What Are the Spill-Overs from Fiscal Shocks in Europe?

An Empirical Analysis*

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ABSTRACT

We use a Vector Auto Regression (VAR) analysis to explore the (spill-over) effects of fiscal policy shocks in Europe. To enhance comparability with the existing literature, we first analyse the effects of these shocks at the national level. Here, we employ identification based on Choleski decomposition and a structural VAR, both of which lead to the same results. Then, we turn to study the cross-border spill-overs of fiscal shocks via the trade channel. Fiscal expansions in Germany, France and Italy lead to significant increases in imports from a number of European countries. In order to mimic the case of monetary union, we also shut off the effects via the short-term interest rate and the nominal exchange rate and find a slight strengthening on average of the cross-country spill-overs from a fiscal expansion. We also conduct a panel data analysis linking bilateral exports to fiscal variables. Here, the effects of fiscal policies are consistent with those for the VAR analysis. Overall, our findings suggest that it may be worthwhile to further investigate the possibility of enhanced fiscal coordination.

Keywords: Fiscal shocks, fiscal policy, monetary policy, spill-overs, impulse responses.

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1. Introduction

With the introduction of monetary union in Europe, the discussion about the need for fiscal policy co-ordination has intensified. While there are many possible aspects to the co-ordination of fiscal policy, this paper focuses on the potential scope for fiscal co-ordination at the macroeconomic level. The Stability and Growth Pact, with its mutual surveillance of countries' public finances, has already provided a step into this direction. However, within the limits provided by the Pact,[1] countries are relatively free to follow their desired fiscal policies.[2] Therefore, many policymakers and experts would like to see a further increase in fiscal co-ordination. Nevertheless, whether enhanced fiscal co-ordination can be useful depends in the first place on the importance of cross-border spill-overs from fiscal policies of European countries. In the absence of such spill-overs, it is hard to make a case for fiscal co-ordination, since the decisions of individual countries would not affect the other countries in the system.[3]

While in theory national fiscal policies can lead to many potential spill-overs (see, for example, Beetsma et al., 2001), in empirical work it has proved hard to establish clear-cut results in this respect (see McKibbin, 1997). In this paper, we will provide a new attempt based on recent developments in the empirical literature on the effects of fiscal policy shocks. Here, the common approach is to set-up a VAR system with a limited number of key macroeconomic variables and to see how these variables react to a discretionary change in fiscal policy (usually the deficit or taxes and spending considered separately).[4] While this approach primarily focuses on the national effects of fiscal policy changes,[5] we show that it can also be usefully employed to shed light on the cross-border spill-overs from fiscal policy at the macroeconomic level. In particular, we shall focus on the effect of fiscal impulses in major European economies on the imports from the other economies in the system.[6] If one finds significant effects here, then this increases the potential scope for the macroeconomic coordination of fiscal policies. Of course, the conceivable macro-economic spill-overs from fiscal policy are not confined to the trade channel. In particular, a national fiscal expansion or contraction may affect both short- and long-term interest rates, an effect that is transmitted to other countries via the common monetary policy in the Euro-area or the international capital market. We present counterfactual experiments in which we control for the effects via the short-term interest rate.

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[1] That is, the three-percent deficit limit and the requirement that the countries strive for a cyclically-adjusted budget that is close to balance or in surplus. For a detailed description of the Pact's provisions and the rationales for the pact, see, for example, Artis and Winkler (1998), Beetsma and Uhlig (1999), Debrun (2000) and the articles collected in Brunila et al. (2001).

[2] The recent failure to impose sanctions on Germany and France for their repeated violations of the Pact's 3% deficit limit, casts doubt on the Pact's ability to sufficiently restrain fiscal policies.

[3] For recent analysis on policy coordination, see, for example, Buti et al. (2001) and Beetsma et al. (2001).

[4] It is impossible to provide an exhaustive list of this recent literature, but examples are Blanchard and Perotti (2002), Perotti (2003), Mountfort and Uhlig (2002), Canova and Pappa (2002), Favero (2001), Fatas and Mihov (2001).

[5] Exceptions are Van Aarle, Garretsen and Gobbin (2003) and Marcellino (2002).

[6] We have not included the United Kingdom as a "major economy", because the fiscal data for the U.K. were of very weak quality.

Our empirical analysis suggests that fiscal expansions in the major three Euro-area economies (Germany, Italy and France) can have a significant and substantial influence on the imports from other EU countries. This effect on imports is tightly linked to the influence that a fiscal expansion has on the national economy. A fiscal expansion leads to more imports if it stimulates domestic activity. Any direct spill-overs caused by government purchases of foreign products seem to be unimportant, though. The effectiveness of the different budget components (spending and net taxes) in stimulating domestic activity depends on the specific country under consideration. A discretionary spending increase in Germany has a marginally significant and short-lived effect on its GDP, while a reduction in net taxes has a much stronger effect on its GDP. For Italy, both a spending increase and a net tax reduction lead to a significant rise in its GDP. Finally, for France, a positive spending shock raises its GDP, while a shock in net taxes has no effect at all.

We conduct our analysis for the period 1970 – 1998, that is, the period before European monetary unification. During substantial parts of this period, countries followed a (partially) independent monetary policy, allowing their central banks to adjust the short-term nominal interest rate and allowing the exchange rate to move in response to shocks. To get a clearer picture of the potential importance of fiscal policy spill-overs under EMU, we therefore attempt to simulate over the sample period a situation in which countries have lost their monetary independence. By taking the interest rate and nominal exchange rate out of the VAR system and including them as exogenous variables, we simulate a situation in which the abovementioned interest rate and nominal exchange rate channels are not operating. The idea is that in EMU, fiscal shocks in an individual country do not affect the nominal exchange rate against Euro-area trading partners, while the effect on the short-run interest rate is relatively small, because the latter is determined at the union level by the ECB. Our empirical results show that the fiscal spill-overs via the import channel become on average slightly stronger.

The remainder of the paper is structured as follows. Section 2 describes our empirical procedure in more detail and sets up the baseline VAR system for France, Germany and Italy. This section focuses only on the domestic effects of fiscal impulses, thereby using a minimal framework from the existing empirical literature. We apply stability tests and a number of robustness checks to assess the adequacy of the model. In particular, we allow for switches in the monetary policy regime during the period under consideration. While the baseline identification is obtained with a recursive ordering, we also explore a structural VAR set-up – without any effects on the results. The next section, Section 3, extends the baseline model for the large economies to include imports from Euro-area trading partners. We consider both the effects on aggregate imports as well as the effects on imports from individual countries. In many cases, we find significant effects of fiscal shocks on imports, even though the exchange rate and the short-run interest rate may adjust in response to the shock. In order to better gauge the fiscal spill-over effects via the trade channel in EMU, this section also considers specifications in which we include the exchange rate and imports as exogenous rather than endogenous variables. Section 4 explores whether the results from the VAR analysis are consistent with the results from a panel data analysis that links bilateral exports to fiscal variables. The advantage of this approach is that we can now

conduct the analysis at the annual frequency level, while still increasing the number of observations substantially. We find that total or discretionary increases in public spending or reductions in net taxes have statistically and economically significant positive effects on international trade. Finally, Section 5 concludes the paper.

2. Analysis of the baseline empirical model

In this section, we consider a baseline empirical specification based on the recent literature on the effects of fiscal shocks. This literature largely neglects cross-border effects of fiscal policies. We employ this baseline specification in order to enhance comparability with this literature and to take it as a starting point for the remainder of the analysis, in which we do allow for international spill-overs from fiscal shocks.

The baseline specification is a VAR system in consumer price inflation (π_t), log of real government spending (g_t), log of real GDP (y_t), log of real net taxes (t_t), the money market rate (i_t) and the log of the real effective exchange rate (s_t), where subscript t denotes the period. An exchange rate appreciation corresponds to a larger value of s_t. We include the exchange rate in order to take explicit account of the fact that the economies under consideration are all characterized by a substantial openness. Including the nominal effective exchange rate instead of the real exchange rate did not have any appreciable effect on the results. Data are at a quarterly frequency and the sample period is 1970Q2 – 1998Q4 (see the Appendix for a detailed description of the data). Rather than working with the budget deficit as a single variable, we split it up into government spending and net taxes, because preliminary analysis showed that the dynamic effects of a fiscal expansion through a spending increase or a reduction in net taxes differ substantially.

2.1. Baseline estimates

The VAR system that we estimate is written as:

$$AX_t = C(L)X_{t-1} + Bu_t, \qquad (1)$$

where A is a lower-triangular matrix with the diagonal elements normalised to unity, $X_t = [\pi_t, g_t, y_t, t_t, i_t, s_t]'$ is the vector of endogenous variables in the system and L is the lag operator with $C(L)$ being the corresponding coefficient matrices.[7] Further, u_t is the (normalised) vector of shocks to the system and C is a diagonal matrix with the standard deviations of the shocks. We thus use a Choleski structure to identify the shocks. Finally, we also include in the system a vector z_t with seasonal dummies, a constant, a time trend and, in the case of Germany, a unification dummy, which takes a value of 1 in 1991Q1

Under the above Choleski identification structure, real government spending is not contemporaneously (within the same quarter) affected by changes in the real activity.

[7] In preliminary analysis we have estimated our VARs in first difference both with and without the imposition of a cointegration relationship between the tax and spending variables as in Blanchard and Perotti (2002). The results are very similar to the ones shown in this section.

Blanchard and Perotti (2002), Perotti (2003), Fatás and Mihov (2001, 2002) make the same assumption. They argue that there is no institutional setting to believe that any spending component reacts automatically to real activity changes. This could be justified by the presence of decision lags as well as the time required to collect information about the state of the economy. The above ordering also implies that there is a contemporaneous effect of output innovations on net taxes. Blanchard and Perotti (2002) impose an elasticity, which they obtain from an estimated response of specific tax components to output fluctuations. Although less sophisticated and maybe less accurate, leaving the relationship between output and net taxes unrestricted seems a reasonable alternative. A similar assumption is made in Fatás and Mihov (2001) and Neri (2001). Further, by ordering net taxes after government expenditure we assume that taxation decisions are taken once expenditure has been decided. This restriction is used in many other studies, including Fatás and Mihov (2001), Blanchard and Perotti (2002), Marcellino (2002), Perotti (2003) and De Arcangelis and Lamartina (2004). Finally, we assume that the money market rate is simultaneously determined by the real and fiscal variables, whereas the latter react sluggishly (after a quarter) to any interest rate movement. This assumption is widely used in the monetary transmission mechanism literature and is generally based on the presence of nominal rigidities and decision lags of the private sector (see, for instance, Peersman and Smets, 2003, and Mojon and Peersman, 2003). The real exchange rate is positioned last, implying that it can be affected by all the variables of the system within the same quarter, as one would expect for a financial variable.

In all our estimations, we set the number of lags in the VAR to six (i.e. one and a half years). The selected number of lags was based on commonly-used criteria such as Schwartz and Akaike, and the need to produce white-noise errors. However, the results show little sensitivity to the selected lag length. Figures 1a-c depict the impulse responses for the variables in the system after a reduction in net taxes or an increase in government spending. In the ensuing discussion, unless explicitly stated otherwise, significance refers to a 10% probability level. In particular, the graphs report the mean impulse response and the confidence bands formed by the 5^{th} and the 95^{th} percentile based on 1,000 Monte Carlo simulations. Further, the size of the impulse is always a one-standard deviation shock of the variable under consideration.

As one would expect, a government spending shock in Germany (see Figure 1a) raises output upon impact, most likely because of the direct contribution of spending to output. However, output quickly falls back and becomes even negative, but not significantly so. Net taxes follow spending and increase significantly, after which they fall back to zero. Upon impact the money market rate increases and becomes significant. However, this effect is only short-lived, which is in line with the fact that inflation does not significantly move and that the significant impact on output is also only short-lived. Figure 1a also shows the impulse responses for Germany after a reduction in net taxes. Output increases and becomes significant after two quarters. In the longer run, output returns to zero. Inflation rises and is just significant after four and six quarters. The money market rate initially falls slightly and then rises to become just significant after six quarters. This moderate response of the money market rate is in line with the rather moderate effect on

inflation. Spending and the real effective exchange rate are not significantly affected, although the latter variable rises to a level close to significance.

Figure 1b shows the corresponding impulse responses for France. A spending impulse leads to a significant rise in output, while the increase in net taxes is close to significance. Upon impact, the interest rate is just significant, but the effect has vanished after two quarters. The movements in both inflation and the real effective exchange rate remain far from significant, though. A discretionary reduction in net taxes neither affects output nor inflation significantly, which might be partly explained by the rise in the money market rate and the appreciation of the real effective exchange rate which becomes significant after two periods.

The impulse responses to a positive spending shock or a discretionary net tax reduction in Italy are reported in Figure 1c. The spending impulse has a significant effect on output, although with a lag of two quarters. It also raises inflation significantly, which prompts a (delayed) monetary contraction (an increase in the short-term interest rate). Net taxes increase over time, but not significantly. Finally, the real effective exchange rate hardly moves. An impulse in net taxes stimulates output. However, output becomes only just significant after a rather long lag of two years. With its fall, the inflation rate exhibits a "price puzzle". Neither public spending, nor the interest rate, react significantly, while the upward movement of the real exchange rate is close to significance after three quarters. This outcome provides weak support for the Mundell-Fleming model, which predicts an appreciation of the exchange rate after a positive fiscal shock under a flexible exchange rate regime.

Table 1 summarizes the information contained in the impulse responses by reporting the impact, maximum and minimum values of the impulse responses to an expansive government spending or net tax reduction shock, together with the period in which the maximum and minimum responses occur. For the net tax reduction we do not report the impact effect, because output can only react with a lag to net taxes, as the latter is ordered after output. To ensure comparability across the various cases, we assume that in each case the size of the shock is equal to one percent of GDP. In the presence of Keynesian multiplier effects, one would expect at least the maximum effect of the increase in government spending on output to be larger than unity. One would also expect it to be larger than the maximum effect of an equal-size reduction in net taxes. We see that in a number of instances the maximum effect and also the impact effect exceed unity. However, there is no evidence that the government spending multiplier exceeds that on net taxes.

We conclude this subsection with an analysis of the forecast error variance decomposition of output at various time horizons. This way, we can assess the relative importance of the different sources of "fundamental" shocks (i.e., the shocks contained in the vector u_t) for the fluctuations in real activity. In particular, we are interested in the contribution of discretionary policy shocks to output variability. We see that for each country, at short horizons the shocks to output explain most of the forecast error variance (see Figure 2). As the forecasting horizon increases, the relative importance of the output shock falls. In particular, and as already expected from the impulse responses seen earlier, the explanatory

power of net tax shocks for German output fluctuations rises to reach a maximum of 17% after seven quarters, after which it slightly falls back. The money market rate gains and public spending loses explanatory power as the forecast horizon increases. In contrast, for France, net tax shocks play a negligible role in explaining output fluctuations, while the role of public spending is correspondingly larger, increasing from over 15% after one quarter to over 24% after four years. The role of the money market rate also increases here over the forecast horizon and becomes even more important than that of public spending. At the end of the forecast horizon, the share of variability in output explained by its own shock has shrunk to just one-third. Finally, for Italy, the explanatory power of public spending fluctuates between 7 and 10% (except for the shortest forecast horizons). The role of net tax shocks is negligible for a horizon of up to one and a half year, after which this source of shocks becomes progressively more important so as to explain almost one-quarter of error variance of output after 4 years. This is largely in conformity with the results for the impulse responses.

2.2. Stability and robustness

We have run stability tests using standard Chow breakpoint and forecast tests on each reduced-form regression of the baseline model, with a breakpoint in 1985Q1. That is, we split the sample in two sub-samples of similar size. The two tests seem to produce somewhat contradicting results (based on a 5% significance level for a one-sided test– see Table 2). In particular, the breakpoint test indicates that in the output equation for Germany, in the government spending and the output equations for France, and the inflation and net tax equations for Italy, there is evidence of instability. On the other hand, the Chow forecast tests run for the same breakpoint cannot reject the stability hypothesis in the vast majority of the reduced-form equations. These findings show that, due to low degrees of freedom for each sub-period, the small sample properties of the test might be problematic.

In order to verify the robustness of the results, we have run the Chow breakpoint test with a different splitting date (1987Q1). This breakpoint corresponds to the time when the currencies in the European Monetary System were generally thought to have acquired a stable value against the German mark and national monetary policies had become subordinated to the German monetary policy. The new results reported in Table 1 provide substantial support in favor of stable relationships.

In view of the possibility that the signing of the Treaty on the European Union (the "Maastricht Treaty") may have constituted a regime shift, we have redone the Chow forecast test, taking 1993Q1 as the breakpoint. There is no evidence of any break in this case, also not for the equations for net taxes and spending. These variables are often thought to be the ones that were most affected by the Treaty.

One possible reason for the instability found in some of the above tests might originate in the monetary regime changes that both France and Italy underwent over the sample period. The latter, in fact, includes the pre-1979 flexible exchange rate regime and the post-1979 period characterised by exchange rate targeting and management of the currency parities,

and by a leading role of the German monetary authorities. In order to control for these effects and allowing for potential changes in the monetary reaction functions of the French and Italian central banks, we have included the German money market rate in the baseline model as an exogenous variable. The estimated impulse responses to the fiscal shocks were unaffected, though.

To allow for a more accurate modelling of the monetary reaction functions, we have tried to distinguish the periods in which the French and Italian authorities followed an independent monetary policy from those in which they directly followed the German monetary authority in order to defend the exchange rate parities. In particular, for France we select the "dependent monetary policy" period as the period 1985Q3 and onwards, while for Italy we identify it as the period before 1988Q1-1992Q2 and the period 1997Q1 and onwards. We created a variable that is equal to the German money market rate during the above periods and zero, otherwise. We have then included this proxy as an exogenous variable in the baseline model and checked for changes in the new impulse responses. Our results (not reported here) indicate stability of the responses to this strategy too. While the above periods were selected on the basis of membership of the European Monetary System as well as the absence of major EMS realignments, the results hardly showed any sensitivity to the precise choice of the periods of "monetary dependence". Overall, it seems that the possible instability of some of the equations found above could be the result of the short sub-samples used to run the Chow tests and the correspondingly low number of degrees of freedom.

As a final check on the baseline specification, we also included lagged values of public debt as an exogenous variable into the model. Because public debt for France was only available as of the end of the seventies, this check was confined to the cases of Germany and Italy. The impulse responses were virtually unaffected, while any findings concerning the significance/insignificance of the impulse responses were completely unchanged.[8]

2.3. Alternative identification schemes

In this subsection we test the robustness of the identifying restrictions resulting from the recursive Choleski structure and implement a structural VAR in a manner similar to Blanchard and Perotti (2002), Perotti (2003) and Marcellino (2002). The structural model given in equation (1) is not directly observable, but can be estimated in its reduced-form representation:

$$X_t = A^{-1}C(L)X_{t-1} + \varepsilon_t, \qquad (2)$$

where ε_t is the VAR residual vector with full variance-covariance matrix Σ. The resulting relationship between ε_t and the structural shocks u_t is given by

$$A\varepsilon_t = Bu_t. \qquad (3)$$

[8] The results are not reported here for the sake of space, but can be obtained upon request from the authors.

Identification requires imposing some restrictions on the parameters of A and B. Writing out explicitly the expression in (3), our starting alternative identification scheme is:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{g\pi} & 1 & 0 & 0 & 0 & 0 \\ 0 & \alpha_{yg} & 1 & \alpha_{yt} & 0 & 0 \\ \alpha_{t\pi} & 0 & \alpha_{ty} & 1 & 0 & 0 \\ \alpha_{i\pi} & \alpha_{ig} & \alpha_{iy} & \alpha_{it} & 1 & \alpha_{is} \\ \alpha_{s\pi} & \alpha_{sg} & \alpha_{sy} & \alpha_{st} & \alpha_{si} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{\pi} \\ \varepsilon_t^{g} \\ \varepsilon_t^{y} \\ \varepsilon_t^{t} \\ \varepsilon_t^{i} \\ \varepsilon_t^{s} \end{bmatrix} = \begin{bmatrix} \beta_{\pi} & 0 & 0 & 0 & 0 & 0 \\ 0 & \beta_{g} & 0 & 0 & 0 & 0 \\ 0 & 0 & \beta_{y} & 0 & 0 & 0 \\ 0 & 0 & 0 & \beta_{t} & 0 & 0 \\ 0 & 0 & 0 & 0 & \beta_{i} & 0 \\ 0 & 0 & 0 & 0 & 0 & \beta_{s} \end{bmatrix} \begin{bmatrix} u_t^{\pi} \\ u_t^{g} \\ u_t^{y} \\ u_t^{t} \\ u_t^{i} \\ u_t^{s} \end{bmatrix} \qquad (4)$$

This representation is similar to Perotti (2003), with the only difference that the fiscal rules parameters $\alpha_{t\pi}$, α_{ty}, and $\alpha_{g\pi}$ are left unrestricted, and are not fixed on the basis of external/institutional information. Additionally, the off-diagonal elements of B are all zero, implying that we do not allow for the structural shocks to be correlated. This assumption is consistent with the results of Blanchard and Perotti (2002), Perotti (2003) and Marcellino (2002), who find that the correlation between spending and tax structural shocks is not statistically different from zero. Differently from the recursive structure of the baseline specification, however, in the starting scheme above we allow for feedback effects from the exchange rate to the money market rate ($\alpha_{is} \neq 0$) and the possibility of net taxes to contemporaneously affect real output ($\alpha_{yt} \neq 0$). In order to have just-identification, consistent with previous studies we abstract from a contemporaneous effect of inflation on output ($\alpha_{y\pi} = 0$) and of government spending on net taxes ($\alpha_{tg} = 0$). The above system of equations is then solved, and the free coefficients of the model and their standard errors are computed.[9] In particular, we proceed by starting with the just-identified system given by equation (4), and deleting one by one the insignificant coefficients with the lowest *t*-statistic.

For each of the three countries, we find that α_{is} and α_{yt} are not statistically different from zero. Hence, the final contemporaneous scheme is equivalent to a Choleski structure, with the only difference that a number of below-diagonal elements are restricted to be zero. Table 3 reports the estimated coefficients (and their respective statistical significance) of the final matrix A and the ones corresponding to the Choleski structure of the baseline model. It is easy to see that the fiscal rule parameters in the two identification schemes are not statistically different from each other. Therefore, not surprisingly, the estimated impulse responses given by the structural model are very similar, if not identical, to the ones of the baseline model. Table 3 also displays the likelihood ratio test for over-identifying restrictions. For all three countries the contemporaneous restrictions implied by

[9] The optimisation algorithm for computing the free parameters and their standard errors is the BFGS method provided in RATS. In order to make sure that we found a global optimum, we used different starting values and checked the robustness of the estimated parameters.

the final estimated matrix A are not rejected, as the likelihood ratio test statistic is far from significant.[10]

Some of our estimates can be compared to what the literature finds. First, we note that the estimated unrestricted output elasticity of net taxes α_{ty} in Germany is very similar to the value of 0.90 that Perotti (2003) imposes for this elasticity. Moreover, the estimated elasticity of real government spending to inflation is equal to –0.45, which is very close, although not directly comparable, to the one assumed by Perotti (2003). As for the other two countries, for Italy we estimate for this elasticity a value of 0.51 and for France a value of 1.94. The latter is not significantly different from the weighted average of the output elasticities of each single tax category estimated in Giorno *et al.* (1995) and Van den Noord (2000), whereas for Italy our unrestricted approach leads to a significantly smaller elasticity.[11]

3. International spill-overs of fiscal shocks

In this section we examine the cross-border effects of domestic fiscal shocks. To this end, we augment the baseline model of the three largest EMU countries (Germany, France and Italy) with their imports from other EU countries and their respective nominal exchange rates during the pre-EMU period. The effects of a fiscal expansion in a large country on the exports of neighbouring countries may operate via several channels: (a) Part of a public spending increase in the big country falls directly on imports. (b) The fiscal expansion stimulates the big-country economy and, thereby, leads to more imports. (c) The prices of the big-country products increase relative to those of the other countries, thereby leading consumers to substitute imports for locally-produced goods. (d) The increase in economic activity in the big country leads to a reaction of its local monetary policy. The latter may support or offset the fiscal expansion. Provided that expansive fiscal shocks have real effects on the domestic activity of the big country, (a) to (c) lead to an increase of domestic imports from its main trading countries, which in turn 'absorb' part of the fiscal stimulus. The latter effect is reduced or strengthened according to the response of monetary policy, which could substitute or complement the fiscal policy.[12]

3.1. Effects on aggregate imports

First, we extend the baseline specification by including aggregate imports from the EU trading partners, as well as a trade-weighted nominal exchange rate. We use the nominal

[10] We have also checked and found that the correlation between the structural spending and net tax shocks is statistically insignificant.

[11] The weighted averages of the output elasticities of each individual net tax component estimated by Giorno et al. (1995) (up to 1992) and Van den Noord (2000) (up to 1999) are, respectively, 2.20 and 2.15 for Germany, 2.01 and 1.35 for France, and 1.49 and 1.93 for Italy. These estimates are based on annual data and are not strictly comparable to the ones we estimate above. (Tax elasticity estimates are sensitive to the estimation period, the frequency of the data, and the method applied. As a result the numbers listed here are only indicative.)

[12] For estimates of complementarity/substitutability of reaction functions, see Wyplosz (1999) and Muscatelli, et al. (2004).

exchange rate in this case, because below we shall simulate the situation of EMU, where the reaction of the nominal exchange rate to a fiscal shock has been shut off. The new specification follows (1), which we again estimate for each of the large countries Germany, France and Italy. However, now the set of endogenous variables is given by $X_t = [\pi_t, g_t, y_t, m_t, t_t, i_t, e_t]'$, where m_t is aggregate real imports of the large country from all EU trading partners in the sample, while e_t is the corresponding trade-weighted average nominal exchange rate. Hence, we assume that imports within the same quarter react to public spending (accounting for the "direct channel" described above) and to output, as is generally the case in Keynesian models. Net taxes are ordered after imports, because we would expect taxes to affect imports with a lag via their effect on output. As before, the short-run interest rate, which can be manipulated almost instantaneously in reaction to developments in the economy, is ordered after all other variables, except for the exchange rate, which as a financial variable can react contemporaneously to all other variables.

Notice that we do not include output of the other countries into the system. The reason is that the resulting structural equation might be mis-specified and any response that follows the domestic fiscal shock could be the result of a combination of other factors (the foreign country monetary and fiscal stance, etcetera) that are not directly accounted for. By simply focusing on the bilateral import of the domestic country from other European countries, not only do we directly analyse the dynamics of the "linking" variable, but at the same time we also have a resulting import equation that is well specified. It includes its main determinants, namely domestic output and the general level of prices, the domestic interest rate, and the bilateral exchange rate.

Figure 3 depicts the impulse responses for German aggregate imports resulting from a positive spending shock or a discretionary reduction in net taxes. The impulse responses of the other variables are virtually the same as under the baseline specification and are not reported. Imports increase after a positive spending shock, but not significantly. This suggests that any direct effect of spending on imports (i.e. the government buying products directly from foreign producers) should play only a minor role. Also, the role of the indirect effect running via increased German economic activity seems only of minor importance, most likely owing to the fact that the increase in German GDP is not very significant and only short-lived. A discretionary reduction in net taxes leads to a significant increase in total imports from EU partners, an effect that can be attributed to the significant stimulus of German activity described earlier. Figure 3 also depicts corresponding impulse responses for French and Italian imports as a result of discretionary shocks in these countries' fiscal policies. A positive spending shock in Italy significantly stimulates imports from its European trading partners, while in the case of France a spending shock has an effect on imports that is just significant. The case of a net tax reduction in France is puzzling, however, because it leads to a (marginally) significant fall in imports.

Table 4 gives an indication of the size of the reaction of aggregate imports to a fiscal impulse. In particular, the table reports the maximum (over the impulse response horizon) elasticity of imports with respect to public spending and net taxes. For Germany the elasticity with respect to public spending is estimated at 0.4, while the elasticities with respect to net taxes for France and Italy are of comparable magnitude. A one-percent net

tax reduction for Germany leads to an increase in imports of approximately 1 percent, while a one-percent increase in public spending for the other two countries boosts aggregate imports by roughly 2 percent. These figures suggest that the effects of fiscal impulses on imports can in some cases be non-trivial.

One of the objectives of this paper is to assess whether a fiscal stimulus in one of the major EU economies could help to stimulate imports and thus activity in neighbouring economies once European monetary unification has taken place. In EMU, the nominal exchange rate is by definition kept fixed, while the short-run interest rate is determined at the union level by the ECB. To the extent that a German, say, fiscal expansion in EMU leads to a rise in German inflation, it may lead to an increase in the short interest rate. However, the effect is diluted, because the weight of Germany in the ECB's objective should correspond to Germany's share in the Euro-area economy.

We can shed some light on the question what the fiscal spill-overs under EMU are by shutting off the endogenous reaction of the nominal exchange rate and the money market rate to fiscal shocks. To this end, the above baseline models are re-estimated, eliminating the nominal exchange rate and the money market rate equations, while maintaining the lagged values of these two variables in each equation of the system.[13] Figure 3 shows the impulse responses of imports when the money market rate and the effective nominal exchange rate are included as exogenous variables rather than endogenous variables. In all the cases, the new impulse responses remain within the original confidence bands. The most substantial deviation from the original impulse responses is detected for the case of an Italian government spending impulse. The initial increase in imports weakens, while the response substantially exceeds the baseline response after two years.

3.2. Effects on bilateral imports

The dynamics of the aggregate imports described in the previous subsection may hide potentially important differences in the movements of bilateral imports by the major economies (Germany, France and Italy) from the individual countries. Therefore, in this subsection, we replace aggregate imports and the trade-weighted nominal exchange rate by their respective bilateral counterparts. Hence, the vector of endogenous variables now becomes $X_t = \left[\pi_t, g_t, y_t, m_t^i, t_t, i_t, e_t^i \right]'$, where m_t^i is the (log) bilateral real import at time t of the major economy from country i, and e_t^i is the (log) bilateral nominal exchange rate at time t expressed in units of the currency of country i for each unit of the currency of the large country. For each major economy, we estimate a model for each European trading partner for which we have data on bilateral trade with the major economy (namely all 15 European Union countries, except for Greece, and where we treat Belgium and Luxemburg as one block). Observe that the new specification allows us not only to study the presence of spill-overs, but at the same time to verify if there are asymmetries between countries due to their respective degree of openness, geographical vicinity and other specific aspects.

[13] We include only the lagged values of these variables, because in the full system these variables are ordered after imports and thus affect imports only with a lag. This way the experiment is made as similar as possible to the case in which the nominal exchange rate and money market rate are included as endogenous variables.

Figure 4a depicts the impulse responses of bilateral imports against Germany after a discretionary reduction in German net taxes.[14] For a majority of the countries – Austria, Belgium/Luxemburg, Denmark, Finland, France, Ireland, Italy and the Netherlands – imports by Germany exhibit a significant increase. For Sweden, Spain and the United Kingdom there are no significant effects and for Portugal the effect is significant in the "wrong" direction. Figure 4b shows the responses of imports to a positive French government spending impulse, while Figure 4c does the same for an Italian government spending increase. For both France and Italy imports from a substantial number of the countries react in a positively significant way to a discretionary government spending increase. We do not report the impulse responses for a reduction in net taxes, because real activity is not significantly affected in France, while it becomes only significant in Italy after a rather long lag. The effects on imports are of correspondingly lesser importance. For completeness, we summarise the effects on the impulse responses of imports in Table 5.

In Figure 4, we also report the impulse responses for imports when we include the interest rate and the nominal exchange rate as exogenous variables, thereby trying to simulate a situation that could more accurately capture the possible spill-overs from fiscal shocks in a monetary union. Figure 4a reports the case of a net tax reduction in Germany. While the new impulse responses always remain within the original confidence bands, the results suggest a strengthening of the spill-over effects on imports from Italy. Figures 4b and 4c show the new impulse responses for a positive spending shock in France and Italy, respectively. In the case of France, the new responses remain within the original confidence bands in all cases, except for imports from Belgium/Luxemburg after two years. Finally, in the case of an Italian spending increase, the new impulse responses differ quite substantially from the original ones in a number of cases. Italian imports from Finland and Sweden exhibit a more persistent increase after the shock, although within the original confidence bands, while for imports from France and Germany the increases are so substantial that the new impulses are outside the original confidence bands three years after the impulse.

[14] We do not show the corresponding impulse responses for a positive German spending shock, because such a shock has only a rather short-lived significant effect on German activity and leads only to a significant increase in imports from France and Ireland, while for Finland and Portugal imports react with a significant decrease.

4. Fiscal spill-overs in a panel trade model[15]

In order to test the robustness of the results of the VAR analysis, in this section we assess the presence of spill-overs from fiscal policy by using a panel trade model. Namely, as in Bun and Klaassen (2002b, 2003),[16] we model bilateral exports at annual frequency according to the following Autoregressive Distributed Lag (ADL) specification:

$$x_{ij,t} = \sum_{s=1}^{n_1} \beta_{1s} x_{ij,t-s} + \sum_{s=0}^{n_2} \beta_{2s} y^{p}_{j,t-s} + \sum_{s=0}^{n_3} \beta_{3s} g_{j,t-s} + \\ + \sum_{s=0}^{n_4} \beta_{4s} rer_{ij,t-s} + \delta' z_{ij,t} + \eta_{ij} + \lambda_t + \tau_{ij} t + \varepsilon_{ij,t}, \tag{5}$$

where $x_{ij,t}$ is the (log) bilateral real export at time t from country i (home country) to j (foreign country), $y^{p}_{j,t}$ is the (log) real private foreign income, $g_{j,t}$ is the (log) real foreign public spending in (consumption and investment) goods and services, and $rer_{ij,t}$ is the (log) bilateral real exchange rate between country i and country j expressed in units of the currency of country i.[17] The vector $z_{ij,t}$ contains the two dummies $EU_{ij,t}$ and $FTA_{ij,t}$. The former scoring one if both country i and j are members of the EU (or European Community) at time t, and zero otherwise. Similarly, $FTA_{ij,t}$ is a dummy equal to one if there is a free trade agreement between country i and j at time t.[18] η_{ij} is the individual effect for the country-pair ij which corrects for the impact of all time-invariant determinants of trade (such as the distance, common border and language, etc), λ_t is a time effect controlling for the general state of the world economy, and τ_{ij} is a parameter representing the omitted trending export determinants between country-pairs. All effects are treated as fixed instead of random. Finally, $\varepsilon_{ij,t}$ is a zero-mean random variable uncorrelated over time and country pairs. We also estimate variations on equation (5), where we replace the government spending variables with other fiscal variables.

In using yearly data, we are able to extend the country sample and the time span substantially. This allows us to measure the fiscal spill-overs taking into account all possible bilateral trade connections between countries. Additionally, we are able to assess the asymmetric role of different components of public expenditure by simply disentangling $g_{j,t}$ into its main components. The main drawback of a panel model, however, is that,

[15] This section is based joint work with Franc Klaassen, whom we thank for his inputs.

[16] Lane and Perotti (1998) explore the short-run impact of movements in different components of fiscal policy on trade balance, exports and imports using yearly data for a panel of 17 OECD countries over 1960-1995. Here we account for the presence of long-run relationships and the dynamic relationship between the sequential paths for fiscal policy and the trade flows. In addition, we enlarge the information set by accounting for all bilateral relationships between countries.

[17] We split total output into government spending on goods and services and private output to directly estimate the effects of public spending on exports.

[18] See the Appendix for data construction and definitions of the dataset.

although time-invariant country-pair fixed effects are directly accounted for, we assume homogeneity of the slope parameters. Moreover, whereas in a VAR system we are able to control for the endogenous feedback effects between the variables, within a single equation approach such effects are hard to estimate. For instance, a domestic fiscal policy implemented through a net tax change affects the trade flows mainly thought output effects. As a result, it would be difficult to measure the overall effects of tax changes in a trade model that includes output.

We employ annual data over the period 1965-2002 for 11 EU countries. Belgium and Luxembourg are taken together, because the export data are only available at the Belgium-Luxembourg Economic Union level. Denmark, Greece and Spain are excluded because of fiscal data availability. We report the results in which two lags of each dependent variable are included. This is a general specification that seems to capture well the dynamics of the bilateral export equation. We also test for the robustness of the results to a longer (three) and shorter (one) lag structure, and to the inclusion of the county-pair specific time trend. The results are robust to these changes in the specification.

Column 1 of Table 6 displays the least squared dummy variable (LSDV) estimates of the baseline model (5).[19] As expected, bilateral export flows are very persistent implying that lagged exports are important determinants of current exports. Foreign private output and the real exchange rate have the expected positive effects, while common membership of a free trade area raises bilateral exports significantly. Common EU (or European Community) membership leads to a further increase in bilateral exports.[20] More importantly, we find that an increase in foreign government spending is associated with a domestic increase in the level of exports. One needs to be careful, though, in interpreting the channels through which a change in public spending affects exports. While an increase in foreign public spending may fall directly on domestic products, the increase in foreign income and thus higher import spending is probably the more important channel. The results can be appreciated in Figure 5a, which shows the dynamic responses of bilateral exports to a temporary change in bilateral real exchange rate, the foreign private output and the foreign public expenditure over a 4-year horizon.

In column 2 we disentangle the public spending into its two components, namely government consumption cg and government investment ig. The latter seems to be the driving force of the results in column 1. However, including these components separately (columns 3 and 4) indicates that both have a significant positive effect on bilateral exports. The government investment effect is smaller than the effect of government consumption, which is consistent with the fact that government investment is a much smaller component of government spending than is government consumption. Ceteris paribus, we would expect a one-percent increase in government investment to lead to a smaller percentage

[19] The bias of LSDV for dynamic panel data can be sizeable when the number of time periods is finite and the number of country-pairs goes to infinity. However, when the time dimension of the panel is large as in our sample, the bias is small and LSDV outperforms standard GMM estimation. Bun and Klaassen (2002a) show that LSDV for a similar data set yields accurate estimates. See Judson and Owen (1999) for a discussion based on a Monte Carlo analysis.

[20] Rose (2000) estimates the effect of currency membership on international trade.

increase in bilateral trade. Finally, column 5 augments the baseline specification with government net taxes nt. Although the latter is not cyclically adjusted, and thus includes a component possibly endogenous to income changes, it has a statistically significant negative effect.

In the VAR analysis we studied the effect of discretionary home fiscal policy shocks on the bilateral imports. To make our panel results more directly comparable to the SVAR and test the robustness of the baseline model, we replace g with a measure of the discretionary public spending shock dg (see the Appendix for a description of its construction). The results are shown in column 1 of Table 7, from which it can be seen that the effect of foreign public spending on domestic exports remains positive and statistically significant, and of similar magnitude as before (see Figure 5b).

In column 2 we replace the public spending shock with a discretionary measure of net tax shock dnt (see Appendix), which controls for the automatic response of net taxes to output changes. The findings are very much in accordance with the SVAR results. Namely, a discretionary increase in foreign net taxes is associated with a statistically significant reduction of domestic exports (Figure 5c). Including the two fiscal shocks together (column 3) produces very similar results (Figure 5d).

The effect of fiscal policy shocks on trade estimated in the above models might be biased downward in the case of Keynesian effects working through private output, or upwards in the case of non-Keynesian effects. In order to answer this question and have an estimate the overall effect of government spending and net tax changes on bilateral exports, we exclude private output from the above three specifications. Columns 4, 5 and 6 show the results from which it is easy to see that foreign fiscal shocks tend to have larger effects on domestic exports for both the public and the net tax shock. Although consistent with a positive indirect effect of fiscal expansions on private output, these findings have to be interpreted with caution, in that our estimates might be biased because of omitted variables. Overall, the results of the trade panel model further reinforce the results obtained in the SVAR models and point to the presence of significant international spill-overs of fiscal policy.

5. Concluding remarks

A major policy question concerns the need for the coordination of fiscal policies, now that there is a common monetary policy in the Euro area. However, there can only be a rationale for fiscal coordination if national fiscal policies have non-trivial effects on other economies. This paper has tried to address this issue empirically, by extending recent analyses of the domestic effects of fiscal impulses to the effects on imports of major EU economies from their trading partners. There exist a variety of potential channels through which a fiscal impulse may affect imports. Yet, it turns out that the main effects run via the stimulus that a fiscal impulse provides to economic activity in the major economies, which in turn leads to more imports from other countries. In many cases this "indirect" channel is relevant, in particular when we consider bilateral imports. By shutting off the effects of the

fiscal shocks on the exchange rate and the short-run interest rate, so as to simulate a situation that corresponds more closely to the EMU case, these results are on average somewhat strengthened.

We have also explored whether the results from the VAR analysis are consistent with the results from a panel data analysis that links bilateral exports to fiscal variables (as well as "traditional" variables determining trade). We find that total or discretionary increases in public spending or reductions in net taxes turn out to have statistically and economically significant positive effects on international trade. The outcomes from the panel data analysis thus are in accordance with those from the VAR analysis.

Overall, our analysis suggests that it might be worthwhile to explore further the scope for enhanced fiscal coordination at the macroeconomic level. Of course, by imposing in the SVAR analysis a common model on the reaction of major country imports from other countries after a domestic fiscal shock, we can only expect to uncover suggestive tendencies in the data. To get a firmer grip on the size of the spill-overs via imports and on the differences in the responses of imports from the various countries, a more detailed and country-specific modelling of the import equations would be desirable. Similarly, in the panel data model it would be desirable to relax the assumption that bilateral exports react in a homogeneous fashion to changes in fiscal policy. However, we leave these refinements for further research.

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Appendix

A. Data sources and description of the quarterly data

Data sources are the Business Sector Database (BSDB), the Main Economic Indicators (MEI) and Economic Outlook (EO) of the OECD Statistical Compendium; the International Financial Statistics (IFS) of the International Monetary Fund (IMF) Database; and the Direction of Trade Statistics (DTS).

Fiscal variables

The BSDB and the IFS contain *quarterly* data for the following:

CGW	=	Government Consumption, Wages
CGNW	=	Government Consumption, Excluding Wages
IG	=	Fixed Investment, Government
TIND	=	Indirect Taxes
TSUB	=	Subsidies
TYB	=	Direct Taxes, Business
TYH	=	Direct Taxes, Households

The EO provides time series at *semi-annual* frequency for the following variables:

SSPG	=	Social Benefits Paid by Government
TRPG	=	Other Current Transfers Paid by Government
SSRG	=	Social Security Contributions Received by Government
TRRG	=	Other Current Transfers Received by Government

Semi-annual data are interpolated to quarterly data, using quadratic matching.

We construct:

PUBLIC SPENDING	=	CGNW + CGW + IG
REVENUES	=	TYH + TYB + TIND + SSRG + TRRG
TRANFERS	=	TSUB + SSPG + TRPG
NET TAXES	=	REVENUES - TRANFERS

Trade variables

The bilateral import flows and nominal exchange rates are collected from the DTS. The original data on bilateral imports are expressed in current prices and currencies of the exporting country, and are then all deflated to 1995 with the exporting country GDP deflator.

The aggregate import flows of Germany, France and Italy from the rest of European Union (EU) countries have been calculated by converting the real bilateral import flows above into US dollars, by using the PPP conversion rates for 1995 available in the Penn World Table 6.1.

The trade-weighted nominal exchange rates were calculated by first creating an index (base year 1995 = 100) for each bilateral nominal exchange rate of the major economy versus each of the remaining EU countries. We have then taken a weighted average of these indices using relative weights based on the real bilateral imports expressed in US dollars, as calculated above.

Other variables

The BSDB, MEI and the IFS contain *quarterly* data for the following:

GDPV	=	Gross Domestic Product (Market Prices), Volume
PGDP	=	Deflator for GDP, base year 1995 = 100
MMR	=	Money Market Rate (line 60b, IFS)
CPI	=	Consumer Price Index (MEI)
REER	=	Real Effective Exchange Rate (line 7001K, MEI)

Variables used in the VAR systems

y	=	log of GDPV
π	=	log of CPI – log of CPI(-1)
i	=	level of MMR
s	=	log of REER
g	=	log of PUBLIC SPENDING, deflated with PGDP
t	=	log of NET TAXES, deflated with PGDP
m	=	log of real aggregate imports from the other EU countries
e	=	log of trade-weighted nominal exchange rate versus the other EU countries
m^i	=	log of real imports from country i
e^i	=	log of nominal exchange rate versus country i

Countries and samples used in the VAR estimation

GERMANY	=	1970:2 – 1998:4
FRANCE	=	1970:2 – 1998:4
ITALY	=	1971:1 – 1998:4

B. Data sources and description of the annual data

Data sources are the Economic Outlook (EO) of the OECD Statistical Compendium; the International Financial Statistics (IFS) of the International Monetary Fund (IMF) Database; and the Direction of Trade Statistics (DTS).

Fiscal variables

The EO provides time series at *annual* frequency for the following variables:

CGAA	=	Government Consumption
IGAA	=	Fixed Investment, Government
PCG	=	Deflator, Public Consumption (base year 1995 =100)
PIG	=	Deflator, Fixed Investment, Government (base year 1995 =100)
TIND	=	Indirect Taxes
TSUB	=	Subsidies
TY	=	Direct Taxes
SSPG	=	Social Benefits Paid by Government
TRPG	=	Other Current Transfers Paid by Government
SSRG	=	Social Security Contributions Received by Government
TRRG	=	Other Current Transfers Received by Government

Additional variables

GDP	=	Gross Domestic Product (Market Prices), Value
PGDP	=	Deflator for GDP at Market Prices (base year 1995 =100)

From the above series, we construct the following variables:

Y	=	Real GDP (GDP*100/PGDP)
G	=	Real Public Spending (CGAA*100/PCG + IGAA*100/PIG)
PY	=	Real Private GDP (Y – G)
IG	=	Real Government Investment (IGAA*100/PIG)
CG	=	Real Government Consumption (CGAA*100/PCG)
REVENUES	=	TY + TIND + SSRG + TRRG
TRANFERS	=	TSUB + SSPG + TRPG
NT	=	Real Net Taxes (REVENUES – TRANFERS)*100/PGDP

Note that due to short data availability for Ireland and the Netherlands, TRPG and TRRG are not included in the calculation of REVENUES and TRANFERS for these countries.

Trade variables

The real bilateral export flows X_{ij} are taken from Bun and Klaassen (2002) (updated with the year 2002) and are constructed as the sum of monthly real exports, where the latter is the nominal domestic currency value of exports divided by a domestic price index. The nominal domestic currency value of exports is obtained by converting the original dollar

denominated export values of the DTS. The real bilateral exchange rate RER_{ij} is the average of the monthly real rates computed using nominal rates and the same price indices used above.

Dummies

The dummies $EU_{ij,t}$ and $FTA_{ij,t}$ control for the effects of free trade between the country pairs i and j. $EU_{ij,t}$ is one if both i and j are members of the EU (or European Community, EC) at time t. Similarly, $FTA_{ij,t}$ is a dummy scoring one if there is a free trade agreement between country i and j at time t. Hence, when both i and j are in the EU, $EU_{ij,t} + FTA_{ij,t} = 2$. The precise dating of the membership of the EU or a free trade agreement is available in Bun and Klaassen (2002b).

Variables used in the panel estimation

y^p	=	log(PY)
y	=	log(Y)
g	=	log(G)
ig	=	log(IG)
cg	=	log(CG)
nt	=	log(NT)
x_{ij}	=	log(X_{ij})
rer_{ij}	=	log(RER_{ij})

Country and data samples:

The panel trade model is estimated for 11 EU countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, United Kingdom, and Sweden. Trade variables for Belgium includes trade flows of Luxembourg. Denmark, Greece and Spain are excluded because the relevant fiscal variables are either missing or too short.
For most countries the sample starts in 1965, with the only exception of the United Kingdom and Belgium (1970). Net Taxes for Ireland and the Netherlands are only available from 1977 and 1969, respectively.

B.1 Constructing a measure of discretionary fiscal policy

In order to construct measures of unexpected or discretionary public spending shock (*dg*), we follow the approach suggested in Fatás and Mihov (2003). Namely, we take the residuals from the following country-specific fiscal rule:

$$g_{i,t} = \alpha_{i1} + \alpha_{i2}t + \beta_{i1}y^{p}_{i,t} + \beta_{i2}y^{p}_{i,t-1} + \gamma_{i1}g_{i,t-1} + \gamma_{i2}g_{i,t-2} + dg_{i,t} \qquad \text{(B.1)}$$

where we instrument the contemporaneous private output with three lags of private output, the index of oil prices, two lags of the GDP deflator and the U.S. private output.

We follow the same approach to calculate a discretionary net tax shock (*dnt*), by taking the residuals from the following net tax rule:

$$nt_{i,t} = \delta_{i1} + \delta_{i2}t + \phi_{i1}y_{i,t} + \phi_{i2}y_{i,t-1} + \omega_{i1}nt_{i,t-1} + \omega_{i2}nt_{i,t-2} + dnt_{i,t} \qquad \text{(B.2)}$$

where we instrument the contemporaneous output with three lags of output, the index of oil prices, two lags of the GDP deflator, and the U.S. output.

Table 1: Output Multipliers of the Fiscal Shocks

	Germany	France	Italy
Government Spending Multiplier			
Impact Size	1.15*	1.52*	0.45
Maximum Size (period)	1.15* (0)	2.75* (8)	1.69* (2)
Minimum Size (period)	-1.97 (12)	1.00 (4)	-1.01 (9)
Government Net Tax Multiplier			
Maximum Size (period)	1.54* (5)	0.07 (4)	3.34* (10)
Minimum Size (period)	0.00 (0)	-0.20 (9)	0.00 (0)

Notes: The table reports the impact, maximum and minimum output response to a government spending (net tax) expansive shock of a size equal to 1 percent of GDP. Stars indicate statistical significance (see Notes to Figure 1a). The number in round brackets is the quarter in which the maximum or minimum effect occurs.

Table 2: Stability Tests in the Baseline Model

	π	g	y	t	i	s
Chow Breakpoint Test						
Breakpoint: 1985Q1						
Germany	1.19	1.49	2.01*	1.86	1.19	1.61
France	1.12	2.16*	2.18*	1.68	1.73	1.67
Italy	2.70*	1.81	1.56	3.92*	0.92	1.84
Breakpoint: 1987Q1						
Germany	1.17	1.66	1.64	1.49	0.66	1.77
France	0.97	1.29	0.89	0.99	1.30	1.15
Italy	0.97	0.82	1.78	1.44	1.27	1.52
Chow Forecast Test						
Breakpoint: 1985Q1						
Germany	0.96	3.37*	1.56	1.24	0.54	1.61
France	0.56	1.11	2.04	0.94	1.11	1.01
Italy	1.09	0.74	1.97	2.06	0.85	0.84
Breakpoint: 1993Q1						
Germany	1.01	1.39	1.36	0.52	0.60	0.91
France	0.58	1.36	0.44	0.64	1.56	0.77
Italy	0.80	1.01	0.93	1.11	0.69	0.92

Notes: The table displays the statistics from Chow tests (breakpoint and forecast) on each reduced-form equation of the baseline model. The test statistic is distributed according to an F-distribution. The null hypothesis refers to the presence of no structural change. (*) indicates statistical significance at 5% level.

Table 3: Recursive and Structural VAR Estimates

	Germany		France		Italy	
	Choleski	*SVAR*	*Choleski*	*SVAR*	*Choleski*	*SVAR*
$\alpha_{g\pi}$	-0.475 (0.330)	-0.475 (0.329)	-0.467* (0.142)	-0.467* (0.144)	-0.612* (0.171)	-0.611* (0.173)
$\alpha_{y\pi}$	0.285 (0.170)	0.284 (0.175)	0.153 (0.114)		-0.033 (0.109)	
α_{yg}	0.249* (0.047)	0.248* (0.047)	0.316* (0.074)	0.286* (0.070)	0.083 (0.060)	0.088 (0.056)
$\alpha_{t\pi}$	1.724* (0.617)	1.588* (0.599)	0.414 (0.632)		-0.488* (0.183)	-0.473* (0.172)
α_{tg}	0.223 (0.196)		-0.444 (0.452)		-0.024 (0.094)	
α_{ty}	0.695* (0.335)	0.873* (0.324)	2.158* (0.522)	1.942* (0.479)	0.521* (0.158)	0.515* (0.157)
$\alpha_{i\pi}$	0.620* (0.195)	0.667* (0.185)	0.712* (0.191)	0.735* (0.194)	0.862* (0.154)	0.877* (0.149)
α_{ig}	0.116* (0.058)	0.128* (0.051)	0.276* (0.139)	0.342* (0.130)	-0.220* (0.082)	-0.221* (0.083)
α_{iy}	0.014 (0.107)		0.218 (0.187)		-0.011 (0.140)	
α_{it}	0.022 (0.032)		-0.080* (0.035)	-0.066* (0.033)	-0.030 (0.077)	
$\alpha_{s\pi}$	0.247 (0.538)		0.488 (0.372)	0.528 (0.336)	-0.298 (0.478)	
α_{sg}	-0.184 (0.156)		-0.070 (0.253)		0.192 (0.249)	
α_{sy}	0.251 (0.280)		-0.124 (0.333)		-0.257 (0.249)	
α_{st}	-0.037 (0.082)		-0.001 (0.056)		0.367 (0.223)	0.341 (0.206)
α_{si}	-0.092 (0.241)		-0.361* (0.167)	-0.379* (0.153)	0.238 (0.264)	
LR Test		4.837		6.139		2.291
p-value		0.774		0.523		0.970

Notes: the table shows the estimates of the contemporaneous coefficients (and their respective standard errors in parenthesis) of matrix A. (*) indicates statistical significance at a 5% level. The selected matrix contains all coefficients that are statistically significant up to a 15% level. The LR Test is a likelihood ratio test for the over-identifying restrictions of the final structural VAR.

Table 4: Maximum Elasticities of Aggregate Imports

	Elasticity with respect to	
	public spending	**net taxes**
Germany	0.42 (1)	0.90 (6)
France	1.90 (9)	0.37 (15)
Italy	1.82 (2)	0.52 (5)

Notes: The number between brackets is the quarter of the impulse response for which the maximum elasticity is reached.

Table 5: Effects of Domestic Fiscal Shocks on Bilateral Imports

	Germany		**France**		**Italy**	
	g	*t*	*g*	*t*	*g*	*t*
Austria	=	+	=	=	+	=
Belgium/Lux.	=	+	+	=	+	=
Denmark	=	+	=	=	=	+
Finland	-	+	=	=	=	=
France	+	+			+	=
Germany			=	-	+	=
Ireland	+	+	+	+	=	+
Italy	=	+	+	+		
Netherlands	=	+	-	-	+	=
Portugal	-	-	=	=	=	=
Spain	=	=	+/-	=	+	-
Sweden	=	=	+	=	+	=
U.K.	=	=	=	=	=	+

Notes: the column with *g* (*t*) summarises the effects of a positive shock to public spending (a discretionary reduction in net taxes) on the bilateral imports from the remaining countries. "+", "-" and "=" respectively stand for a significant increase, a significant decrease or a stable reaction of the bilateral imports. "+/-" indicates a significantly positive response followed by a significantly negative response over the 16 quarter horizon period. Greece is not included.

Table 6: Bilateral Export Panel Model

	1	*2*	*3*	*4*	*5*
$x_{ij,t-1}$	0.622***	0.622***	0.623***	0.624***	0.623***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.054)
$x_{ij,t-2}$	0.056	0.056	0.054	0.054	0.051
	(0.044)	(0.044)	(0.044)	(0.044)	(0.049)
$rer_{ij,t}$	0.473***	0.473***	0.471***	0.471***	0.503***
	(0.037)	(0.038)	(0.037)	(0.037)	(0.037)
$rer_{ij,t-1}$	-0.116**	-0.114**	-0.114**	-0.113**	-0.130**
	(0.052)	(0.052)	(0.052)	(0.038)	(0.053)
$rer_{ij,t-2}$	-0.107***	-0.113***	-0.107***	-0.107***	-0.121***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.041)
$y^p_{j,t}$	1.161***	1.140***	1.160***	1.185***	1.389***
	(0.106)	(0.105)	(0.107)	(0.103)	(0.106)
$y^p_{j,t-1}$	-0.672***	-0.619***	-0.641***	-0.642***	-0.664***
	(0.168)	(0.167)	(0.168)	(0.165)	(0.168)
$y^p_{j,t-2}$	-0.251**	-0.271**	-0.251**	-0.281**	-0.400**
	(0.058)	(0.116)	(0.116)	(0.115)	(0.058)
$g_{j,t}$	0.311***				0.276**
	(0.106)				(0.120)
$g_{j,t-1}$	-0.245				-0.345*
	(0.163)				(0.186)
$g_{j,t-2}$	-0.089				0.075
	(0.102)				(0.129)
$cg_{j,t}$		0.164	0.272**		
		(0.131)	(0.127)		
$cg_{j,t-1}$		-0.301	-0.318		
		(0.205)	(0.206)		
$cg_{j,t-2}$		0.086	0.006		
		(0.143)	(0.131)		
$ig_{j,t}$		0.054**		0.060***	
		(0.022)		(0.021)	
$ig_{j,t-1}$		-0.006		-0.016	
		(0.037)		(0.035)	
$ig_{j,t-2}$		-0.038		-0.042	
		(0.028)		(0.026)	
$nt_{j,t}$					-0.136**
					(0.063)
$nt_{j,t-1}$					0.031
					(0.068)
$nt_{j,t-2}$					0.027
					(0.045)
EU	0.043***	0.044***	0.043***	0.043***	0.044***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
FTA	0.075***	0.075***	0.076***	0.075***	0.066***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
Panel size	110	110	110	110	110
Observations	3860	3860	3860	3860	3700

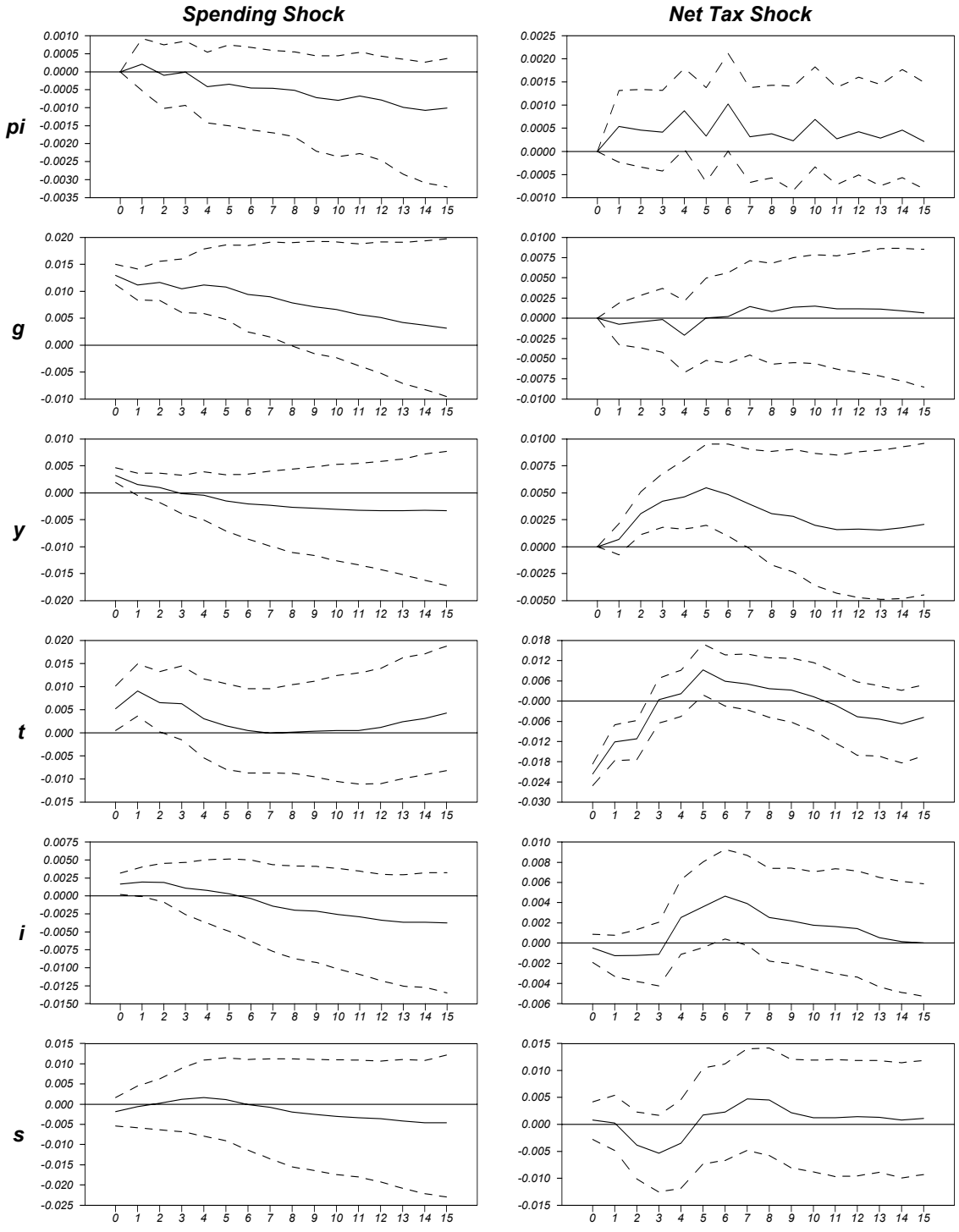
Notes: the table shows the estimates of the coefficients (and their respective standard errors in parentheses) in alternative specifications of model (5). (*), (**) and (***) indicate statistical significance at 10%, 5% and 1% level, respectively. Each model is estimated with a time effect, country-pair fixed effects and country-pair time trends. See the Appendix for variable definitions.

Table 7: Bilateral Export Panel Model with Fiscal Shocks

	1	*2*	*3*	*4*	*5*	*6*
$x_{ij,t-1}$	0.623***	0.637***	0.633***	0.648***	0.654***	0.648***
	(0.049)	(0.052)	(0.052)	(0.049)	(0.051)	(0.051)
$x_{ij,t-2}$	0.055	0.047	0.052	0.029	0.028	0.033
	(0.045)	(0.048)	(0.048)	(0.045)	(0.045)	(0.047)
$rer_{ij,t}$	0.478***	0.478***	0.489***	0.524***	0.512***	0.521***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.038)	(0.038)
$rer_{ij,t-1}$	-0.102*	-0.103*	-0.089*	-0.198***	-0.161***	-0.148***
	(0.052)	(0.051)	(0.052)	(0.052)	(0.052)	(0.052)
$rer_{ij,t-2}$	-0.131***	-0.139***	-0.167***	-0.115***	-0.150***	-0.175***
	(0.038)	(0.038)	(0.039)	(0.038)	(0.039)	(0.039)
$y^p_{j,t}$	1.226***	1.196***	1.223***			
	(0.107)	(0.129)	(0.132)			
$y^p_{j,t-1}$	-0.681***	-0.689***	-0.762***			
	(0.168)	(0.200)	(0.202)			
$y^p_{j,t-2}$	-0.248**	-0.232**	-0.204			
	(0.116)	(0.140)	(0.141)			
$dg_{j,t}$	0.329***		0.287**	0.403***		0.335***
	(0.114)		(0.118)	(0.120)		(0.119)
$dg_{j,t-1}$	0.119		-0.002	0.173*		0.018
	(0.112)		(0.113)	(0.110)		(0.113)
$dg_{j,t-2}$	-0.108		-0.064	-0.119		-0.097
	(0.110)		(0.108)	(0.115)		(0.083)
$dnt_{j,t}$		-0.139**	-0.137**		-0.259***	-0.260***
		(0.062)	(0.063)		(0.058)	(0.058)
$dnt_{j,t-1}$		-0.095*	-0.098*		-0.223***	-0.222***
		(0.057)	(0.056)		(0.054)	(0.052)
$dnt_{j,t-2}$		-0.043	-0.039		-0.077	-0.067
		(0.052)	(0.052)		(0.050)	(0.049)
EU	0.045***	0.043***	0.042***	0.047***	0.059***	0.041***
	(0.009)	(0.001)	(0.010)	(0.009)	(0.010)	(0.011)
FTA	0.085***	0.075***	0.077***	0.077***	0.074***	0.076***
	(0.013)	(0.014)	(0.014)	(0.013)	(0.014)	(0.013)
Panel size	110	110	110	110	110	110
Observations	3790	3600	3580	3790	3600	3580

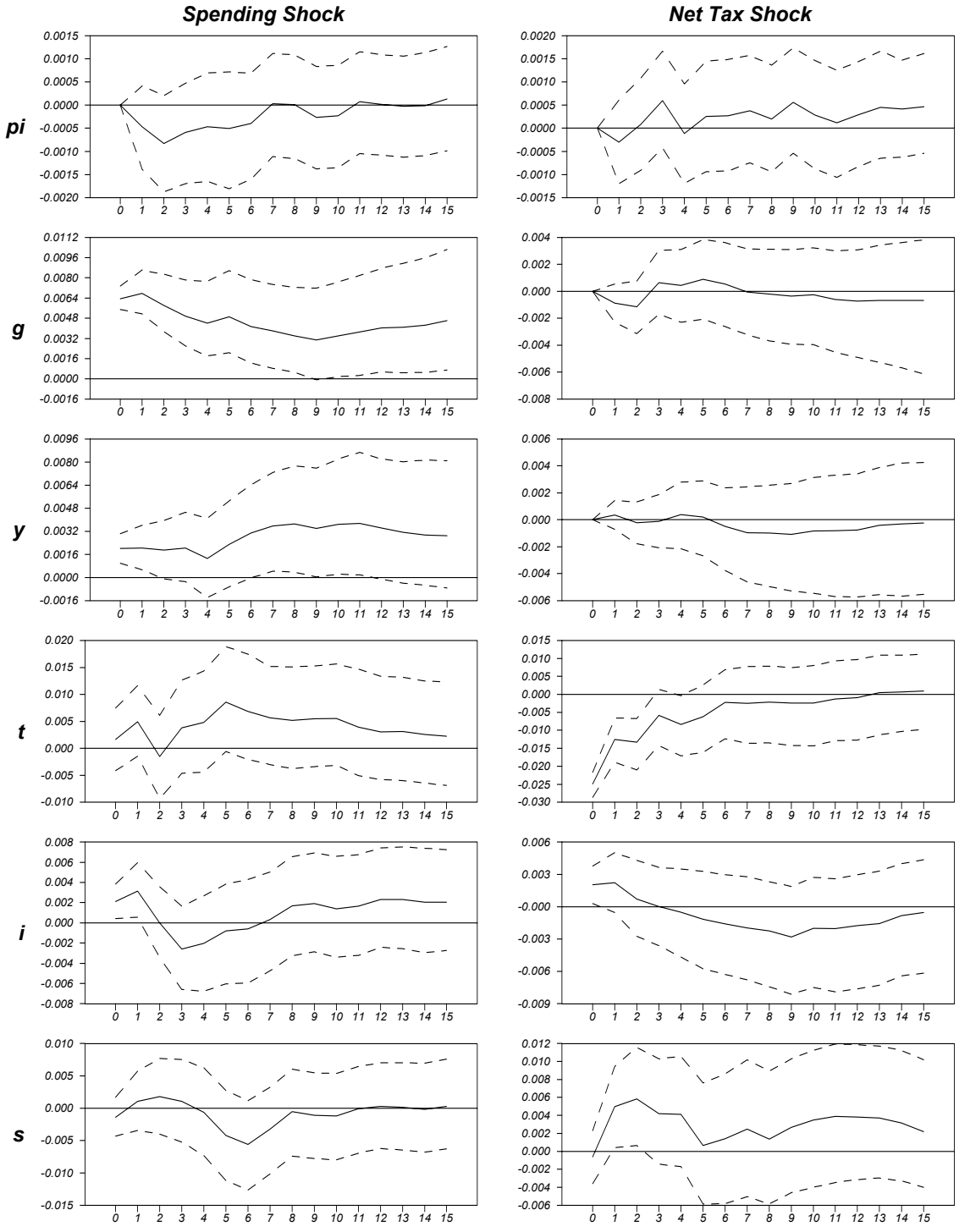
Notes: the table shows the estimates of the coefficients (and their respective standard errors in parenthesis) in alternative specifications of model (5). (*), (**) and (***) indicate statistical significance at 10%, 5% and 1% level, respectively. Each model is estimated with a time effect, country-pair fixed effects and country-pair time trends. See the Appendix for variable definitions.

Figure 1a: Impulse Responses to a Fiscal Expansion for Germany



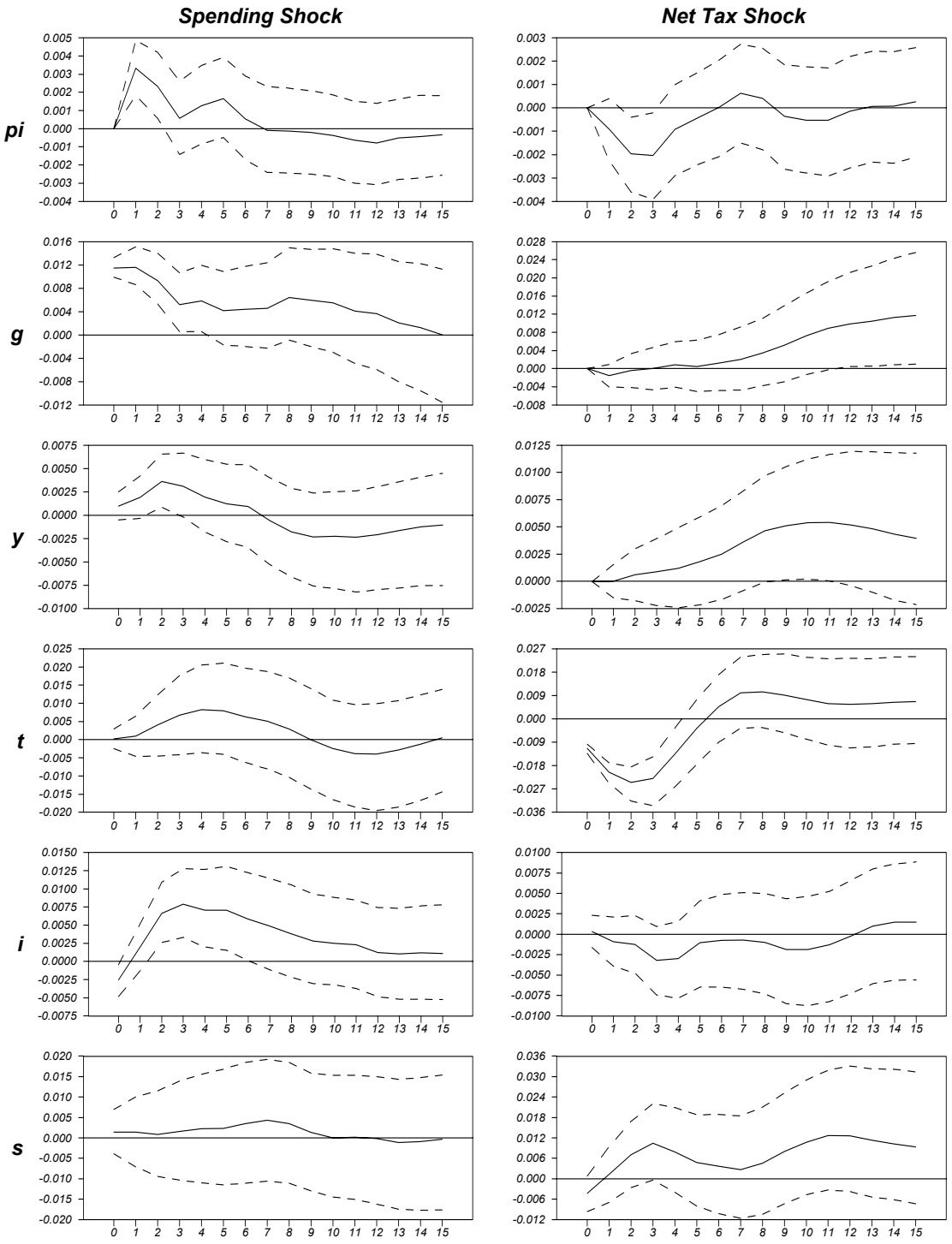
Notes: the graphs report the mean impulse response (solid line) and the 90% confidence band (dashed line) formed by the 5th and the 95th percentile based on 1,000 Monte Carlo simulations.

Figure 1b: Impulse Responses to a Fiscal Expansion for France



Notes: see Figure 1a.

Figure 1c: Impulse Responses to a Fiscal Expansion for Italy



Notes: see Figure 1a.

Figure 2: Forecast Error Variance Decomposition of Output

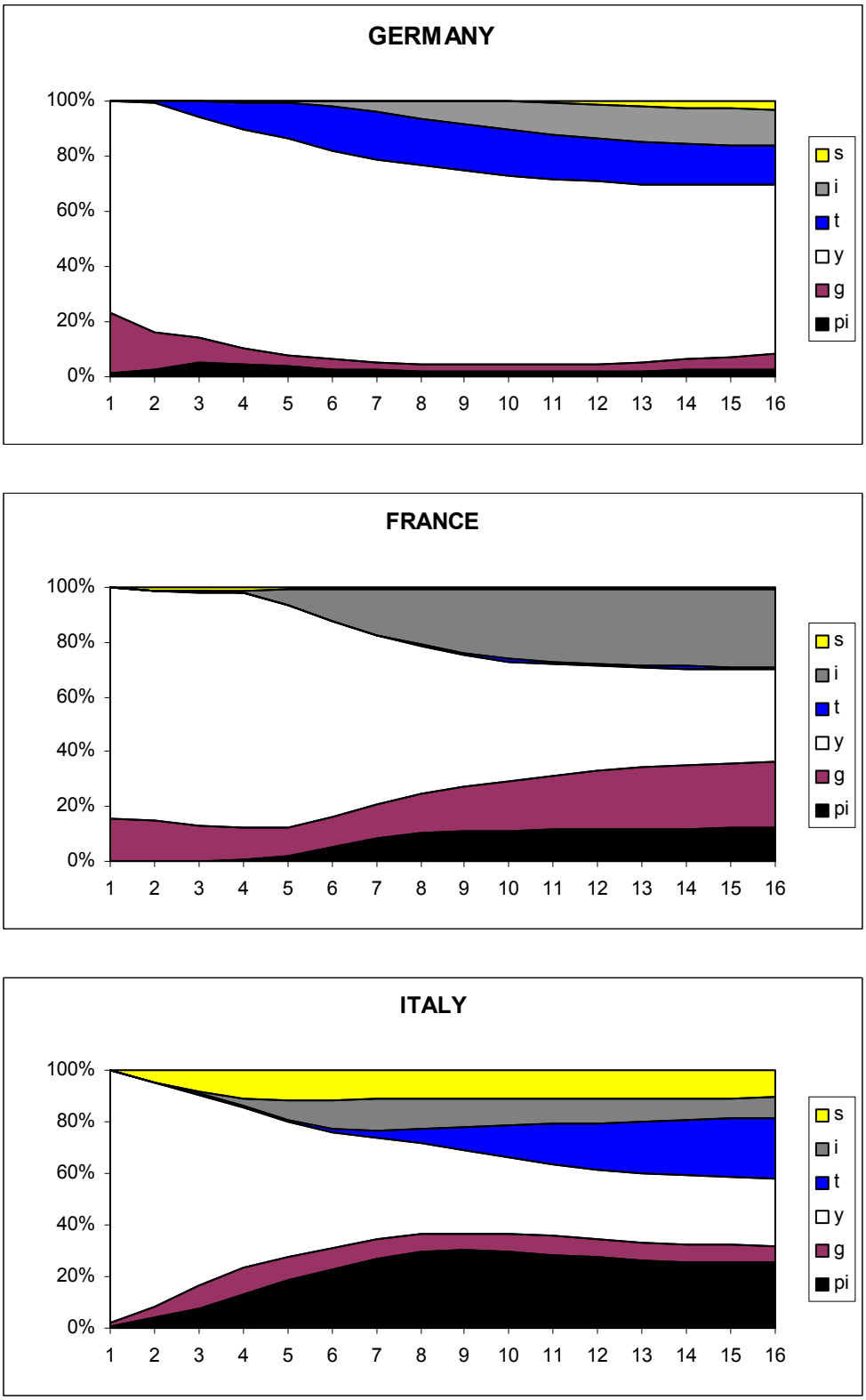
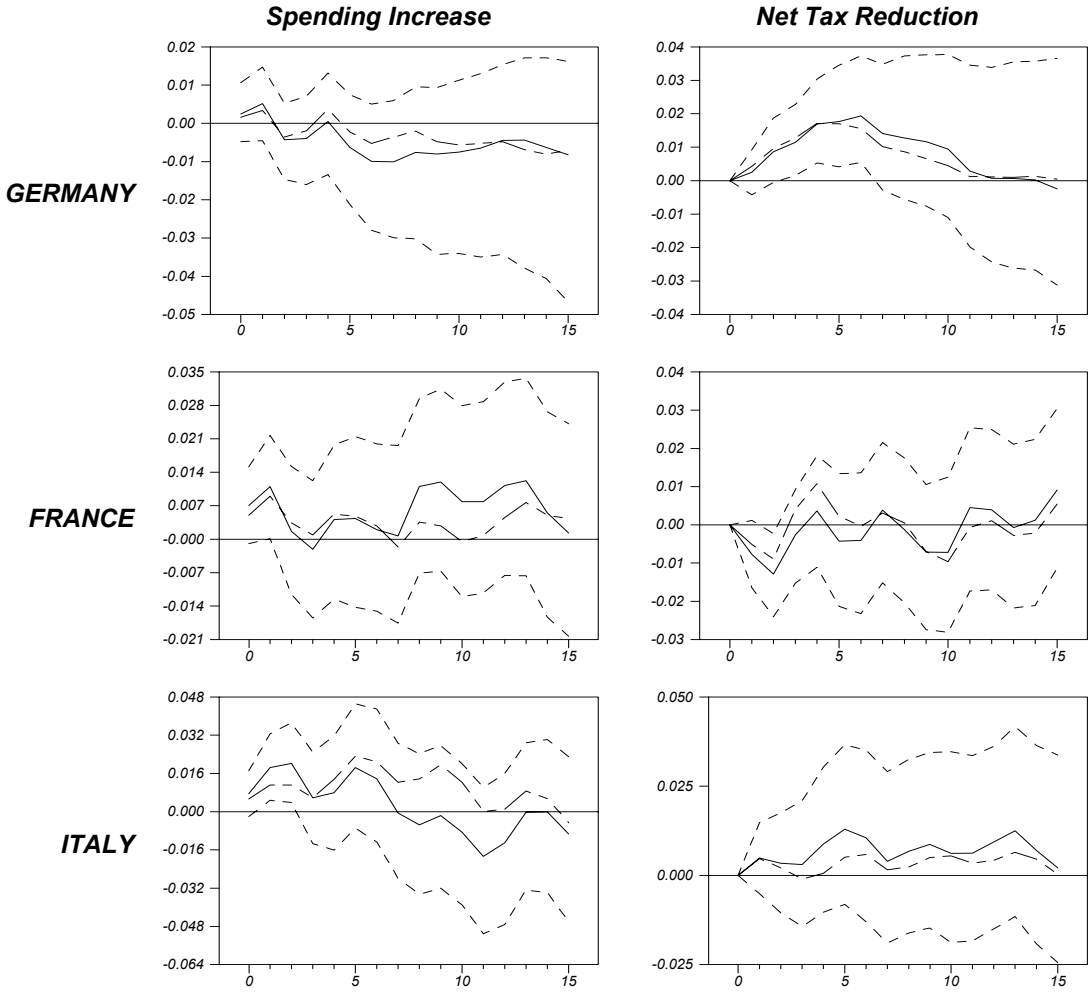
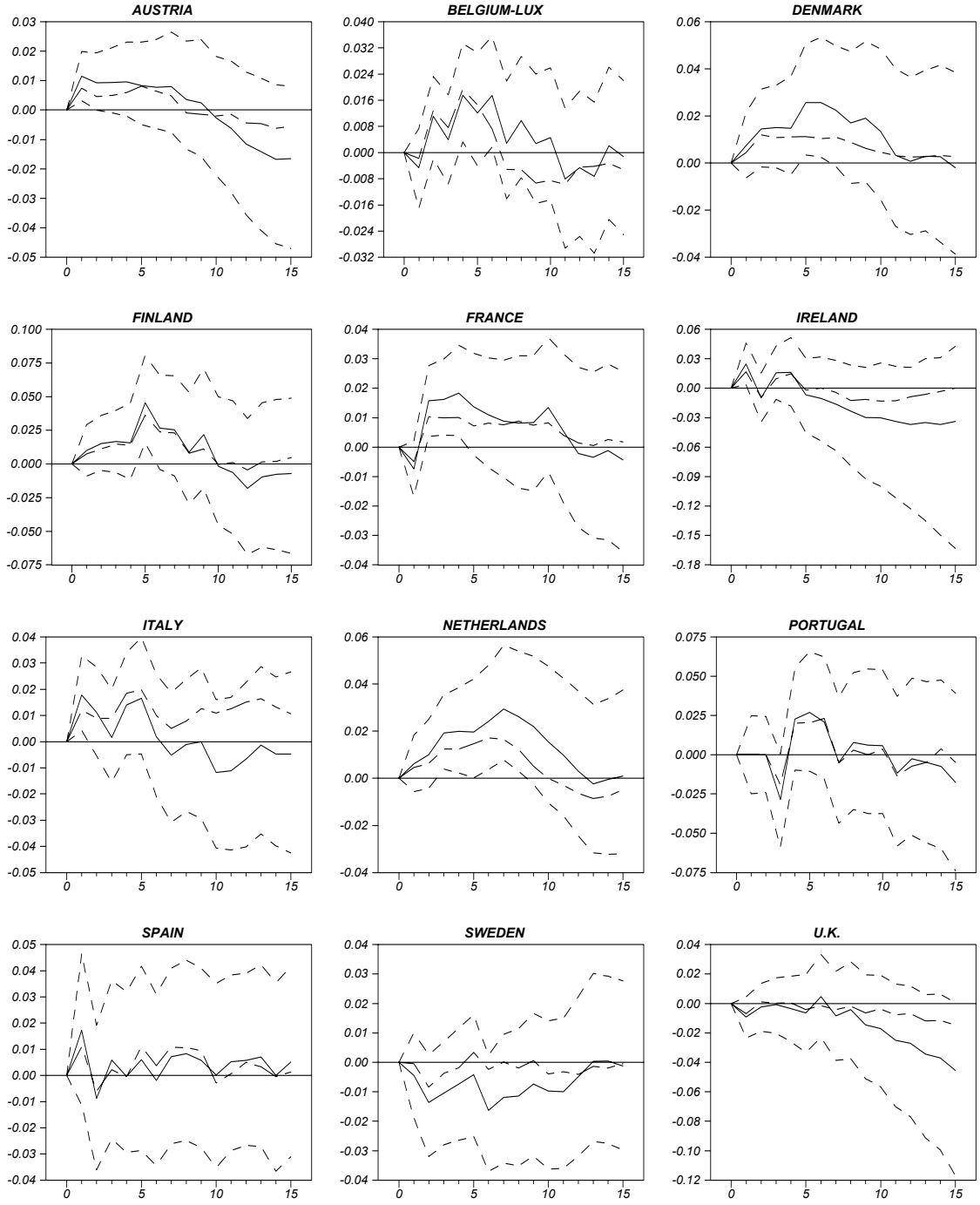


Figure 3: Impulse Responses for Aggregate Imports



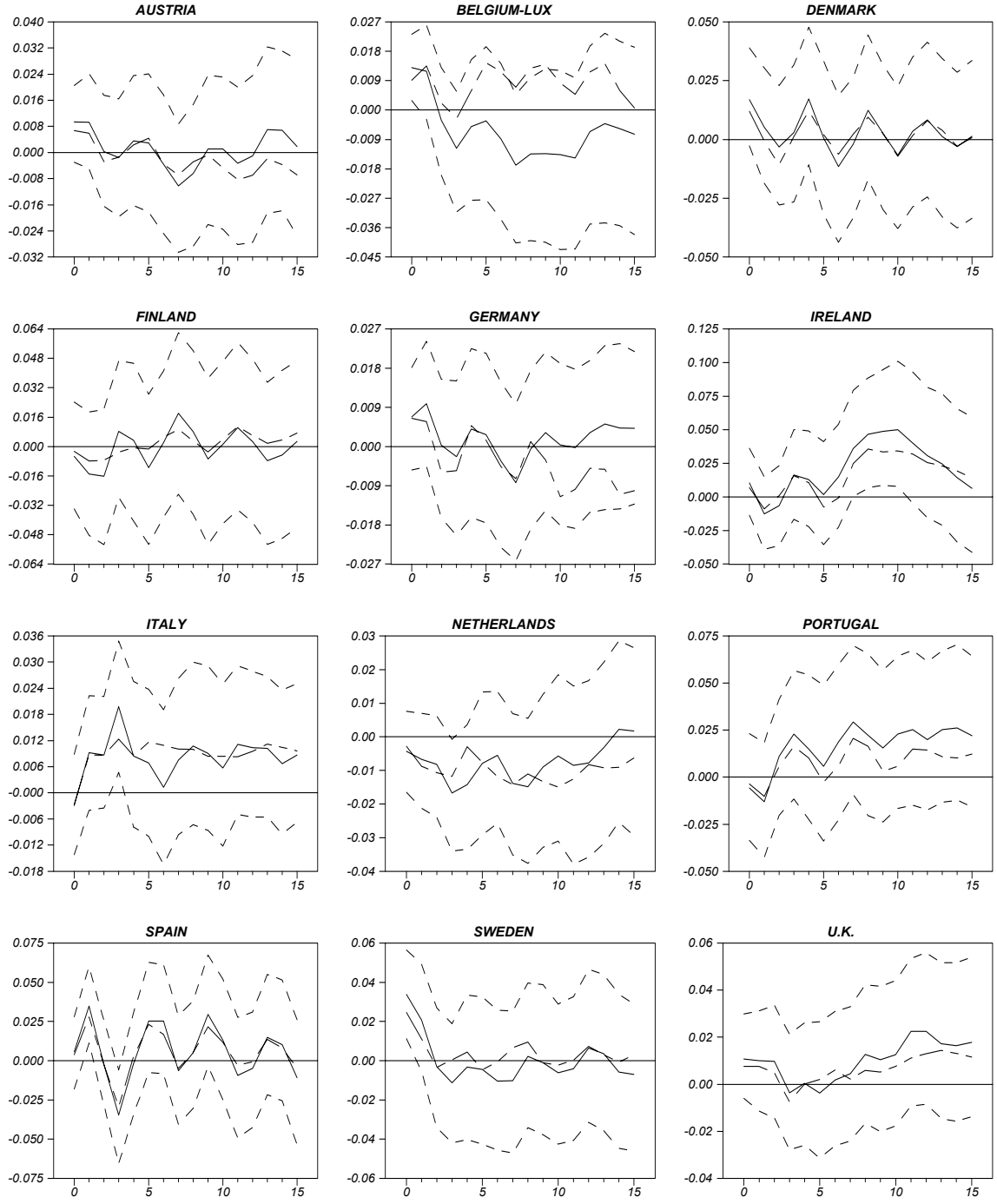
Notes: the graphs report the mean impulse response (solid line) and the 90% confidence band (dashed line) formed by the 5th and the 95th percentile based on 1,000 Monte Carlo simulations. The semi-dashed line is the impulse response with the exchange rate and the interest rate exogenous.

Figure 4a: Impulse Responses Bilateral Imports to Net Tax Reduction Germany



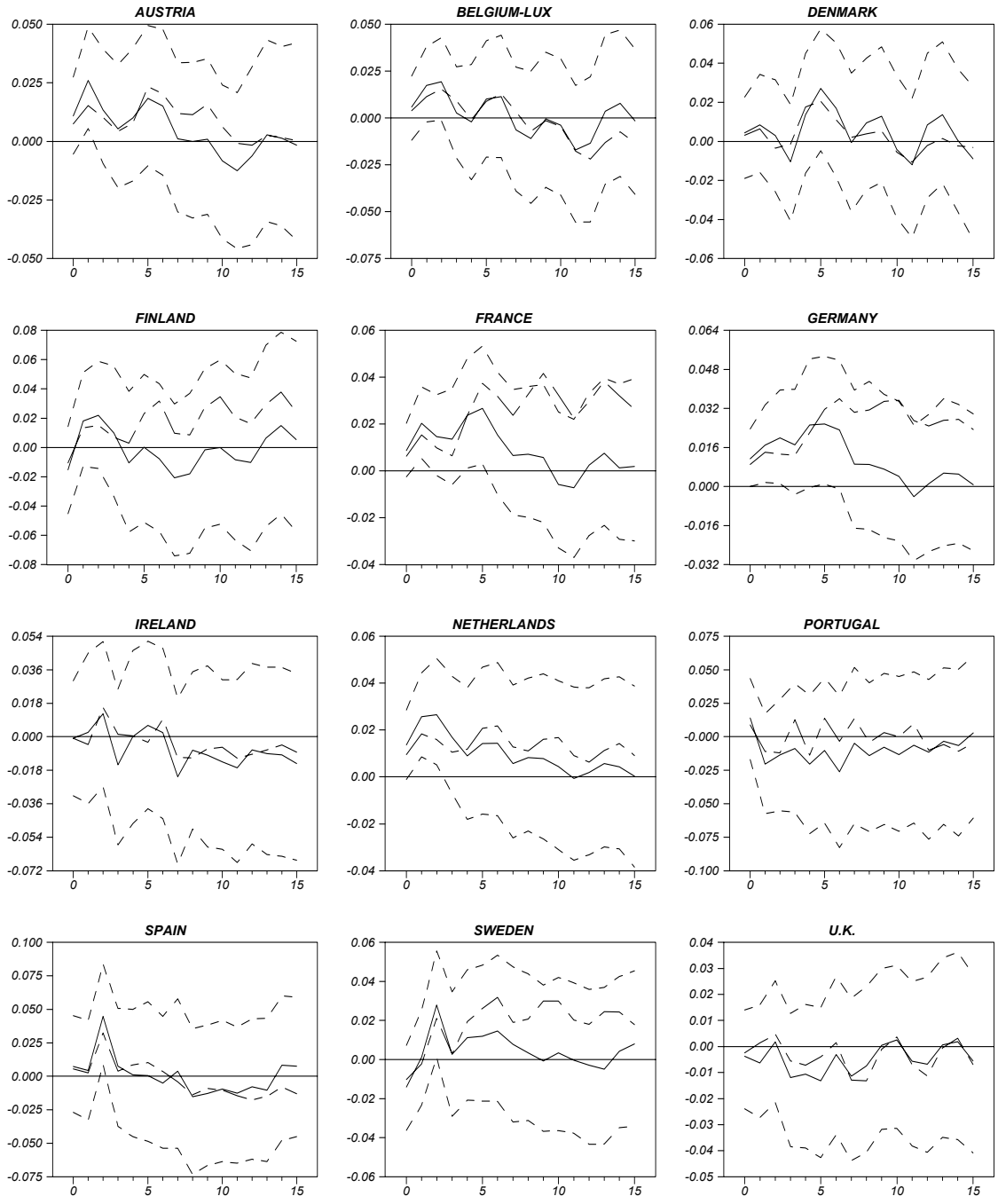
Notes: see Figure 3.

Figure 4b: Impulse Responses Bilateral Imports to Spending Increase France



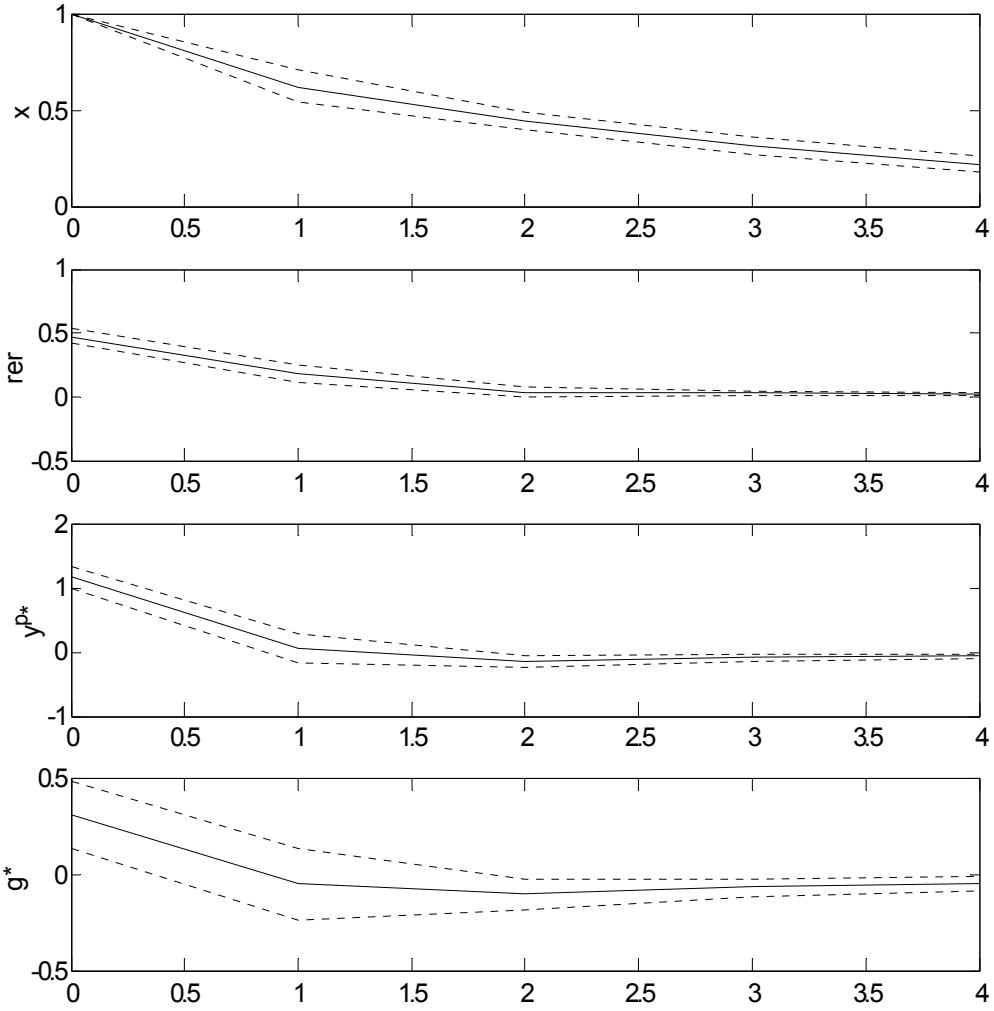
Notes: see Figure 3.

Figure 4c: Impulse Responses Bilateral Imports to Spending Increase Italy



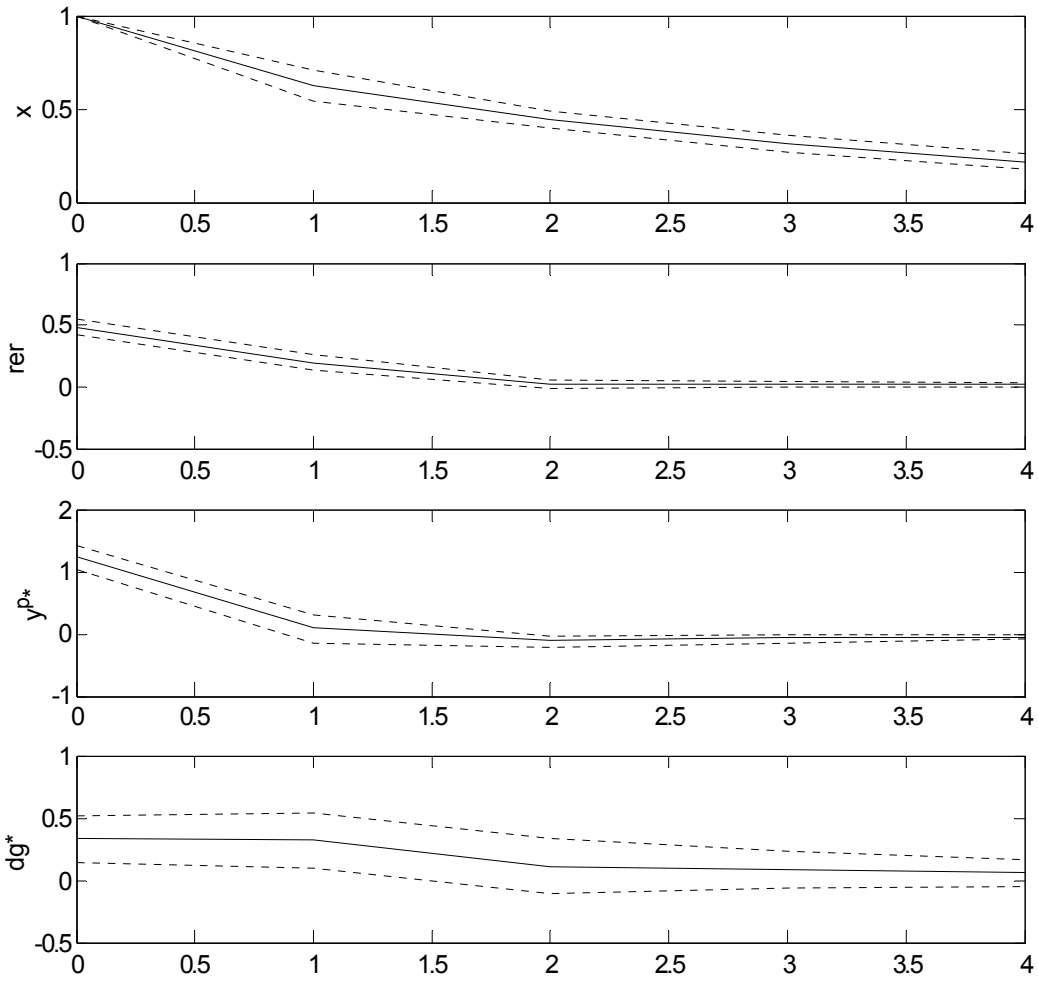
Notes: see Figure 3.

Figure 5a: Impulse Responses of Bilateral Exports in the Panel Model with Public Spending



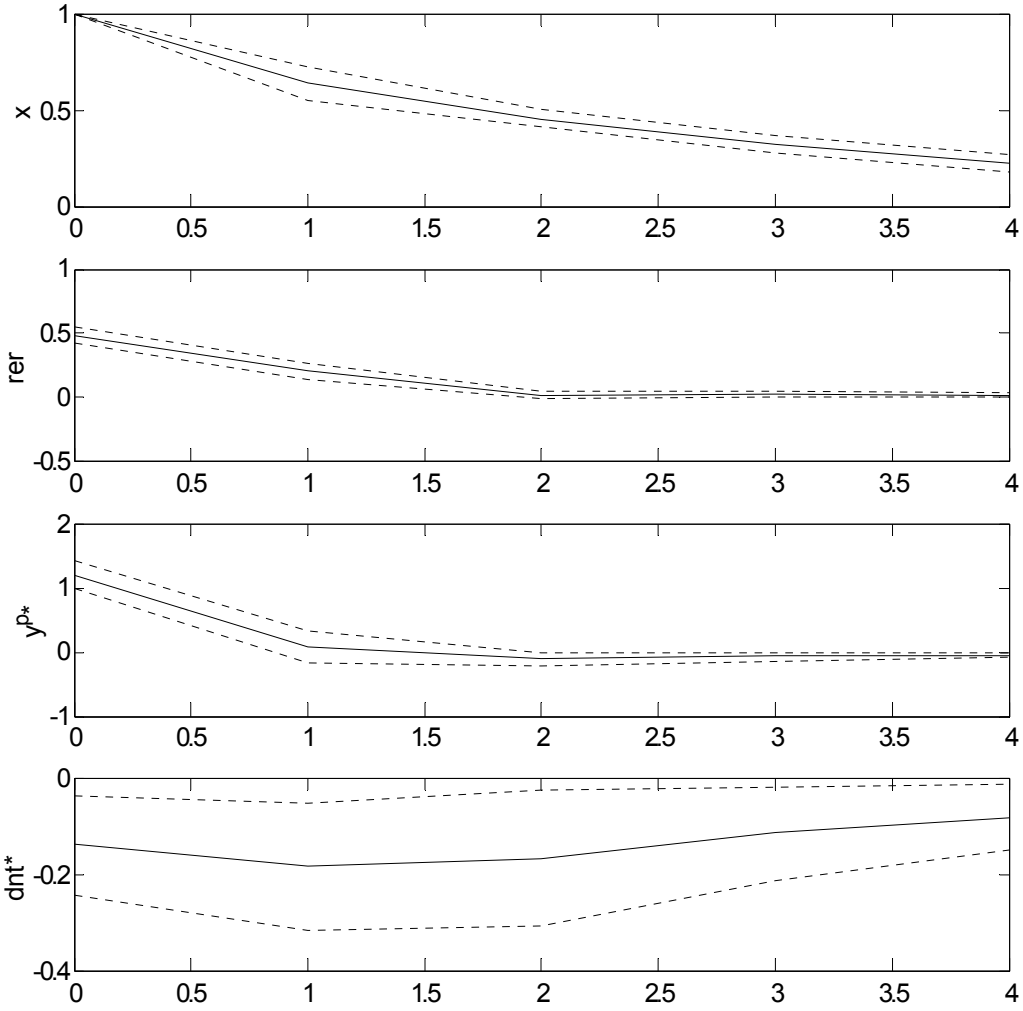
Notes: the graphs report the impulse response (solid line) and the 90% confidence band (dashed line) of bilateral real exports to a 1% temporary increase in real domestic exports, the real bilateral exchange rate, real foreign private output, real foreign public spending.

Figure 5b: Impulse Responses of Bilateral Exports in the Panel Model with Discretionary Public Spending Shocks



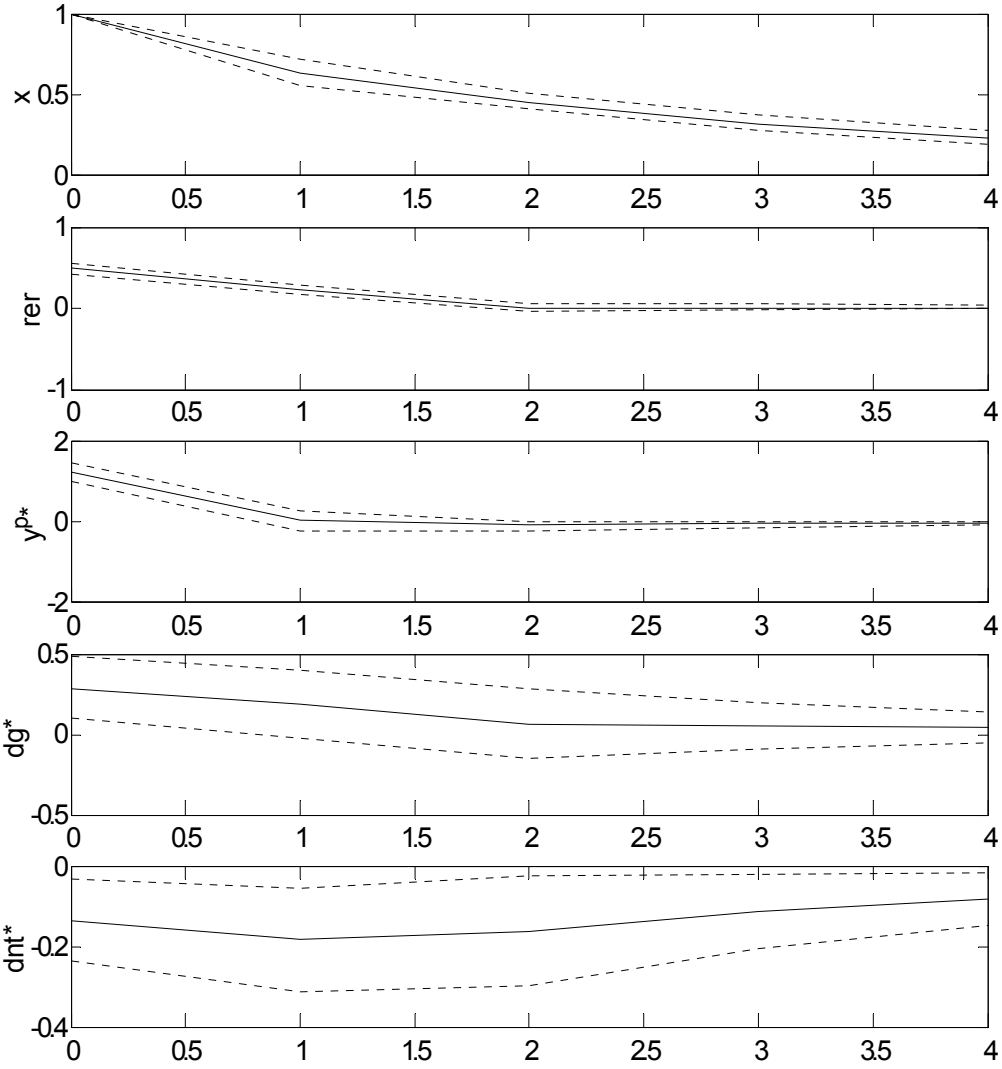
Notes: the graphs report the impulse response (solid line) and the 90% confidence band (dashed line) of bilateral real exports to a 1% temporary increase in real domestic exports, real bilateral exchange rate, real foreign private output, real foreign public spending shock.

Figure 5c: Impulse Responses of Bilateral Exports in the Panel Model with Discretionary Net Tax Shocks



Notes: the graphs report the impulse response (solid line) and the 90% confidence band (dashed line) of bilateral real exports to a 1% temporary increase in real domestic exports, real bilateral exchange rate, real foreign private output, real foreign net tax shock.

Figure 5d: Impulse Responses of Bilateral Exports in the Panel Model with Public Spending and Net Tax Shocks



Notes: the graphs report the impulse response (solid line) and the 90% confidence band (dashed line) of bilateral real exports to a 1% temporary increase in real domestic exports, real bilateral exchange rate, real foreign private output, real foreign public spending shock, and real foreign net tax shocks.