units is the result of a complicated structure of lagged interdependencies, it would instead emerge as "common shocks" in the two alternative frameworks.

In the specification, we use $\Xi\theta = \Xi_1\theta_1 + \Xi_2\theta_2 + \Xi_3\theta_3 + \Xi_4\theta_4$ where Ξ_j are loading matrices of dimensions $NGk \times N$, $NGk \times G$, $NGk \times M$, $NGk \times p$ respectively; θ_j are mutually orthogonal factors capturing, respectively, movements in the coefficient vector which are country-specific; movements which are variable-specific; movements which are specific to predetermined variables, movements which are specific to the lags. Since predetermined variables are intended to capture movements that affect all variables of the system, θ_3 can be interpreted also as a global factor.

The model we consider has time invariant parameters and the VAR errors have fixed volatilities. Since most the recent literature has instead estimated models where

both the coefficients and the volatilities are time varying (see e.g. Faccini et al. 2012, Benati and Lubik 2013), a few words of explanations for our choices are needed. First, as it is clear from (4), the estimated model does have an error term which is heteroskedastic, but time variations in the covariance matrix of the v_t are produced by the lags of the endogenous variables rather than an independent process. Second, while it is common to specify a parametric law of motion for the evolution of the VAR coefficients, we will take a non parametric approach. That is, to examine the extent of time variations, we will estimate the model on a fixed window of data and roll through the sample. This procedure is very much akin to the one employed by Canova (2009) to estimate time variations in DSGE models and this allows direct comparison of the results of the two approaches. A non-parametric approach to time variations is preferable because estimation of the model is, computationally, much less demanding. In addition, by changing the window size, we can assess how important are slow vs. fast moving time variations in the transmission of fiscal shocks.

2.1 Estimation

It is quite easy to estimate a model like (4). If we stack the t observations in a vector the model is

$$Y = \sum_{j=1}^{4} \mathcal{Z}_j \theta_j + v \tag{5}$$

which is a standard SUR model. If the factorization in (3) were exact, the error term would be uncorrelated with the regressors and classical OLS could be used to estimate the vector θ and thus the vector δ using (3). Consistency of the estimates would be ensured as T grows. When the factorization in (3) allows for an error, v_t has a particular heteroskedastic covariance matrix which needs to be taken into account in the estimation.

Our approach to estimation is Bayesian, primarily because the sample size is small and we are interested in the exact small sample (rather than asymptotic) distribution of θ_j. To simplify the computations we assume $V = \sigma^2 I$, which make sense given the

fact the variables of the model have similar units. This implies that the error term of the model $v_t \sim N(0, \sigma_t \Omega)$, where $\sigma_t = (I + \sigma^2 X_t' X_t)$. Thus, the unknowns of the model are the vector of factors θ, their scale matrix σ^2, and the covariance matrix of the VAR shocks Ω.

We assume an independent prior for the three blocks and assume a semi-conjugate structure of the form

$$\begin{aligned} \theta &\sim N(\theta_0, R_0) \\ \Omega^{-1} &\sim W(NG, Q_0) \\ \sigma^{-2} &\sim G(0.5, 0.5 s^2), \end{aligned} \tag{6}$$

where the hyperparameters $(\theta_0, R_0, Q_0, s^2)$ are treated as fixed quantities, W stands for Wishart distribution and G for Gamma distribution. We estimate θ_0, R_0 using averages of cross sectional data; Q_0 is estimated using the residuals of the country specific models, while s^2 is obtained using the average of variance of the residuals of $AR(p)$ regressions of the NG endogenous variables.

To obtain the posterior distribution for $\phi = (\theta, \Omega^{-1}, \sigma^{-2})$ we combine the prior with the likelihood of the data, which is proportional to

$$L \propto \left(\prod_t |\sigma_t \Omega|^{-1/2} \right) \exp \left[-\frac{1}{2} \sum_t \left(Y_t - \mathcal{Z}_t \theta \right)' \left(\sigma_t \Omega \right)^{-1} \left(Y_t - \mathcal{Z}_t \theta \right) \right]. \tag{7}$$

Let $Y^T = (Y_1, ..., Y_T)$ denote the available sample. Using Bayes rule, we have $p\left(\phi \mid Y^T\right) = \frac{p(\phi) L\left(Y^T \mid \phi\right)}{p(Y^T)} \propto p(\phi) L\left(Y^T \mid \phi\right)$ and the posterior distribution for the elements of ϕ, can be obtained by integrating out the remaining elements from $p\left(\phi \mid Y^T\right)$. Once these distributions are found, location and dispersion measures can be easily obtained.

For the model we use, the analytical computation of $p\left(\phi \mid Y^T\right)$ is impossible, because $p\left(Y^T\right)$ requires integration of the joint distribution of (ϕ, Y^T) with respect to ϕ. To draw sequences from the posterior without any need to compute them we use the Gibbs sampling. Each Gibbs sampling cycle requires $p\left(\theta | \Omega^{-1}, \sigma^{-2}, Y^T\right)$, $p\left(\Omega^{-1} | \theta, \sigma^{-2}, Y^T\right)$,

$p\left(\sigma^{-2}|\Omega^{-1},\theta,Y^T\right)$, the conditional posterior of each block of unknowns. Given the prior, the first two are very easy to obtain. In fact, it can be shown that

$$\begin{aligned} p\left(\theta|\Omega^{-1},\sigma^{-2},Y^T\right) &\sim N\left(\theta_1,R_1\right) \\ p\left(\Omega^{-1}|\theta,\sigma^{-2},Y^T\right) &\sim W\left(\omega_1,Q_1\right) \end{aligned} \tag{8}$$

where

$$\begin{aligned} R_1 &= (R_0^{-1}+\sum_t \mathcal{Z}_t(\sigma_t\Omega)^{-1}\mathcal{Z}_t) \\ \theta_1 &= R_1^{-1}(R_0^{-1}\theta_0+\sum_t \mathcal{Z}_t(\sigma_t\Omega)^{-1}Y_t) \\ \omega_1 &= NG+T \\ Q_1 &= (\sum_t (Y_t-\sum_j \mathcal{Z}_{jt}\theta_{jt})(\sigma_t)^{-1}(Y_t-\sum_j \mathcal{Z}_{jt}\theta_{jt})')+Q_0 \end{aligned}$$

As it is clear from (7), the conditional posterior for σ^{-2} does not have a standard format because of the Jacobian term $|\sigma_t\Omega|$. Thus, to compute this conditional posterior we use a Metropolis step where candidate draws are obtained from $\sigma^{2\dagger}=\sigma^{2i-1}+\nu$, where σ^{2i-1} is the previous draw and ν is distributed as a normal with mean zero and variance λ. The value of λ is selected to have an acceptance rate of the order of 25-35 percent.

Since our system satisfies the regularity conditions set up in Geweke (2000), cycling through the conditional distributions in (8) produces in the limit draws from the joint posterior of these unknowns. From these, the marginal distributions of θ can be computed averaging over draws in the nuisance dimensions. Convergence to the invariant distribution is checked with standard methods. The results we present are based on the last draw of 500 chains of length 5000 all starting in a small random interval of the last draw of a single (burn-in) chain of 50000 draws.

We summarize the posterior information contained in our sample using impulse responses and multipliers. Given our model structure, impulse responses are computed as the difference between two conditional forecasts, one where an orthogonal

shock is set to one in period t and zero otherwise and another where the shock is zero at all t. Formally, let $\mathcal{F}_t^j$ be a conditioning set containing the initial conditions Y^T, draws from the posterior of ϕ, and a value of $\epsilon_j = Hu$, $j = 1, 2, ...$the structural shock of interest. Then, the impulse responses are

$$IR_y^j(t, \tau) = E(y_{t+\tau}|\mathcal{F}_t^1) - E(y_{t+\tau}|\mathcal{F}_t^2) \qquad \tau = 1, 2, \ldots \tag{9}$$

In this version of the paper, contractionary expenditure shocks are identified using a block recursive restrictions, where government expenditure is assumed to be predetermined relative to the other domestic variables. While such an assumption maybe controversial, in our setting – where the variables are measured in year-on-year growth rates, demeaned and standardized – it is less of a problem since the covariance matrix of the reduced form shocks is nearly diagonal.

Multipliers are computed as in Auerbach and Gorodnichenko (2012): the short run ones are obtained dividing the sum of the output responses by the sum of expenditure responses for horizon zero and 1 (so that they measure the average over two quarters); the long run ones are obtained summing up the responses of output and dividing by the sum of the government expenditure responses over twelve quarters, form horizon zero to horizon 11.

2.2 An indicator of the fiscal stance

The reparametrization that (4) produces is useful to decompose the dynamics of the endogenous variables into its components. In fact, the factor structure we assume for δ conveniently allows us to measure, for example, the relative importance of common, unit, or variable specific influences for fluctuations in Y_t. For example, $CLI_t = \mathcal{Z}_{1t}\theta_1$ plays the role of an (vector) of $N \times 1$ of unit specific indicators, while $CLI_t = \mathcal{Z}_{2t}\theta_2$ plays the role of a $G \times 1$ vector of variable specific indicators. Since we are interested in extracting the components which have to do with the stance of fiscal conditions in regions and countries, we will construct a regional fiscal stance indicator as $RFI_{jt} = \sum_{i=1}^{N} \mathcal{Z}_{1it}\theta_{1i} + \mathcal{Z}_{2jt}\theta_{2j}$, where $\mathcal{Z}_{2jt}\theta_{2j}$ is the deficit or the Debt indicators, and track its

behavior over time. Similarly, an indicator of the national fiscal stance in country i can be constructed as $NFI_{jit} = \mathcal{Z}_{1it}\theta_{1i} + \mathcal{Z}_{2jt}\theta_{2j}$. When these indicators are positive, the stance will be loose, while when they are negative the stance is tight. Note that in both cases we net out the effects due to exogenous variables. Thus, the measures integrate out effects due to global business cycles to focus only on regional and national specific fluctuations.

3 The data

In our exercises we restrict attention to 7 countries in the Euro area, which cover about 87 percent of the area wide GDP (and trade). Four are from the "periphery" (Greece, Italy, Spain and Portugal) and three from the "core" (France, Germany and the Netherlands). For each country there are eight endogenous variables: real government consumption expenditure, total government revenues, total gross government debt, real gross domestic product, real total private consumption, real total fixed investment, the capital accounts, and an interest rate on 10 years government securities. The predetermined variables, common to all countries, are: the US treasury bill rate, the US gross domestic product, the US consumer price index, the Euro area short term interest rate, the Euro area gross domestic product, and the Euro area consumer price index. Thus, these variables should capture real, monetary and price effects in the US and the EU which are responsible for the common movements present in the domestic variables of the seven countries. All the data comes from Datastream, except for the capital account series, which are from the IMF, and private and government consumption, fixed investments in Portugal which come from the OECD database. The sample goes from 1990:1 to 2011:4.

We use standardized, demeaned year-on-year growth rates of these variables. We need to standardize the variables to make sure that our equal weighting scheme implicit in the choice of Ξ makes sense. We take year-on-year growth rates since some series display important seasonal patterns despite being officially deseasonalized. Fur-

thermore, since there are strong trends in the debt series, we eliminate a linear trend from the year-on-year growth rate of the debt series prior to standardizing it. Interest rates are in year-on-year changes.

Before we present the results, a few comments on the choice of variables are in order. First, since we are using government consumption expenditure and total revenues, the deficit series we construct is not comparable with the deficit series typically reported in the literature and the press and has also not much to do with the concept of primary deficit. However, it can be considered an upper bound for the measure of fiscal stance, since when a deficit is recorded total revenues are not even sufficient to cover current consumption expenditures leaving the burden due to transfers, expenditure for investments and other items to debt financing. Similarly, the dynamics of the debt measure we use need not to correspond to the dynamics of the deficit measure we construct because of the above mentioned discrepancy and because the debt has different maturities and the rollover occurs at different times.

4 The results

The presentation of the results is organized around six main themes. First, we present indicators of the fiscal stance we construct; we report both aggregate and country specific measures. Second, we discuss how expenditure growth shocks domestically spread in the peripheral Euro area countries. Third, we compute the domestic and international output growth multipliers in the short and in the medium run. Fourth, we discuss the channel of international transmission. Fifth, we examine the differences obtained when the contractionary expenditure growth shock is coordinated across the periphery. Finally, we compare the dynamics that contractionary expenditure growth shocks generate before and after the recent crisis.

4.1 Indicators of the fiscal stance

To start with, we examine the dynamics of our indicators measuring the health of the fiscal stance in the area. We present two types of indicators, one which reflects the debt situation of the countries we consider and one which reflects the deficit situation. Figure 1 reports the time series behavior for the aggregate indicators; figures 2 and 3 report the time series for the country specific indicators.

The dynamics displayed in figure 1 agree with the conventional wisdom. For example, debt control was loose (the indicator is above the zero line) at the beginning of the sample and efforts were made to tighten debt control before the Maastricht Treaty was implemented in 1993. The process was reversed in the middle of the 1990s and a period of very loose debt control followed. Since 1996 there has been a persistent attempt to decrease the debt level in the area. This has resulted in a tight debt stance which lasted until 2002. Since then, the debt started increasing again and the indicator turned loose in the middle of the 2000's. Since 2008 the indicator rapidly moved from tight to loose and reached a level which was higher than the one experienced in the mid-1990s. In the last two years, the rapid increase was reversed but, at the end of the sample, the level of debt is still considerably above the historical average.

The indicator based on the deficit also shows dynamics which agree with the conventional wisdom. It was positive in the early 1990s, when almost all countries run a deficit; it turned negative before the creation of the Euro, and again positive in the early 2000s. From 2003 to 2008 the deficit declined persistently, primarily because of the large increase in revenues experienced in many of the countries under consideration, and turned massively positive in 2009 and 2010. In these two years, the demeaned standardized growth rate of current government expenditure (excluding transfers and excluding expenditures for investment purposes) exceeded the demeaned standardized growth rate of total revenues by 2.5 percentage points, a number which is unprecedented in the sample. Given that the variables are standardized, the prob-

ability that this occurs, given the historical sample, is less than one percent. In the last two years of the sample, because of the large cut in expenditures, the indicator turned negative, with 1.7 points below its average level of the period. This is a large adjustment and nothing similar has been observed over the sample. In fact, the probability of observing such a change is less than 10 percent. In comparison, the adjustments performed prior to the Euro changeover where roughly one-third in size.

The national indicators display patterns which are qualitatively similar to the aggregate indicators and only level differences are observed. This is because the estimated country specific component is small relative to the estimated variable specific component and the dynamics of the latter tend to dominate. Interestingly, the deficit stance in Germany appears to be looser than the one of several other countries. In fact, the indicator is on the positive side much more often than on the negative side. While this is primarily due to the fact that revenues fluctuate much less in Germany than in other countries, making swings in the deficit measure smaller than elsewhere, it is interesting to notice that the country that most supports fiscal conservativism seems to apply it domestically in a somewhat relaxed way.

4.2 The domestic response to contractionary expenditure shocks in the periphery

Figures 4 to 7 report the responses of (the level of) government consumption expenditure, total debt, real GDP, real consumption, real investment, the capital account balance, the long term interest rate and net export to a one percent decline in the standardized growth rate of government consumption expenditure for horizons up to 4 years in the pre-crisis sample (1990-2007).

Overall, the cross-country heterogeneities in the responses are pervasive. For example, contractions of government expenditure may have temporary recessionary output effects (Greece), persistent recessionary output effects (Portugal), insignificant output effects (Spain) or temporary expansionary output effects (Italy). The medium term effects (4 years) also appear to be heterogeneous, with Italy, Spain and Portugal

output responses being significantly below the initial steady state, while Greek output response is insignificant. There are two reasons for these heterogeneities. First, the reduction in government expenditure growth is very temporary in Greece but more persistent in the other three countries. Second, while the dynamics of consumption and investment are very much country specific (consumption declines and investment increases in Greece; they both decline in Italy; consumption temporarily increases and investment is insignificant in Portugal; consumption responses are insignificant, but investment increases in Spain), net export strongly increases in Italy, Spain and Portugal, because of the large fall in imports and the moderate increase in export. Thus, the output effect largely depends on the magnitude of the net export change: if it large enough, like in Italy, output increases, if it is not, the output response is insignificant or decreases. Hence, if the cut in government consumption growth is accompanied by a larger reduction in imports growth, presumably because both less imports are consumed by the government and domestic consumers switch from foreign to domestically produced goods, the cut in consumption expenditure growth may have temporarily virtuous output effects on the economy. Notice that, in general, a shock is on average absorbed within 6-8 quarters and the virtuous cycle, if generated, is quickly reversed because of the large fall in consumption and investment.

Two other interesting facts need to be mentioned. First, temporary reductions in the growth rate of government consumption expenditure do not make the long term interest rate decrease. In fact, if we exclude Spain, where the effect in insignificant at all horizons, the cut in the growth rate of government consumption expenditure temporarily increases long term rates in Italy and Portugal, while in Greece the effect is persistent. Thus, the idea that a more conservative management of the fiscal balance may lead markets to decrease the cost of government financing is not supported by the data. Financial markets do not necessarily see in this cut convincing evidence that the government is genuinely interested in reducing the deficit. For Greece this is obvious, since the cut in expenditure growth is reversed two quarters after the initial impulse. For Italy and Portugal, markets seem to wait to see if the cut is persistent

and sizable before reversing the initial increase in long term rates.

Second, because of the dynamics of the long term interest rate, cuts in the growth rate of government expenditure do not necessarily trigger reductions in the outstanding debt level. For example, in Italy debt keeps on growing, while in Spain debt responses are insignificant. To understand why this happens one should remember that there are two contrasting effects driving debt dynamics. On the one hand, because output falls, revenue also fall making deficits going up in some countries (see e.g. Spain and Portugal). On the other hand, because within a country the maturity of the debt is varied and because not all the debt is rolled over every period, the interest costs do not necessarily change one to one with the changes in the long term rates. Depending on the relative importance of the two effects, debt dynamics may be positive or negative. Interestingly, the medium term responses of the debt in Italy reproduce quite well the medium term responses of government consumption expenditure, suggesting that interest payments may be important in the short run but they are not crucial to generate the observe debt dynamics in the medium run.

Finally, note that the dynamics of the capital account balance are also very heterogeneous. Temporary reductions of the growth rate of government consumption expenditure generate persistence capital outflows in Greece and Italy, temporary capital inflows in Portugal and medium run outflows in Spain. In all cases, the observed changes are of an order of magnitude smaller than those in net export. Thus, prior to 2007 the trade channel was much more important than the financial channel for the domestic transmission of fiscal policy shocks in the periphery of the Euro area.

4.3 International multipliers

Do the contractionary expenditure shocks spillover to other countries? Is the spillover fast or does it take some time to see the international effects? What are the channels of international transmission of fiscal shocks? What happen to the spreads between long term rates?

Table 1 reports the output growth multipliers produced by expenditure growth

shocks computed in the short run (2 periods) and in the medium run (12 periods). Several interesting aspects of the table deserve some comments. For example, the majority of the short term multipliers are significant, making instantaneous spillovers statistically significant. In the periphery, the magnitude of the multiplier exceeds the magnitude of the domestic changes (compare e.g. Greek and Italian multipliers to Greek expenditure growth shocks, or Portugal and Spain multipliers in response to Portuguese expenditure growth shocks) and in the core countries the effects are large (compare, e.g., the French multipliers to Greek or Portuguese expenditure growth shocks, the German multipliers to Italian, Spanish or Portuguese expenditure growth shocks, or the Netherlands multipliers to Greek or Italian expenditure growth shocks). The sign of the multipliers is varied: contractionary expenditure shocks in Italy produce short run expansionary output effects in all countries but Spain; contractionary expenditure shocks in Greece produce expansionary output effects in France and Germany; but contractionary expenditure shocks in Portugal and Spain lead to temporary output growth contractions both in France and Germany.

In the medium run, and excluding Greek expenditure growth shocks which generate insignificant effects in all countries, the same tendencies are present with two important differences: the multipliers become larger in some countries and smaller in others; the international expansionary effects produced by government expenditure cuts are more subdued in Italy and disappear in Greece. In terms of magnitude, a one percent decline in the growth rate of government expenditure makes domestic output decline by 0.2 percentage points in the medium run, while international effects vary from -0.09 to 0.33. Thus, in a number of instances, international spillovers are substantial, even in the pre-2007 era.

4.3.1 Channels of international transmission

Since international spillovers appear to be relevant, it is worth examining which channel could be important in transmitting domestic fiscal contractions in the Euro area. Given, the evidence contained in figures 3-7, we expect the trade channel to be im-

portant. However, one should remember that while within Euro area trade accounts for most of the movements in the trade balance in the countries we consider, capital account changes need not reflect movements from the Euro area only. Thus, while it is possible that domestic capital inflows and outflows are small, these may be consistent with large capital outflows toward the core countries. In figures 8-11, we present the responses of the capital account, of the trade balance and of the spread between the long terms interest rates of the countries where the contractionary expenditure growth shock occurs and the domestic long terms interest rate in France, Germany and the Netherlands.

Overall, there is substantial heterogeneity in the responses, depending on the country where the shock is generated and the core country whose responses we consider. Nevertheless, it seems that the trade channel is important, and in some notable cases the capital flows channel seems relevant. Take the case of Italy government expenditure growth cuts, for example. The responses of net exports are significant in France, Germany and the Netherlands, and although the sign differs, the effect is everywhere strong. There are also important capital movements in these three countries: while France temporarily benefits from capital inflows and the Netherlands persistently benefits, Germany capital account seems to be unresponsive in the short run while capital outflows appear in the medium run and, perhaps surprisingly, the pattern mirrors pretty much what the current account pattern does in Italy. In general, the dynamics of capital flows in response to government expenditure have country specific characteristics which may have to do with factors that are not controlled for in the analysis.

The pattern of the spreads is, on the other hand, interesting, since it suggests a very strong dual feature. Again, considering a contractionary fiscal shock in Italy, which is the major country in the periphery, the spread with German and Dutch long term interest rates increases, due to the fact that both Italian long term interest rates increase and German and Dutch interest rates fall. However, while the spread with German long term rates is persistently above zero for up to four year, the one with the

Netherlands follows pretty much the dynamics of Italian long term rates. French long term rates instantaneously jump up so that the spread with Italian long term rates is insignificant over the first two quarters. After that, French rates move to zero but Italian rates fall making the spread negative. Thus, both the initial "contagion" effect on French long term rates and the initial "flight to quality" that seem to characterize Dutch long term government bonds are reversed as soon as Italian long term rates start to fall. The presence of such patterns is remarkable because the period we consider does not include the recent crisis period.

4.4 Common shocks

As it is well known, the current fiscal consolidation did not involve only one country but almost simultaneously occurred in the four peripheral countries we consider. The question we would like to investigate is whether the international effect that are produced are simply the sum of the effects due to each of the national contractionary shock or whether there are externalities, which make international effects larger or different. Note that such a comparison is impossible to make if using country specific VARs. Instead, our setup allows us to quantify the difference by examining the output effects of a simultaneous reduction of government consumption expenditure growth in Greece, Italy, Spain and Portugal. The last column of table 1 reports the output multipliers that are generated in the short and in the medium run.

Second round effects appear to be unimportant in the short run. Thus, for example, the output growth responses in France, Germany and the Netherlands are similar to the largest responses reported with single country shocks, while in the peripheral countries the median multiplier is somewhat smaller than the domestic multiplier. For Italy, the expansionary effects of fiscal contractions disappear. In the medium run, the effects are more mixed. In some countries, the multipliers are larger (Greece or Italy), but in others they are smaller and insignificant (Germany). Interestingly, French output growth seems to benefit most from the coordinated expenditure growth cut, both in the short and in the medium run, while Dutch output growth appears

to have the largest procyclical behavior with multipliers of the order of 0.5 in the medium run.

Overall, there does not seem to be economically important externalities effects in the period prior to 2007, which would significantly change the sign or the magnitude of international multipliers. We can think of two reasons for why this is not the case. First, coordinated fiscal contractions have occurred at the beginning of the 1990s and when they occurred they were quickly reversed. Thus, the combined effects of the measures could be underestimated. Second, apart from the beginning of the 1990s, and perhaps the end of the 1990s, there are very few episodes of coordinated fiscal contractions in the sample and the large standard errors we obtain on the multipliers in the medium run reflect the fact that the information about these events in the sample is probably limited.

4.5 Expenditure cuts combined with revenue increases

(To be done)

4.6 How has the recent crisis changed the domestic responses and the transmission?

The sample we have considered so far stops at 2007. Thus, the dynamics we present are those one should expect to occur after a temporary consolidation measure in somewhat tranquil times. We know that after 2007 comovements across countries, both in Euro area (see Canova and Ciccarelli, 2012) and around the world (see Imbs, 2011) have dramatically increased. A relevant question to ask is thus whether the recent financial crisis has altered both the stylized facts and the pattern of transmission of fiscal shocks we have described in the previous sections.

To measure time variations in the transmission of shocks is now common to use time varying coefficients (TVC) structural VARs. In our case, it is possible to use a structural version of the TVC panel VAR described by Canova and Ciccarelli (2009), employing some standard assumption to describe the law of motion of the coefficients

and of the variances. Rather than following this route, which would require a considerable amount of computational time, we instead examine time variations using a nonparametric approach, similar to the one described in Canova (2009). That is, we estimate the model over rolling different windows of fixed length and trace out how the economy responds to the shocks in different samples. The advantages of such an approach are clear: there is no need to specify the law of motion of the parameters; there is no need to complicate the analysis by adding a Kalman smoother step in the Gibbs sampling routine we employ; time variations in the variance of the shocks are possible and may be correlated with the time variations in the parameters. The main disadvantage is that the results may depend on the window used. In future versions of the paper we plan to examine the sensitivity of our results to changes in the window size. Since the evidence we have presented so far uses 18 years of quarterly data, we move forward the window one year at the time and repeat estimation 5 different times. The last sample starts at 1994 and ends in 2011. We present a subset of the results we obtain in figures 12-15, in table 2 and in figure 16 where we report, respectively, the responses of the domestic variables to shocks, the output multipliers that are generated, and the dynamics of the current account, the spread and the trade balance after single country shocks in France, Germany and the Netherlands for the sample 1994-2011 when the contractionary shock is common to all the periphery.

The crisis seems to have eliminated certain heterogeneities that appeared within the earlier sample and commonalities seem now to dominate. For example, the domestic dynamics of a contractionary expenditure growth in Greece are now similar to those of the other countries and rather than being quickly reversed the expenditure growth contraction is quite persistent. Similarly, the expansionary output effects of fiscal contraction, which were strong in the short run in Italy, now disappears. Spain seems to be the exception, as persistent contractionary expenditure shocks seem to lead to temporary output increases. In all countries the net export effects are still strong and the sign of the responses of output are, once again, generally due to the magnitude of net export responses, since in addition to government expenditure also

investment generally falls, while consumption is either unchanged or falls after about one year. Spain is, again, the exception since private consumption increases along with output.

The contraction in government expenditure growth also seems to produce very similar effects on the local debt: in the medium run, debt falls and significantly so reflecting the relative large surplus generated with the contractionary measure. While the dynamics of debt seems similar, there is much more heterogeneity in the dynamics of long term rates. Expenditure growth contractions in Greece and Spain make them fall, at least in the medium run; in Italy, they leave long term interest rates unchanged and in Portugal they make them increase. We suspect that these differential patterns have very much to do with the dynamics of the capital account balance in each of the countries. In fact, while there are capital outflows in Italy and Spain after the shock, there is a strong and sustained capital inflow in Portugal.

A very interesting picture obtains when comparing the multipliers we presented in table 1 with those in table 2. In fact, both the magnitude and the significance of the multipliers decreases in the 1994-2011 sample, and spillovers from the periphery to the core also seem reduced. For example, short run multipliers generated by expenditure growth shocks in the periphery are smaller in the short run and insignificant (except for Greece) in the medium run. This weakening of the international transmission is counteracted by a much larger effect due to common shocks. As shown in the last column of table 2 international output growth multipliers exceeding one are present and the probability that contractionary fiscal shocks generate expansionary effects both in the short and the medium run increase substantially. The bigger beneficiaries besides Spain seem to be Germany and the Netherlands, who experience increases in GDP growth of the order of three-quarters of a percentage. On the contrary, France suffers and the output growth gains experienced in the first sample are now turned into output growth losses. Thus, our results seem to align well with the strong vocal support in Germany and the Netherlands for joint austerity measures in the periphery often heard in the international press, the persistence of austerity measures

in countries like Spain, despite the very high unemployment rate, and the reluctance of France to continue pursuing austerity measures.

The different signs in the multipliers of core countries are easy to explain. While all core countries experience significant capital inflows and Germany and the Netherlands large trade surpluses, both in the short and in the long run, French exports are hurt, probably as a consequence of the fall of domestic consumption in the periphery and of the switch from foreign produced to locally produced goods, and this makes the trade balance persistently fall in France, thus inducing contractionary domestic effects.

In sum, the last five years of the sample have averaged out a number of idiosyncrasies that existed in the domestic transmission of contractionary expenditure growth shocks in the periphery of the Euro area, but have also increased the asymmetries in the spillover effects in the core countries. Multipliers are now larger than before especially when we consider common shocks. As emphasized in Canova and Pappa (2011), this could also be due to the fact that monetary policy has been relatively accommodative in the last few years and that real rates have been close to zero or negative. What is perhaps more surprising is the fact that combined contractionary expenditure measures in the periphery seem to be quite expansionary in some core countries and this is likely to create further political and economic tensions between the periphery of the Euro area, which is contracting, and certain core countries, which are expanding. It may also explain the current stalemate in the policy arena and the bipolar distribution of supports for austerity vs. growth measures.

5 Conclusions (TBW)

This paper contributes to the ongoing debate on fiscal policy with new evidence on questions concerning the transmission of fiscal shocks in the euro area and the generated multipliers. In particular, the paper addresses a number of questions which are key to understand the medium term consequences of the current expenditure cuts: (i) What is the international fiscal stance? (ii) What is the size of international

multipliers relative to domestic ones? (iii) Are the effects of coordinated changes larger than the sum of effects induced by individual changes? (iv) Are fiscal contractions likely to have larger effects in the recent sample than in the past?

To answer these questions, the paper uses a panel VAR model where real, trade, financial and fiscal variables are jointly considered for a set of periphery (Greece, Italy, Spain and Portugal) and core (Germany, France and Netherlands) countries in the euro area. The methodology is particularly suited to address these questions because it allows to construct indicators of the fiscal stance – both at Euro area and at country level – and to examine their evolution over time in an integrated framework that takes into account macroeconomic, monetary policy and financial linkages across countries.

The main findings of the paper can be summarized as follows. First, the fiscal stance indicators based on deficit and debt show dynamics which agree with the conventional wisdom and can easily be interpreted in the light of the recent economic developments. Second, contractionary expenditure shocks in the periphery of the euro area have quite heterogeneous domestic effects and the key to understand the sign of the effect is the dynamics of the trade balance that the shocks generate. Moreover, the short term effect on total debt and long term interest rates are not sizeable, suggesting that the signalling effects that contractionary expenditure measures generate in financial markets are quite limited. Third, the spillover effects are also very heterogeneous and depend both on the (periphery) country where the expenditure contraction is designed and on the (core) country whose response is considered. In general, while trade effects are important, capital movements appear to be limited and the effects on sovereign spreads, at time, perverse. Fourth, a contractionary expenditure shock in the periphery has similar domestic and international output effects before 2007, suggesting that the international repercussions of fiscal changes where important also before the crisis. Furthermore, a simultaneous effort in the periphery to improve the fiscal balance results in output effects in the core which are not much larger than the largest output effect originated by a contractionary shocks in a peripheral

country. Finally, as expected, the magnitude of the spillovers changes after 2007 but, perhaps surprisingly, the virtuous effects of contractionary expenditure shocks tend to disappear, dragging all countries in the area in the same recessionary spiral.

Country-by-country analysis of the results seems to align well with the strong vocal support in Germany and the Netherlands for joint austerity measures in the periphery often heard in the international press, with the persistence of austerity measures in countries like Spain, despite the very high unemployment rate, and with the reluctance of France to continue pursuing austerity measures. Interestingly, the last five years of the sample have averaged out a number of idiosyncrasies that existed in the domestic transmission of contractionary expenditure growth shocks in the periphery of the Euro area, but have also increased the asymmetries in the spillover effects in the core countries. Multipliers are now larger than before especially when we consider common shocks, perhaps due to the accommodative monetary policy stance. What is perhaps more surprising is the fact that combined contractionary expenditure measures in the periphery seem to be quite expansionary in some core countries and this is likely to create further political and economic tensions between the periphery of the Euro area, which is contracting, and certain core countries, which are expanding. It may also explain the current stalemate in the policy arena and the bipolar distribution of supports for austerity vs. growth measures.

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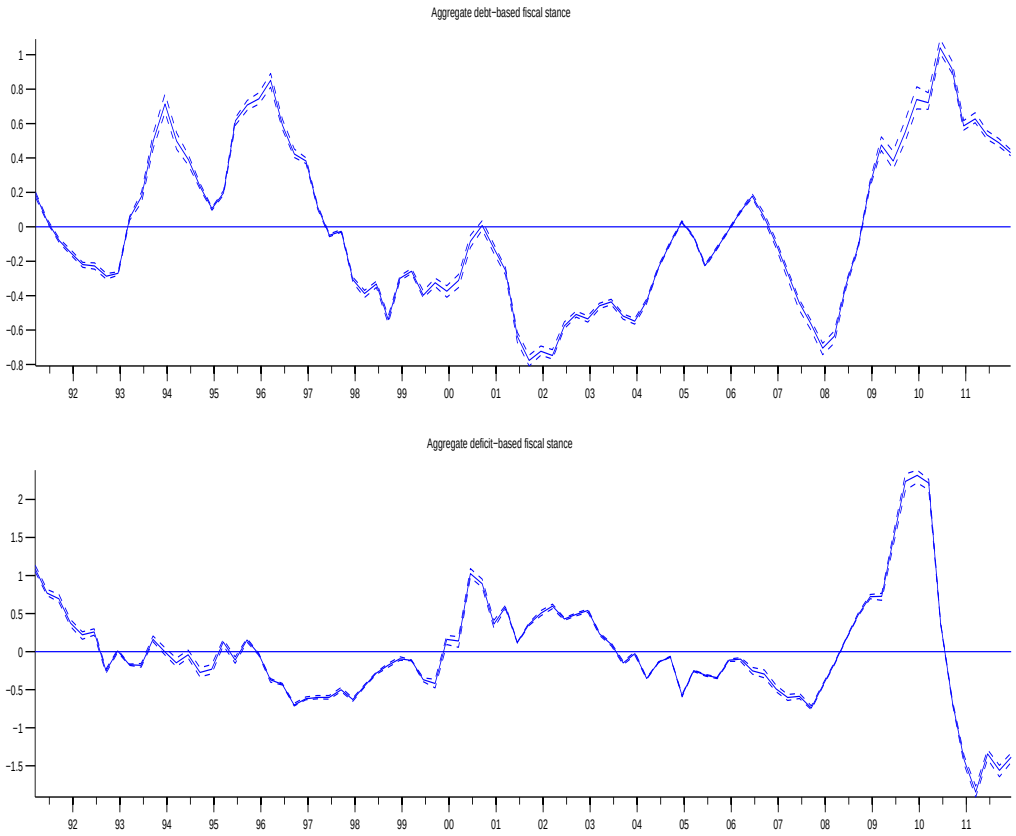

Figure 1: Aggregate indicators of the fiscal stance

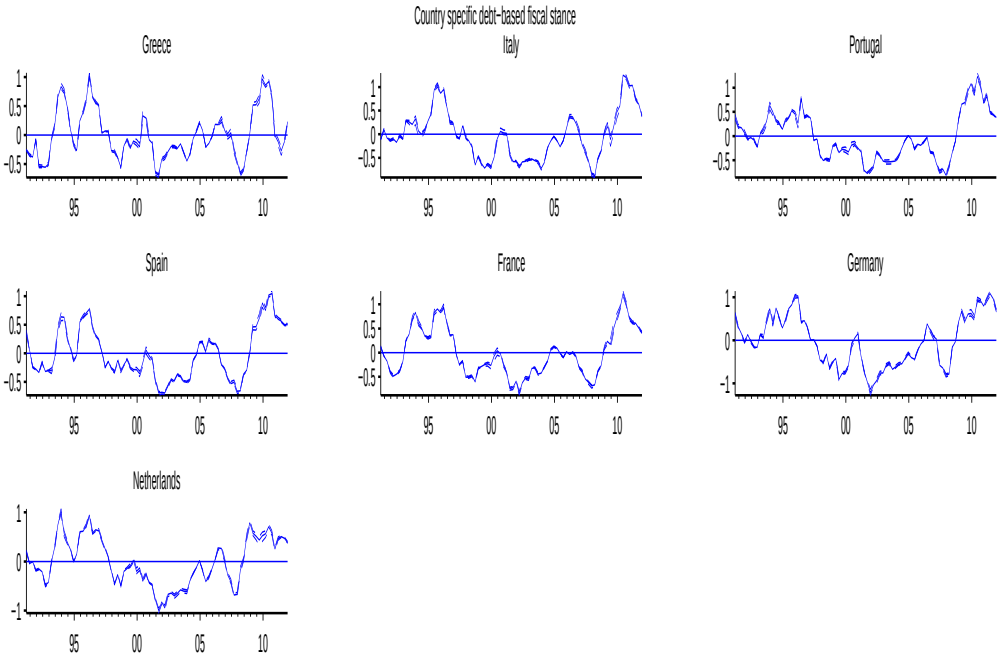

Figure 2: Country specific debt based fiscal stance

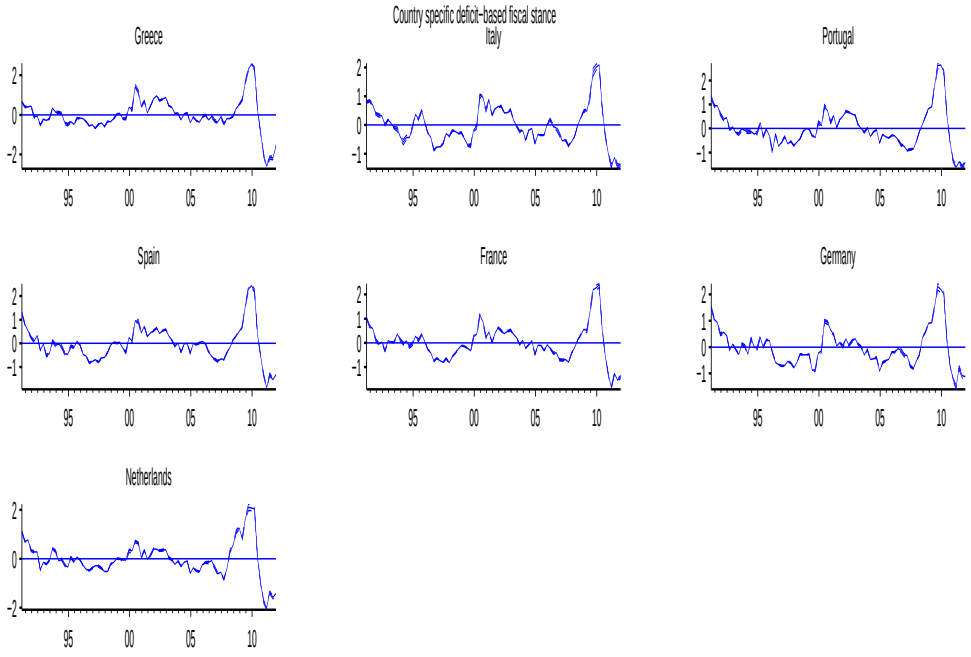

Figure 3: Country specific deficit based fiscal stance

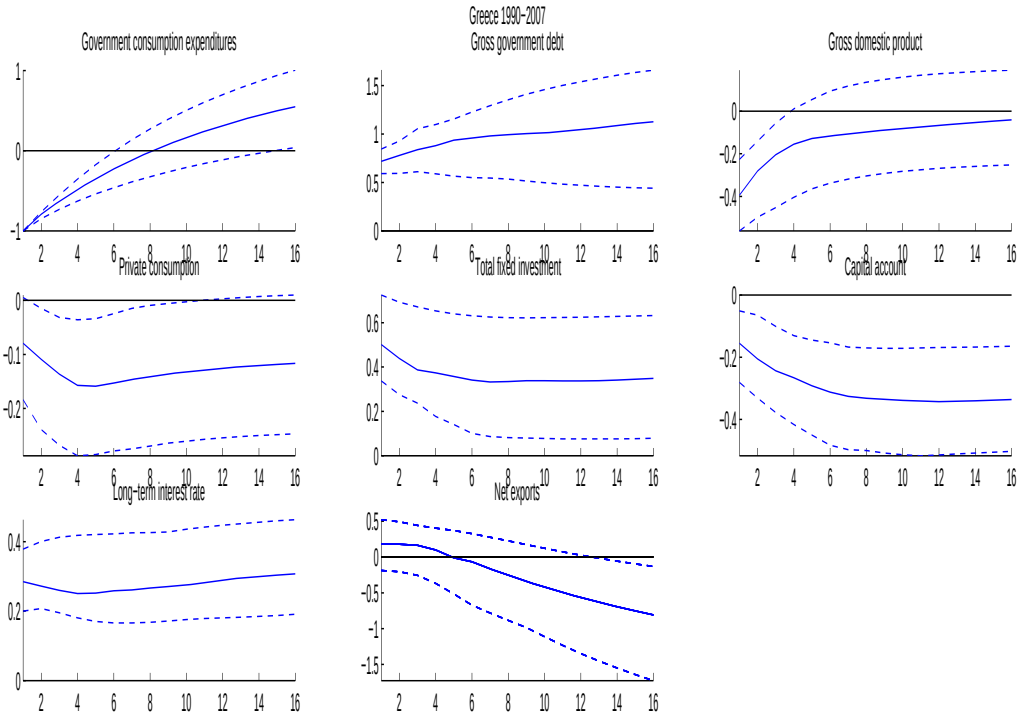

Figure 4: Domestic responses to a contractionary expenditure growth shock in Greece

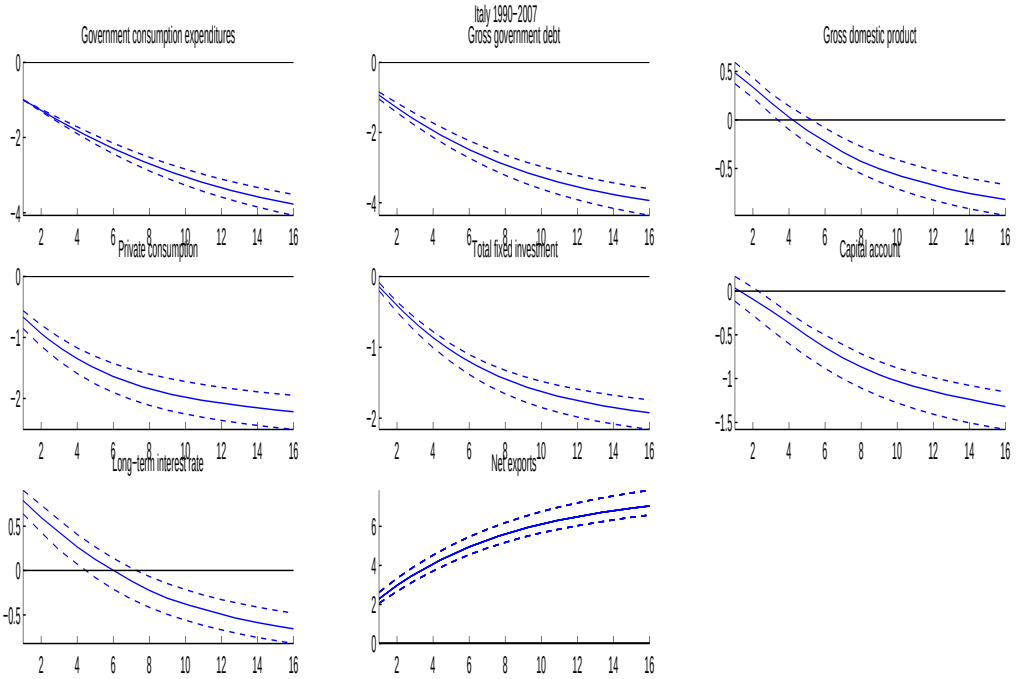

Figure 5: Domestic responses to a contractionary expenditure growth shock in Italy

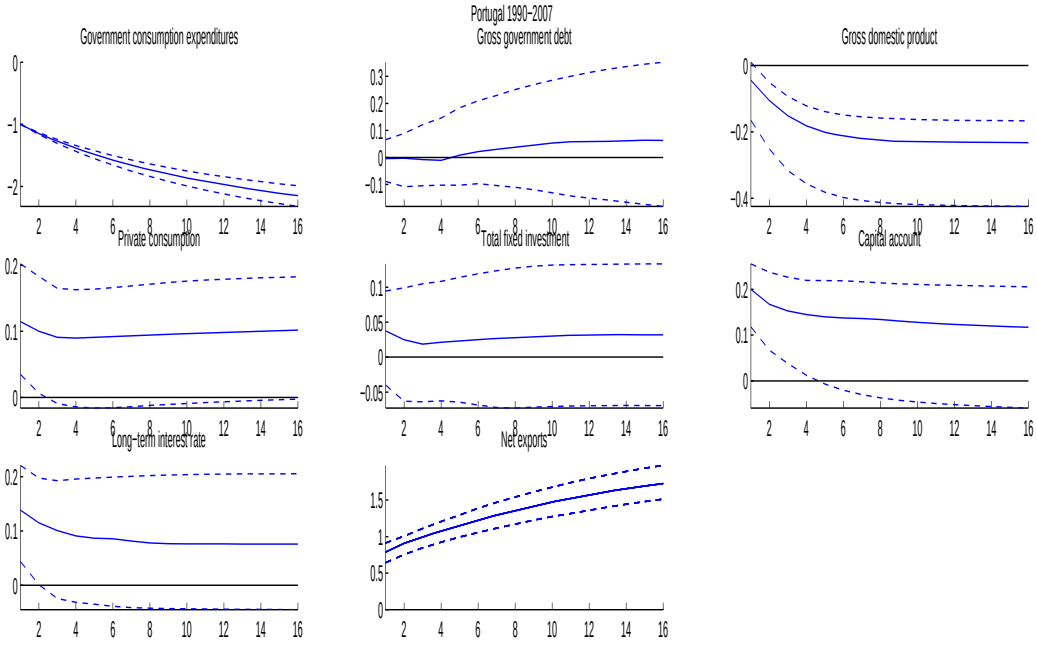

Figure 6: Domestic responses to a contractionary expenditure growth shock in Portugal

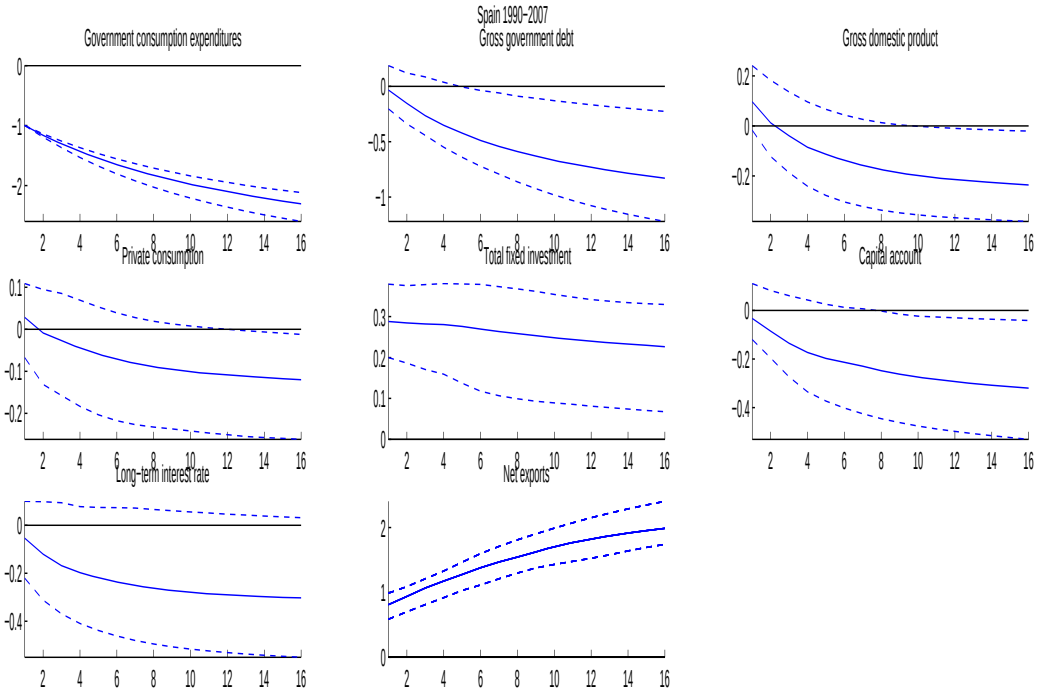

Figure 7: Domestic responses to a contractionary expenditure growth shock in Spain

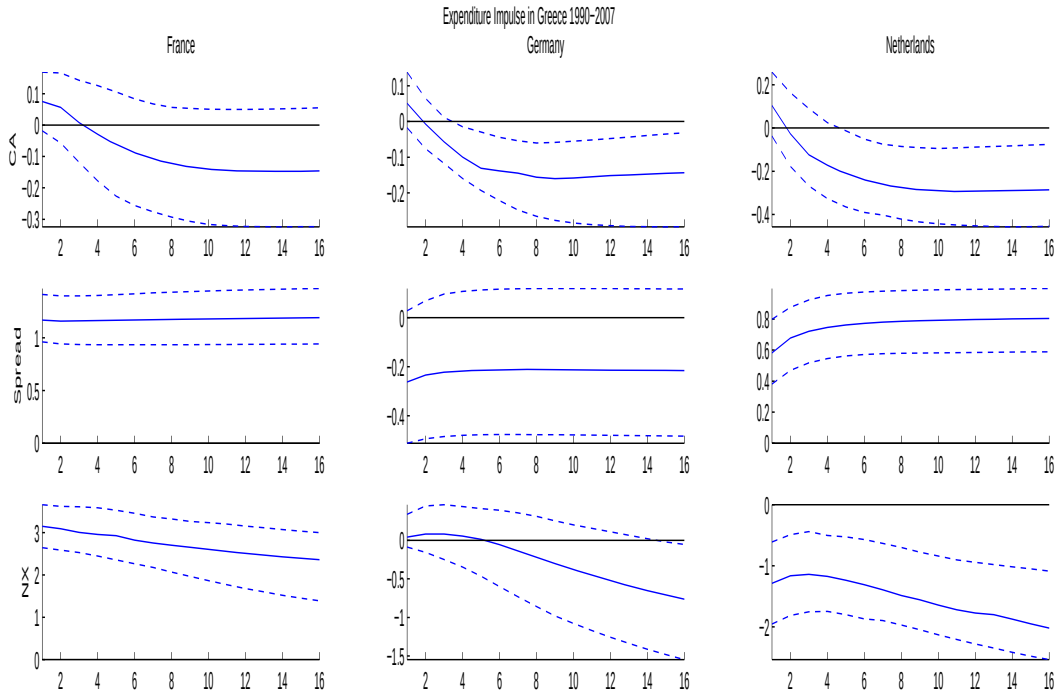

Figure 8: International responses to a contractionary expenditure growth shock in Greece

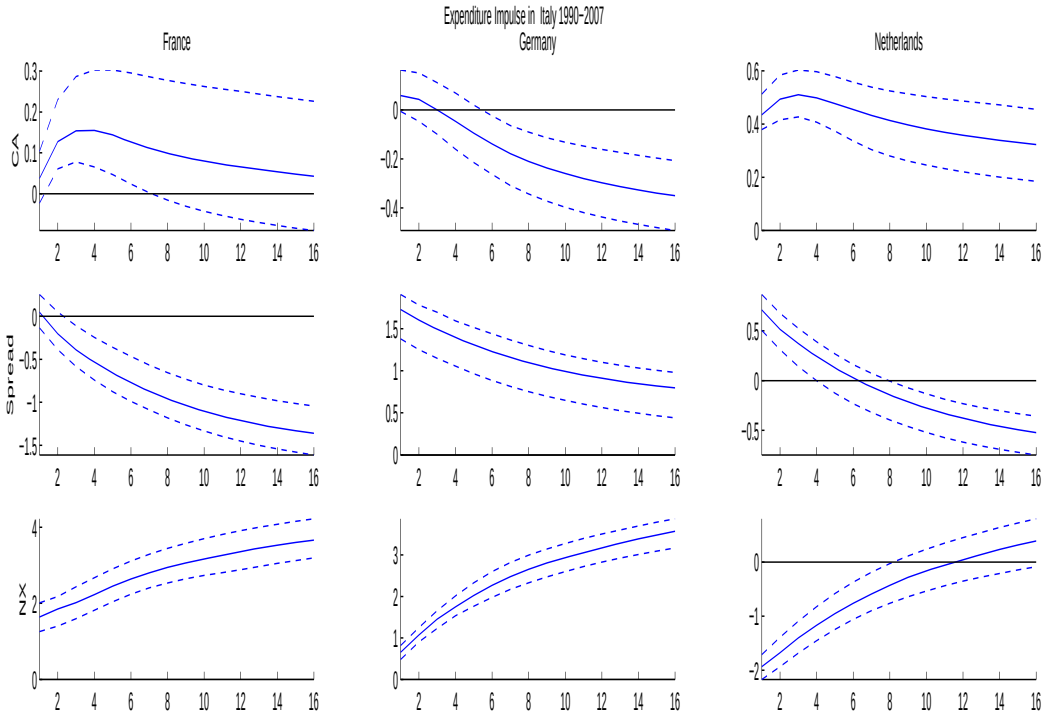

Figure 9: International responses to a contractionary expenditure growth shock in Italy

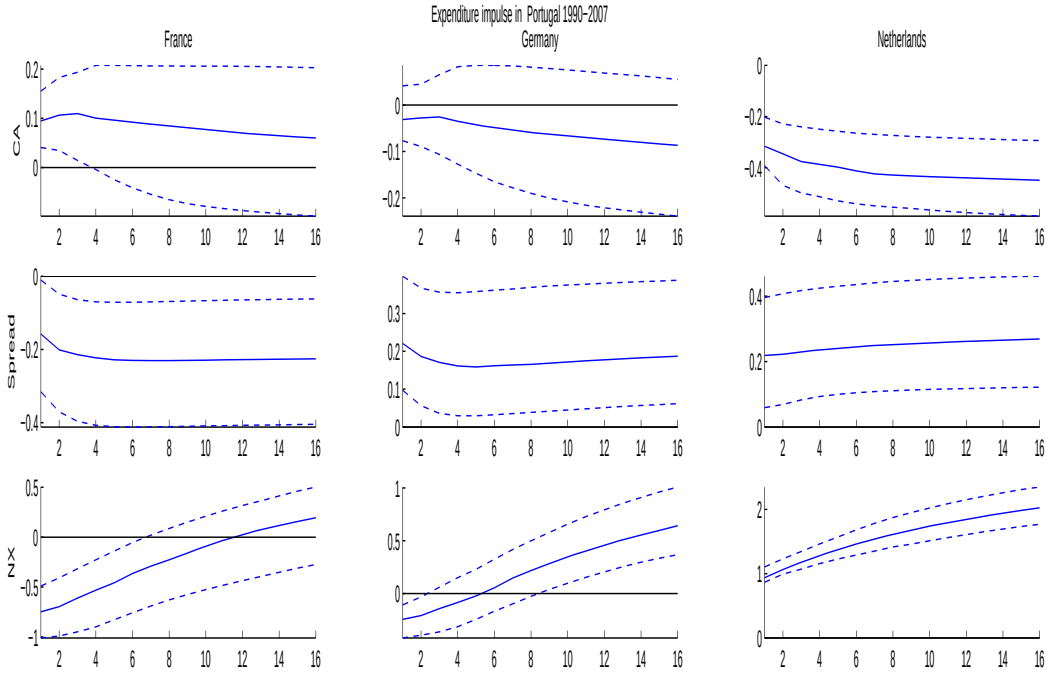

Figure 10: International responses to a contractionary expenditure growth shock in Portugal

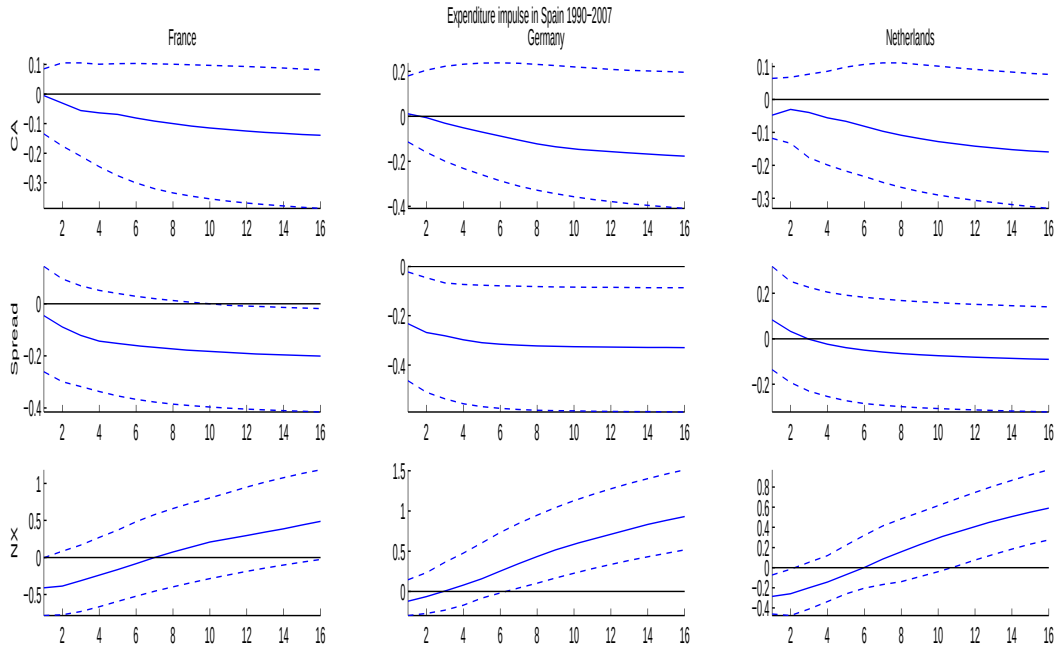

Figure 11: International responses to a contractionary expenditure growth shock in Spain

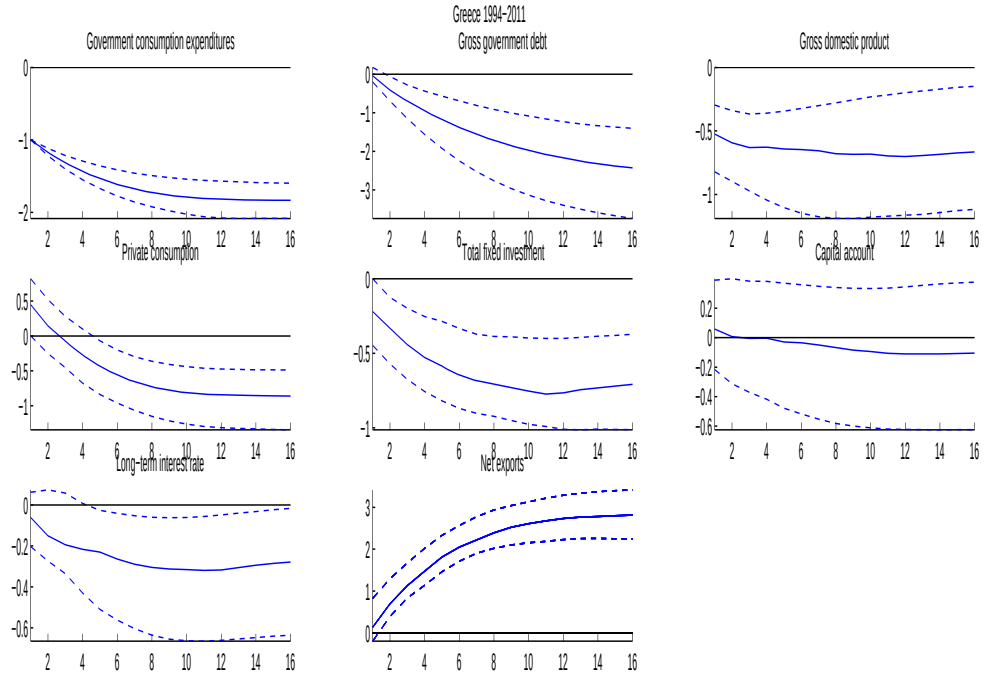

Figure 12: Domestic responses to a contractionary expenditure growth shock in Greece

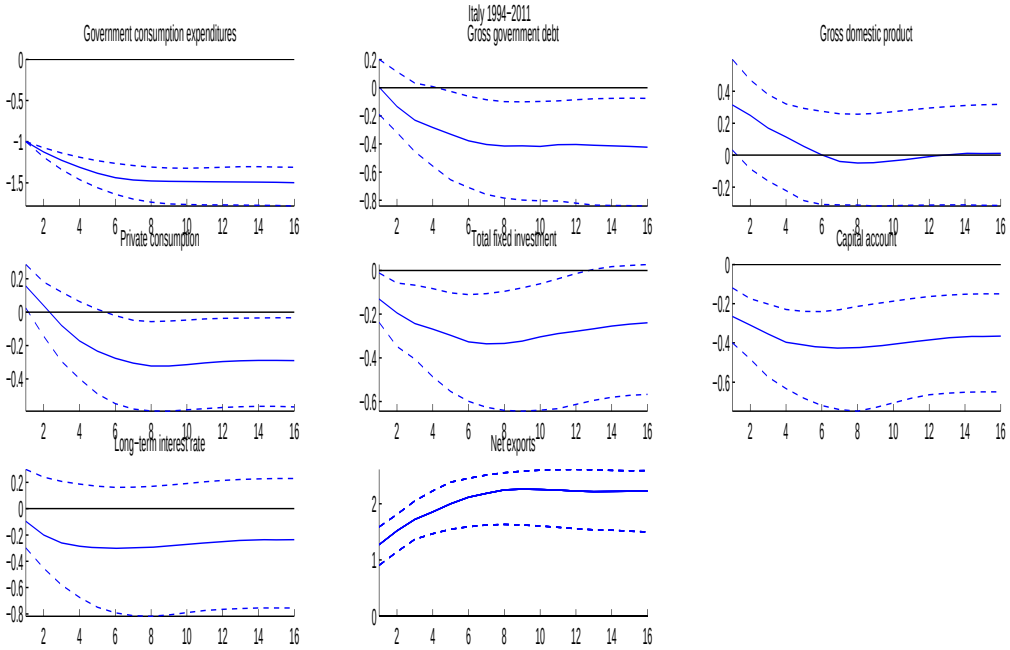

Figure 13: Domestic responses to a contractionary expenditure growth shock in Italy

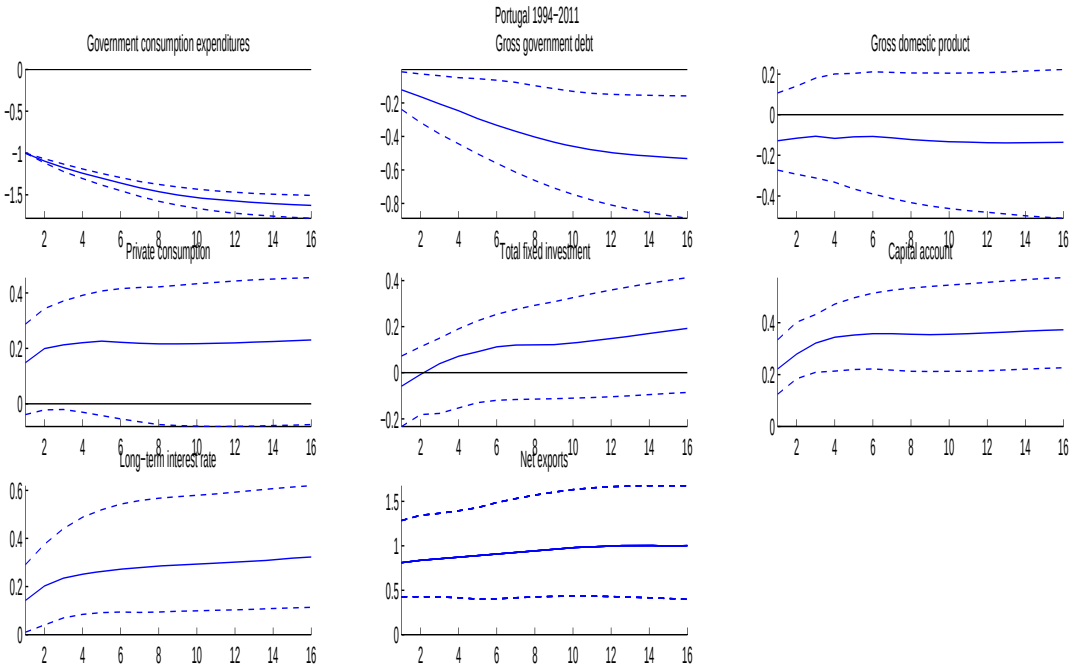

Figure 14: Domestic responses to a contractionary expenditure growth shock in Portugal

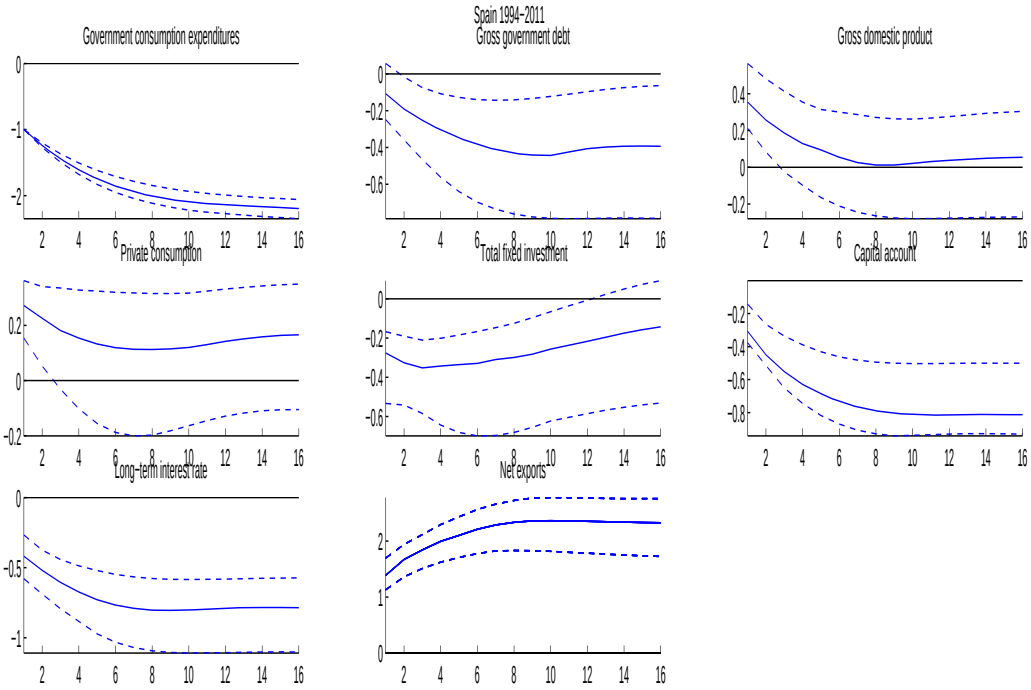

Figure 15: Domestic responses to a contractionary expenditure growth shock in Spain

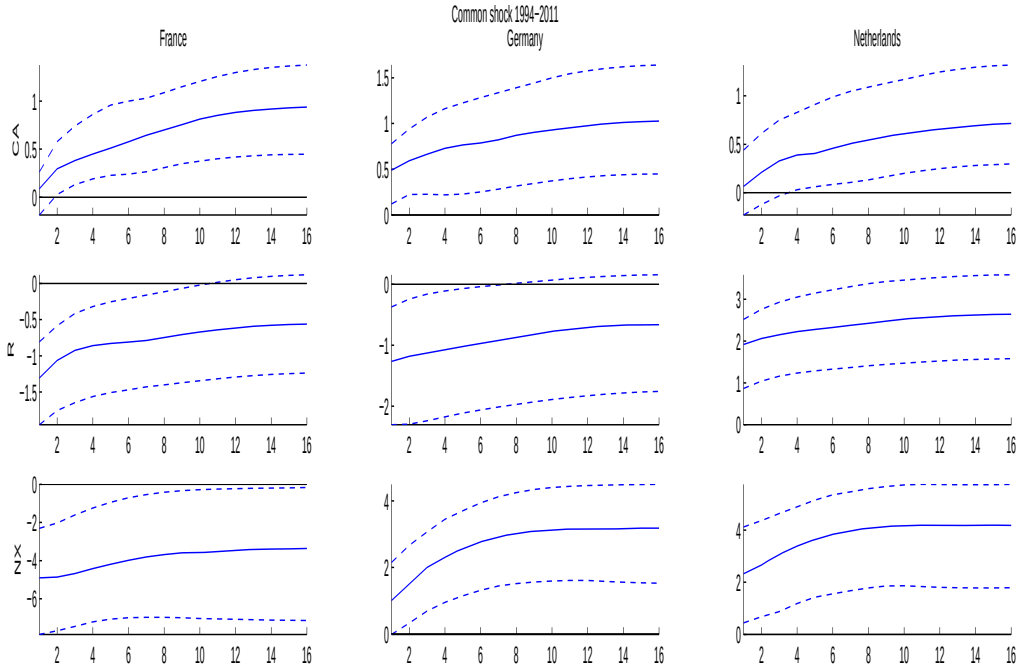

Figure 16: International responses to a contractionary expenditure growth shock in the periphery

Short term multipliers					
	Greece	Italy	Portugal	Spain	Common
Greece	0.35 (0.18,0.60)	-0.03 (-0.05,-0.02)	0.04 (0.02,0.05)	0.03 (0.01,0.05)	0.26 (0.11,0.43)
Italy	0.75 (0.53,0.92)	-0.27 (-0.33,-0.17)	0.04 (0.02,0.05)	0.03 (0.01,0.05)	0.27 (0.16,0.38)
Portugal	0.36 (0.16,0.60)	-0.32 (-0.43,-0.21)	0.09 (0.04,0.22)	0.03 (0.01,0.05)	0.05 (-0.19,0.25)
Spain	-0.68 (-0.97,-0.35)	0.24 (0.15,0.38)	0.28 (0.17,0.38)	-0.01 (-0.16,0.11)	0.05 (-0.21,0.43)
France	-2.57 (-3.04,-2.13)	-0.31 (-0.40,-0.21)	0.32 (0.22,0.49)	0.40 (0.21,0.55)	-1.18 (-1.62,-0.89)
Germany	-0.44 (-0.68,-0.22)	-0.35 (-0.44,-0.29)	0.18 (0.11,0.24)	0.12 (0.02,0.27)	-0.34 (-0.51,-0.13)
Netherlands	1.17 (0.81,1.58)	0.77 (0.67,0.87)	-0.31 (-0.39,-0.19)	-0.06 (-0.15,0.04)	1.17 (0.99,1.38)
Medium term multipliers					
Greece	0.06 (-0.71,0.69)	0.04 (0.02,0.05)	0.09 (0.06,0.11)	0.08 (0.05,0.11)	0.16 (0.08,0.25)
Italy	-0.41 (-1.74,1.12)	0.20 (0.16,0.25)	0.12 (0.08,0.15)	0.13 (0.09,0.17)	0.46 (0.35,0.56)
Portugal	-0.30 (-0.97,0.18)	-0.13 (-0.15,-0.07)	0.11 (0.08,0.21)	0.05 (0.03,0.09)	0.04 (-0.05,0.14)
Spain	1.35 (-0.46,3.59)	0.23 (0.18,0.29)	0.25 (0.17,0.32)	0.09 (0.01,0.18)	0.24 (0.11,0.43)
France	4.33 (-5.11,13.63)	-0.12 (-0.16,-0.07)	0.24 (0.17,0.35)	0.28 (0.14,0.39)	-0.46 (-0.64,-0.32)
Germany	0.95 (-0.67,3.26)	-0.05 (-0.09,-0.01)	0.17 (0.11,0.22)	0.15 (0.07,0.26)	-0.04 (-0.14,0.10)
Netherlands	-1.25 (-5.70,1.92)	0.33 (0.28,0.38)	-0.09 (-0.16,-0.02)	0.01 (-0.04,0.10)	0.54 (0.43,0.64)

Table 1: Output multipliers, country specific and individual shocks, 1990-2007

Short term multipliers					
	Greece	Italy	Portugal	Spain	Common
Greece	0.50 (0.30,0.76)	0.02 (-0.02,0.07)	-0.01 (-0.03,0.04)	0.01 (-0.03,0.03)	0.50 (0.26,0.79)
Italy	-0.00 (-0.25,0.30)	-0.23 (-0.40,0.07)	-0.01 (-0.03,0.04)	0.01 (-0.03,0.03)	-0.20 (-0.47,0.20)
Portugal	0.56 (0.34,0.83)	0.59 (0.34,0.85)	0.11 (-0.13,0.27)	0.01 (-0.03,0.03)	1.14 (0.72,1.59)
Spain	-0.99 (-1.27,-0.70)	0.00 (-0.17,0.29)	-0.22 (-0.43,-0.01)	-0.21 (-0.40,-0.07)	-1.40 (-1.74,-0.79)
France	-0.59 (-1.18,0.32)	0.04 (-0.37,0.47)	0.61 (0.45,0.86)	0.25 (0.08,0.55)	0.55 (-0.40,1.47)
Germany	-0.37 (-0.75,-0.03)	-0.36 (-0.65,-0.13)	0.06 (-0.15,0.24)	-0.04 (-0.16,0.10)	-0.64 (-1.17,-0.29)
Netherlands	-0.67 (-1.21,-0.07)	0.27 (-0.05,0.56)	-0.67 (-0.91,-0.40)	0.07 (-0.15,0.26)	-0.88 (-1.71,-0.13)
Medium term multipliers					
	Greece	Italy	Portugal	Spain	Common
Greece	0.38 (0.11,0.63)	0.05 (-0.09,0.26)	-0.01 (-0.10,0.17)	0.03 (-0.07,0.09)	0.42 (0.11,0.68)
Italy	-0.36 (-0.63,-0.13)	0.00 (-0.22,0.19)	0.01 (-0.09,0.17)	0.02 (-0.07,0.08)	-0.33 (-0.46,0.03)
Portugal	0.11 (-0.10,0.39)	0.44 (0.15,0.75)	0.08 (-0.13,0.34)	0.01 (-0.10,0.06)	0.44 (0.12,0.88)
Spain	-0.79 (-1.03,-0.44)	0.16 (-0.09,0.49)	-0.22 (-0.41,0.01)	-0.02 (-0.13,0.12)	-0.74 (-1.03,-0.23)
France	-0.55 (-0.95,0.01)	0.05 (-0.30,0.32)	0.48 (0.25,0.67)	0.16 (-0.04,0.34)	0.10 (-0.60,0.66)
Germany	-0.43 (-0.77,-0.13)	-0.24 (-0.57,0.00)	0.06 (-0.10,0.28)	-0.04 (-0.15,0.11)	-0.61 (-0.86,-0.21)
Netherlands	-0.72 (-1.10,-0.20)	0.22 (-0.08,0.50)	-0.41 (-0.65,-0.23)	0.02 (-0.10,0.19)	-0.76 (-1.24,-0.17)

Table 2: Output multipliers, country specific and individual shocks, 1994-2011