On the usefulness of government spending in the EU area

Marattin, Luigi and Salotti, Simone

University of Firenze, University of Bologna

December 2009

On the usefulness of government spending in the EU area

Luigi Marattin[±] Simone Salotti[÷]

This version: July 15th,2010

Abstract

This paper investigates the effects of government spending on private consumption and investment in the European Union. A certain consensus has been reached on the expansionary Keynesian effects on the economic activity of fiscal impulses. However, the existing empirical literature has concentrated on few countries, mostly outside the EU. We check the validity of this result for the EU area, by using annual data and a panel vector auto-regression approach (PVAR), with particular attention being paid to robustness across alternative identification assumptions (based on Cholesky orderings). Our results show that shocks in public spending positively affect private consumption and investment. According to our baseline estimate, a 1% increase in public spending produces a 0.24% impact rise in private consumption, and a 0.41% impact rise in private investment. The effects are substantial, and die out slowly in the case of private consumption (the cumulative impact amounts to 0.56% after 3 years), but much faster in the case of private investment. A further disaggregation between wage and non-wage components reveals that public salaries have a relatively stronger stimulating role. Note that this is not due to the different weights on GDP of the two components, which have comparable values in our sample.

JEL classification: E62, C33

Keywords: fiscal policy, private consumption, panel vector autoregression.

[±] Department of Economics – University of Bologna – Strada Maggiore 45 – 40125 – Bologna (Italy) – Tel: +39 – 051-2092606 (email: *luigi.marattin@unibo.it*)

[÷] Department of Mathematics for Decisions – University of Florence – Via Lombroso 6/17 – 50134 – Firenze (Italy) (email: *salotti@unisi.it*)

1. Introduction

How does government spending affect private consumption in the EU area? The relationship between these two variables has been widely explored in both theoretical and empirical macroeconomic literature. Theoretically, two main alternative views can be distinguished: the Real Business Cycle (RBC) and the Keynesian approaches. In standard RBC models (see, e.g., Baxter and King, 1993), an increase in government consumption increases the net present value of taxation, because Ricardian equivalence holds among intertemporally optimizing consumers. This, in turn, reduces permanent income, and the associated negative wealth effect causes both a decrease in private consumption and an increase in labour supply.[1] As a result, a positive government spending shock reduces private consumption and increases output. On the other hand, Keynesian approaches rescue a positive relationship between government and private consumption, basically by including additional effects on the above chain of events. The combined effects of credit-constrained agents (who are not able to smooth consumption over time and are therefore forced to consume out of their current real wage) and nominal price rigidities (which permit an outward shift of the labour demand curve following the increase in aggregate demand) can cause an increase in real wage and thus an increase in aggregate consumption, as long as the share of credit-constrained agents is quantitatively relevant (Gali et al., 2007).[2] Recently, Monacelli and Perotti (2008) employed preferences à la Greenwood et al. (1988) so to reduce the size of the outward shift of the labour supply curve following the negative wealth effect.[3] Thus, they obtain the increase in the real wage which leads to an increase in aggregate consumption through the standard substitution effect, with no need of assuming credit-constrained agents.[4]

A large econometric literature has developed in order to verify the empirical relevance of the two competing theoretical approaches. While most of the studies are VAR-based analysis exclusively based on US economy (Fatas and Mihov, 2001; Blanchard and Perotti, 2002; Gali and Perotti, 2003; Ramey, 2007; Monacelli and Perotti, 2008), very few focus on selected European countries (Monacelli and Perotti, 2006; Perotti, 2004; Biau and Girard, 2005; Perotti, 2007). Moreover, the object of the analysis

[1] This effect assumes that consumption and leisure are normal goods.

[2] In general equilibrium models, the real wage increase occurs if the monetary policy response to output is not strong enough to reduce the increase in labour demand.

[3] See also Schmitt-Grohe and Uribe (2008) and Jaimovich and Rebelo (2009). Other attempts include the consideration of a negative reaction of the mark-up in monopolistic competitive frameworks (Ravn et al., 2006), or an ad-hoc complementarity between labour supply and aggregate consumption in the utility function (Linneman, 2006).

[4] Bouakez and Rebei (2007) insert non-sperability between government expenditure and private consumption in the utility function, so to obtain a positive comovement within an otherwise standard frictionless RBC framework.

is often the relationship between public spending and GDP, not private consumption. In a nutshell, a large part of the evidence points towards a positive effect of government expenditure on private consumption, although results vary considerably across different estimation techniques and identification strategies (see Perotti, 2007 for a detailed survey). However, none of the above contributions is specifically targeted at the European economy as a whole. Indeed, they either concentrate on one or two EU countries - namely the UK and West Germany - as a part of a wider analysis that includes also USA and Canada, or they are country-specific studies (Biau and Girard, 2007 on France; Giordano et al,. 2008 on Italy). Three notable exceptions are contributions by Beetsma et al. (2006), by Fiorito and Kollintzas (2004), and by Burriel et al. (2010), all based on EU countries. However, they all differ substantially from our present contribution. In particular, Beetsma et al. (2006) use a parsimonious three-variables PVAR (public spending, net taxes and GDP) as the focus of their analysis is different from the links between public spending and private consumption. On the other hand, in Fiorito and Kollintzas (2004) the approach is totally different from the other VAR-based studies cited above, as they perform a GMM estimation of an Euler equation assuming non-separability between private and public consumption in the utility function.[5] Finally, Burriel et al. (2010) estimate a structural VAR using a new quarterly EU dataset, following the strategy of Blanchard and Perotti (2002) in order to facilitate the comparison. Although, they mainly look at the effects of fiscal policy on GDP, among the additional results, they also present the estimates of some parsimonious VARs that include either private consumption or investment, with qualitative results roughly in line with ours.

In this paper we perform a detailed PVAR analysis on 14 EU countries, using annual data from 1970 to 2006. Firstly, we estimate a 6-variables PVAR capable to grasp the effects of fiscal policy on private consumption and investment. Then, we disaggregate public expenditure between wage and non-wage components to investigate the main responsible for the estimated transmission mechanisms. We back up these analysis with extensive robustness checks concerning not only the identification scheme, but also the panel dimension of the sample. The novelty of our contribution is based on two dimensions: the estimation methodology and the sample under investigation. About the former, we adopt a PVAR approach, which is becoming increasingly widespread in macroeconomic analysis (Beetsma et al. 2006, 2008, Almunia et al. 2010). The use of a PVAR allows us to take advantage of the resulting large sample dimension, which, given the non-parsimonious nature of our model and the data frequency

[5] Nevertheless, Fiorito and Kollinztas (2004) achieve interesting results in terms of disaggregation of public expenditure; they find that while public goods substitute for private consumption, public expenditure on merit goods seems to complement for it.

(annual), strengthens the validity of our results. However, this occurs at the cost of assuming homogenous slope parameters, although we explicitly account for the necessary country-specific heterogeneity by allowing for country fixed effects. About the latter, while the empirical literature is mostly US-based, we specifically focus on the European Union area.

Our results can be summarized as follows. Increases in government expenditure positively affect both private consumption and private investment. According to our baseline estimate, a 1% increase in public spending produces a 0.24% on impact rise in private consumption, and a 0.41% impact rise in private investment. The effects are substantial, and die out slowly in the case of private consumption (0.56% cumulative impact after 3 years), but much faster in the case of private investment. A crucial validation of our results lies in their full robustness to a wide range of alternative identification schemes, VAR dimensions, sample and time variations. In particular, given the well known sensitivity of Structural VAR analysis to changes in the identification assumptions (in our case, the Cholesky ordering), we believe it to be a strong support of our estimation results.

Several additional results come out of the analysis. The disaggregation between wage and non-wage components of public expenditure reveals that public salaries have a relatively stronger stimulating role. Note that this is not due to the different weight on GDP of the two components, which have comparable values in our sample. Finally, public investment seems to have no stimulating effects neither on private consumption nor investment.

The remainder of this paper is organized as follows. Section 2 presents our empirical model and the dataset. We also extensively detail and discuss our identification strategy to identify exogenous spending shocks. In section 3 we present the results of the baseline estimations, focusing on the responses to shocks in government consumption. Moreover, we concentrate on the robustness of the preferred Cholesky ordering by performing a series of alternative estimations based on different identification assumptions. Section 4 presents additional robustness checks, mainly along three dimensions: different sets of variables, and different sub-samples and time spans. Section 5 concludes.

2. Empirical model, data, and estimation strategy

In this section we present our empirical model based on a six-variables PVAR and the data used in the analysis. Most importantly, we outline and discuss our identification strategy, whose robustness will be tested straight away in section 3.

2.1. Model and data

Our approach is based on a PVAR with annual data. There are two reasons behind the adoption of this particular strategy. First, the PVAR technique combines the traditional VAR approach with panel data, which allows for unobserved individual heterogeneity. While the advantage of using panels consists in an increase in the number of observations, the disadvantage is the need to impose certain homogeneity restrictions. However, by focusing on EU countries only, we limit the potential heterogeneity, as the EU economies share many similarities and are part of a substantially integrated economic area. Moreover, we check the validity of this neglected heterogeneity by performing several robustness checks based on the variation of the countries in the sample (see subsection 4.2). Second, we use annual rather than quarterly data, unlike a substantial part of the previous empirical literature. While this is a choice induced by the lack of non-interpolated quarterly data, on the other hand the annual frequency presents some advantages. For instance, since there is no quarterly calendar for fiscal policy revisions, the interpretation of fiscal shocks may be facilitated. Also, potential anticipation effects of fiscal policy changes play a smaller role with annual data, as identified shocks are more likely to be truly unanticipated (as argued by Beetsma et al. 2008, following Ramey, 2007).

Our sample consists of 14 EU countries (Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Germany, Greece, Netherlands, Portugal, Spain, Sweden and UK) over the period 1970-2006.[6] Data are mainly from the OECD Economic Outlook no.84, although we integrated this source with the Main Economic Indicators (published by the European Commission) and the World Development Indicators (published by the World Bank).

The structural form of our PVAR model is given by:

$$A_0 Z_{it} = A(L) Z_{it-1} + e_{it}, \qquad (1)$$

where Z_{it} is an ($mx1$) vector of endogenous variables; A_0 is an (mxn) matrix with 1's on the diagonal and contains the parameters that capture the contemporaneous relations among the variables; $A(L)$ is a matrix polynomial in the lag operator L; finally, e_{it} is the structural disturbance vector. Pre-multiplying (1) by A_0^{-1}, we obtain the reduced form that we can actually estimate:

$$Z_{it} = B(L) Z_{it-1} + u_{it}, \qquad (2)$$

[6] The panel is balanced, apart from very few missing values (Denmark 1970, all series; France 1970-1976, public debt; Portugal 1970-1976, all series). Data from West Germany and Germany are combined by splicing growth rates in 1991. We excluded Luxembourg due to limited availability of fiscal variables.

where $B(L) = A_0^{-1}A(L)$ and $u_{it} = A_0^{-1}e_{it}$ is the reduced form residual vector.

2.2. The identification strategy

In the baseline specification, the vector Z is as follows:

$$Z_{it} = (GC_{it}, T_{it}, P_{it}, I_{it}, C_{it}, B_{it}), \qquad (3)$$

where GC_{it} is government expenditure (wage plus non wage components), T_{it} is cyclically-adjusted net taxes (cyclically adjusted direct plus indirect taxes minus cyclically adjusted net social security contributions), I_{it} is private investment, C_{it} is private consumption, P_{it} is price level (Consumer Price Index, CPI), B_{it} is government gross financial liabilities. All variables (but pricces, which are just expressed as the natural logarithm of the CPI) are per capita real values, deflated by their own deflator and in natural logarithms.[7] The estimation is carried out using the first differences of these variables. Our identification scheme is based on a lower triangular Cholesky decomposition with the above indicated ordering. Hence, a variable coming earlier in the ordering affects the next ones both contemporaneously and with a lag, while a variable coming later has merely lagged effects on the preceding ones. The main drawback of using annual data is that specific identifying assumptions might be rather strong. We justify them on the base of both theoretical and empirical previous models. Also, we explore several alternative Cholesky orderings in subsection 3.3. In our preferred set of assumptions, with the ordering of equation (3), we allow government debt to be contemporaneously affected by all variables: prices, government consumption and tax revenue as it comes straightforward from the government flow budget constraint, plus private demand variables. Notwithstanding the annual data frequency, we order nominal prices before aggregate demand components, as macroeconomic models calibrated on the Euro area estimate the average frequency of price adjustment above four quarters (Gali et al., 2001; Smets and Wouters, 2005). Tax revenue affects private sector variables, but it is not affected by them within the period, as we use cyclically-adjusted net taxes, as in Blanchard and Perotti (2002). Thus, short-term business cycle fluctuations do not contemporaneously affect the measure of net taxes that we employ. Government expenditure is ordered first, as spending plans are usually determined before the new fiscal year starts. This neglects the simultaneous pro-cyclicality of government spending (Lane, 2003). Nevertheless, government spending can be affected

[7] In all the estimates that follow, we have also tried the same specification using the GDP deflator for all variables, instead of their own deflators. Results do not change.

by last period levels of private consumption and investment, as well as of all the other variables of the system (we use one lag in our preferred specification, although we perform an estimation with two lags among the robustness checks in Section 4). Furthermore, we relax this assumption in one of the robustness checks based on alternative orderings, finding that the positive effects of government expenditure on private consumption are only relatively affected, while they are greatly reduced for what concerns private investment.

Since some of these assumptions may seem too strong at first glance, in subsection 3.3. we extensively check their validity by estimating the PVAR with alternative orderings of the variables, finding that our main results hold under a wide variety of identification schemes. The use of a PVAR approach requires the underlying structure to be the same for each cross-sectional unit. This is likely to be violated in practice, even if focusing on the EU ensures a certain degree of similarity among the countries of the sample. Nevertheless, we allow for individual heterogeneity by adding country fixed effects. Since they are correlated with the regressors due to the lags of the variables, the mean-differencing procedure commonly used to eliminate fixed effects will create biased coefficients. To overcome this problem, we use forward-mean differencing (Helmert procedure, see Arellano and Bover, 1995). This procedure preserves the orthogonality between transformed variables and lagged regressors, thus we use the latter as instruments and estimate the coefficients by system GMM (Love and Zicchino 2006, Holtz-Eakin et al 1988).[8]

Next section illustrates the results of our analysis. We focus on the impulse-response functions, which describe the reaction of one variable in the system to the innovations of another variable while holding all other shocks at zero (that is, we use orthogonalized shocks).

3. Estimation results

The results are presented in three different subsections. First, we present the preferred specification results concerning the impact of government expenditure (specified as both public consumption and investment) on private sector variables. Then, we deepen the analysis by disaggregating public spending between wage and non wage expenditure. Finally, we investigate the sensitivity of the results to alternative Cholesky orderings. Throughout the discussion, we concentrate on the responses of all the variables to government expenditure shocks, and especially on the effects on private consumption and investment.

[8] To perform the analysis we used the Stata Pvar routine written by Inessa Love (see Love and Zicchino, 2006).

3.1. Total government expenditure

Figure 1 shows the impulse responses for a 1% increase in government spending (see Table 1 for details).

Insert Figure 1 about here

Public spending has a positive impact both on private consumption and private investment, in line with the existing empirical results for different economic areas. On impact, the former increases by 0.24% and the latter by 0.41%. The effects are substantial, and are very persistent in the case of private consumption (positive and statistically significant effects last until the third year from the shock, for a cumulated response of 0.56%), but rapidly decline in the case of private investment where the sole contemporaneous effect is statistically different from zero.

We also investigate the role of government investment, by estimating the model in equation (3) where we replace government consumption with public investment. Figure 2 (details in Table 2) shows the impulse responses for a 1% increase in public investment.

Insert Figure 2 about here

Not surprisingly, given the modest share of government investment on GDP (the average in the sample is 3.2%), the responses are quantitatively much less important. Particularly, there is weak evidence of crowding-out effects, as private investment reacts negatively on impact with a very low elasticity of -0.04%. As for the effects on private consumption, there is a negligible (though statistically different from zero) positive elasticity only on impact (+0.01%).

3.2. Does the distinction between wage and non-wage expenditure matter?

The above results reveal the existence of positive effects of government expenditure on private consumption and investment. In this subsection we disaggregate the former in order to draw further insights on its transmission mechanisms to the economy, estimating two alternative models closely related to the one of the baseline. In the first, we replace total public spending with the government wage bill (GW_{it}). In the second we replace it with government non-wage expenditure (GNW_{it}).

Figures 3 and 4 show the impulse responses for an increase in, respectively, government wage and government non wage expenditure (details are to be found in Tables 3 and 4).

Insert Figures 3 & 4 about here

The responses of private consumption are qualitatively and quantitatively consistent to the baseline case. However, shocks in wage and non-wage components of public expenditure impact differently on the variables of the system. In particular, the first exerts quantitatively larger and more persistent effects than the second on all the variables of the system. Two years after the shock, the effects of government wage on private consumption are approximately three times bigger than non-wage expenditure (the cumulative impact is 0.46% for the former and 0.16% for the latter).[9] Private investment reacts in a similar way. It is considerably and positively stimulated on impact by government wages shocks (+0.59%), and rather weakly by the residual component of government purchases of goods and services (+0.06% on impact). Note that this result is not due to the relative weights of the two components, which are comparable in the sample (government wage spending averages 12.00% of GDP, while non-wage expenditure is 11.77%. of GDP on average).

This greater importance of the wage component of public expenditure is consistent with the results of Fatàs and Mihov (2001) for the US economy. As a robustness check, they separately include in their model wages, non wage expenditure and public investment, finding that the former is the main responsible for the estimated rise in private consumption.

3.3. Alternative Cholesky orderings

Although many Structural VARs in the literature are identified through Cholesky decomposition (Marcellino 2006, Fatàs and Mihov 2001, Favero 2002), the estimations' sensitivity to alternative orderings of the variables in the vector is no doubt a weak point of such an identification strategy. For that reason, in this subsection we test the robustness of our results to four alternative orderings in vector Z_{it} . All impulse response functions are reported in Figure 5, where the baseline point estimates are reported in order to facilitate the comparison.

Insert Figure 5 about here

[9] However, wage shocks cease to be statistically significant after one year, whereas non-wage shocks keep displaying their (quantitatively small) effects even 5 years after the shock.

First, we verify if a change in the ordering of expenditures and receipts matters (as in Marcellino 2006), covering the possibility that the government adjusts the level of its purchases according to its flow budget constraint within the year. This modification does not alter the results. Second, following some previous estimations of average price stickiness below four quarters (Christiano et al. 2005), we allow aggregate demand components to affect nominal prices within the year, ordering prices immediately after private investment and consumption. We also allow cyclically-adjusted tax revenue to be contemporaneously affected by private variables, in case the latter are hit by non-cyclical shocks. Both this changes do not alter the results. Finally, we relax the assumption of considering public spending as the most exogenous variable of the system in two additional ways. Allowing it to be contemporaneously affected by both cyclically adjusted net taxes and prices does not alter dramatically the responses, the only appreciable differences being higher responses of both prices and debt to public spending shocks. On the contrary, ordering private consumption and investment first in the Cholesky decomposition produces smaller estimated responses of both variables to shocks in public spending (as expected, since this ordering imposes a zero response on impact). Remember that, according to this alternative specification, we allow for government spending to be strongly pro-cyclical (see Lane, 2003). In this case, while the response of private consumption remains positive as in our baseline specification, the positive reaction of private investment to public spending shocks disappears.

4. Robustness checks

In this section we perform a series of additional robustness checks to verify the results of our model's preferred specification. We proceed along three dimensions: the first set of tests modifies the PVAR dimension; the second checks the robustness to variations of the countries included in the sample; finally, we re-estimate the baseline model for two different periods.[10]

4.1. Different VAR dimensions

Figure 6 shows the responses of both private consumption and private investment to shocks in public spending resulting from five different 5-variables VARs obtained by excluding (one at a time) public debt, net taxes, price level, private investment, private consumption. Figure 7 shows the responses of the same two variables of interest to shocks in public spending, this time resulting from three different

[10] Furthermore, we also ran other simple robustness checks (not shown here). For instance, we used the GDP deflator to deflate all the variables instead of using the own deflators. Results are never significantly affected.

4-variables VARs obtained by excluding the following pairs of variables (one at a time): public debt and net taxes, public debt and price level, price level and net taxes. Only the point estimates are reported. Together with these alternative estimates, the baseline responses are reported in order to facilitate comparisons (see the thick solid lines).

Insert Figures 6 & 7

Both private consumption and investment are positively affected by public spending shocks, as in the preferred specification, but the latter does not react positively once prices are excluded from the model. More precisely, the response of private investment keeps the positive sign on impact in the three alternative specifications without prices, but in all cases after one year the response goes to zero and turns negative afterwards. This confirms the weaker estimated reaction of private investment with respect to private consumption, since a similar sensitivity is observed when the Cholesky ordering is altered so to prevent a contemporaneous reaction of private consumption and investment to public spending shocks.

4.2. Sample variation

We firstly estimate our PVAR excluding one country member at a time to see if there are single countries driving the results of the whole panel (as in Benetrix and Lane, 2009). Figure 8 shows the private consumption and investment responses to shocks in government spending, with the thick solid lines being the responses of the baseline model.

Insert Figure 8 about here

The figure demonstrates the robustness of the baseline responses to changes in the sample. Only in one case the exclusion of one country produces some slight quantitative differences, again in the response of private investment.[11] Then, we re-estimate the same baseline model for a set of "core" EU countries: France, Italy, Germany, Belgium and the Netherlands (as in Appendix C of Beetsma et al. 2006). Figure 9 shows the estimated responses of all the variables of the system to a public spending shock.

[11] Precisely, there is a smaller response of investment (and of consumption, even if the distance from the baseline estimate is lower) when Portugal is excluded.

Insert Figure 9 about here

The more relevant difference lies in the prices response, which is smaller than the one estimated for the whole sample (the baseline point estimate lies mostly outside the 95% confidence interval estimated for the core countries). As for the private consumption response, it does not differ significantly from the baseline, even if the contemporaneous effect is smaller (+0.05%). Again, the response of private investment differ from the preferred estimate, though it never lies outside the 95% confidence interval estimated for the core countries.

The importance of this particular pair of robustness tests is to be particularly emphasized, since it indicates the existence of a certain degree of sample homogeneity, necessary for the credibility of the panel analysis.

4.3. Time variation and other checks

As for the time dimension variation of the model, we re-estimate our PVAR concentrating on two alternative time spans. First, as some contributions provide evidence that both the variance of fiscal policy shocks and their effects on consumption have declined after 1980 (see e.g. Perotti 2004, Romer and Romer 2007), we estimate the model limiting the period of interest to 1980-2006. Figure 10 shows the impulse response functions of all variables to shocks in public spending.

Insert Figure 10 about here

The baseline responses appear once again to be qualitatively robust, although there is a significantly smaller response of prices. On the other hand, the 95% confidence intervals of the new responses of private consumption and investment comfortably contain the baseline point estimates, which are slightly larger, as expected

Second, as the introduction of the Euro might have affected most countries in our sample, we restrict the sample period to the pre-EMU years (1970-1998). This modification might be viewed as a sort of control for potential structural breaks – caused by the monetary policy structural change – in the way fiscal policy affects the economy in the EU countries. Figure 11 shows the impulse response functions of all variables to a shocks in government spending.

Insert Figure 11 about here

The only noteworthy difference is the larger response of private investment with respect to the baseline estimate.

We perform two final robustness checks. First, we re-estimate the preferred specification of the model with two lags instead of one (see Figure 12).

Insert Figure 12 about here

While the contemporaneous effects of a public spending shock do not differ substantially from the baseline estimates, the subsequent dynamics change for most of the variables. However, the baseline point estimate lies outside the newly estimated 95% confidence intervals only in the case of private consumption (starting from the second year after the shock). Finally, we estimate a different model where GDP is included in lieu of private consumption and investment (see Figure 13).

Insert Figure 13 about here

The response of GDP to a 1% public spending shock is 0.23% on impact, and reaches a cumulative response of 0.58% after three years. This is in line with the estimated responses of private consumption and investment, which are a substantial part of GDP.

5. Conclusions

The qualitative and quantitative response of private consumption to government expenditure shocks is a strong dividing line between Keynesian and RBC macroeconomic approaches. The empirical literature, although far from having reached a consensus, mostly find a positive relationship. However, the existing contributions have only marginally investigated the EU area, as they mainly looked at few countries (particularly the United States). In this paper we perform a PVAR analysis on 14 EU countries, using a balanced annual dataset from 1970 to 2006. Our results – robust to a wide range of robustness checks including sample and time variation as well as alternative Cholesky orderings- can be summarized as follows. First, shocks in government expenditure positively and persistently affect private consumption and investment (respectively, 0.24 and 0.41% on impact). Second, the disaggregation between wage and non-wage components reveals that public salaries have a relatively stronger stimulating role., Note that this is not due to the different weight on GDP of the two

components, which have comparable values in our sample. Third, we do not find a similar stimulating role for public investment (especially relative to the private counterpart). Finally, the private investment results are the one that shows the higher sensitivity to robustness checks, especially when we set to zero its contemporaneous response to public spending shocks and when we estimate more parsimonious PVARs excluding prices.

While the first two results push towards a Keynesian world, the last two call for some caution in reading the stimulating role of public spending. Generally speaking, the effects of public expenditure deserve some additional attention: a further and more detailed disaggregation of government spending might be needed, as well as a parallel distinction - for instance - between purchases of durable and non-durable consumption goods. As the need of finding the most appropriate "exit-strategy" from the 2009 massive increase in public expenditure intensifies, these investigations regarding the usefulness of public money might become more and more useful.

References

Almunia, M., Benetrix, A., Eichengreen, B., O'Rourk, K.H. and Rua, G. (2010), "From Great Depression to Great Credit Crisis: Similarities, Differences and Lessons", *Economic Policy*, 25 (62), 219-265.

Arellano, M. and Bover, O. (1995), "Another Look at the Instrumental Variable Estimation of Error Component Models", *Journal of Econometrics*, 68, 29-51.

Baxter, M. and King, R. (1993), "Time Separable Preferences and Intertemporal Substitution Models of the Business Cycle", *Quarterly Journal of Economics*, 99, 817-840.

Beetsma, R., Giuliodori, M. and Klaassen, F. (2006), "Trade Spill-Overs of Fiscal Policy in the European Union: A Panel Analysis", *Economic Policy*, 21(48), 639-687.

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

Benetrix, A. and Lane, P. (2009), "Fiscal Shocks and the Real Exchange Rate", IIIS Discussion paper, 286.

Biau, O. and Girard, E. (2007), "Politique budgétaire et dynamique éeconomique en France: l'approche VAR structurel", *Économie et Prévision*, 169–171, 1-24.

Blanchard, O. and Perotti, R. (2002), "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output", *Quarterly Journal of Economics*, 117(4), 1329-1368.

Bouakez, H. and Rebei, N. (2007), "Why Does Private Consumption Rise After a Government Spending Shock?", *Canadian Journal of Economics*, Vol. 40(3), 954-979.

Burriel, P., de Castro, F., Garrote, D., Gordo, E., Paredes, J. and Pérez, J. (2010), "Fiscal Policy Shocks in the Euro Area and the US: An Empirical Assessment", *Fiscal Studies*, 31(2), 251-285.

Christiano, L., Eichenbaum, M. and Evans,C. (2005), "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy", *Journal of Political Economy*, Vol.113(1), 1-45.

Fatàs, A. and Mihov, I. (2001), "The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence", CEPR Discussion Paper, 2760.

Favero, C. (2002), "How Do European Monetary and Fiscal Authorities Behave?", CEPR Discussion Paper, 3426.

Fiorito, R. and Kollintzas, T. (2004), "Public Goods, Merit Goods and the Relation between Private

and Government Consumption", *European Economic Review*, 48, 1367-1398.

Gali, J., Gertler, M. and Lopèz-Salido, J. (2001), "European Inflation Dynamics", *European Economic Review*, 45 (7),1121-1150.

Gali, J., Lopèz-Salido, J. and Valles, J. (2007), "Understanding the Effects of Government Spending on Consumption", *Journal of the European Economic Association*, Vol. 5(1), 227-270.

Gali, J. and Perotti, R. (2003), *Fiscal Policy and Monetary Integration in Europe*, Blackwell.

Giordano, R., Momigliano, S., Neri, S. and Perotti, R. (2008), "The Effects of Fiscal Policy in Italy: Evidence from a VAR Model", Bank of Italy Discussion Paper 656.

Greenwood, J., Hercowitz, Z. and Huffman, G. (1988), "Investment, Capacity Utilization and the Real Business Cycle", *American Economic Review*, Vol. 78, 402-417.

Holtz-Eakin, D., Newey, W. and Rosen, H.S. (1988), "Estimating Vector Autoregressions with Panel Data", *Econometrica*, 56(6),1371-1395.

Jaimovich, N. and Rebelo, S. (2009), "Can News About the Future Drive the Business Cycle?", *American Economic Review*, 99(4), 1097-1118.

Lane, P. (2003), "The Cyclicality of Fiscal Policy: Evidence from the OECD", *Journal of Public Economics*, 87, 2661-2675.

Linnemann, L. (2006), "The Effect of Government Spending on Private Consumption: A Puzzle?", *Journal of Money, Credit and Banking*, 38(7), 1715.

Love, V. and Zicchino, L. (2006), "Financial Development and Dynamic Investment Behavior: Evidence from Panel VAR", *Quarterly Review of Economics and Finance,* 46(2), 190-210.

Marcellino, M. (2006), "Some Stylized Facts of Non-Systematic Fiscal Policy in the Euro Area", *Journal of Macroeconomics,* 28, 461-479.

Monacelli, T. and Perotti, R. (2006), "Fiscal Policy, the Trade Balance and the Real Exchange Rate: Implications for International Risk Sharing", Manuscript, IGIER - Bocconi.

Monacelli, T. and Perotti, R. (2008), "Fiscal Policy,Wealth Effects and Mark-Ups", NBER Working Paper No. 14584.

Monacelli, T. amd Perotti, R. (2008), "Openness and the Sectoral Effects of Fiscal Policy", *Journal of the European Economic Association*, 6(2-3), 395-403.

Perotti, R. (2004), "Estimating the Effects of Fiscal Policy on OECD Countries", Working Paper, IGIER-Bocconi.

Perotti, R. (2007), "In Search of the Transmission Mechanism of Fiscal Policy", Working Paper, IGIER-Bocconi.

Ramey, V.A. (2007), "Identifying Government Spending Shocks: It's All in the Timing", Manuscript, University of California, San Diego.

Ravn, M., Schmitt-Grohè S. and Uribe, M. (2006), "Deep Habits", *Review of Economic Studies*, 73(1), 195-218.

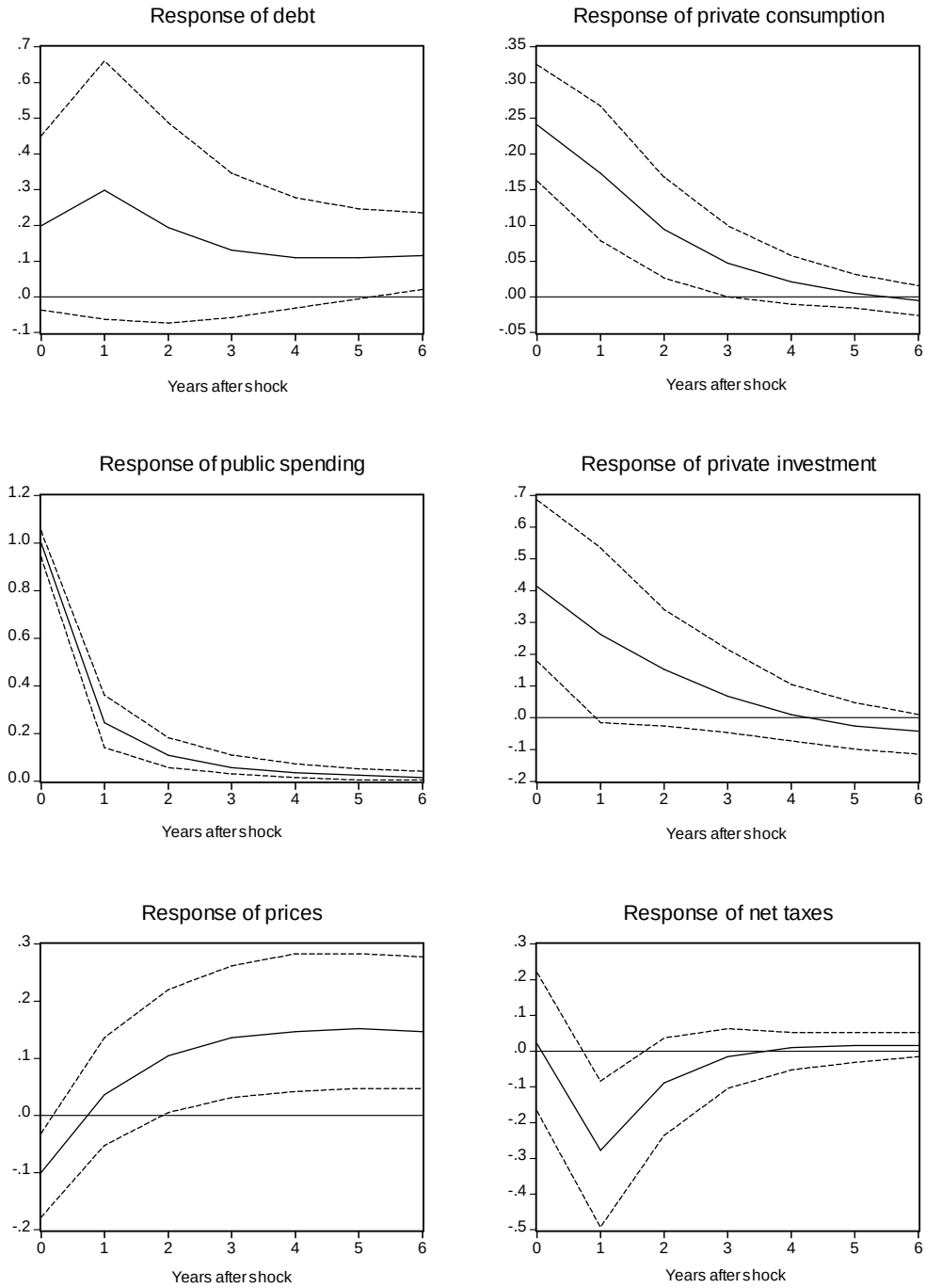
Romer, C. and Romer, D. (2007), "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks", Working paper, University of California, Berkeley.

Schmitt-Grohè, S. and Uribe, M. (2008), "What's 'News' in Business Cycle", NBER Working Paper No.14215.

Smets, F. and Wouters, R. (2003), "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area", Journal of the European Economic Association, Vol. 1(5), 1123-1175.

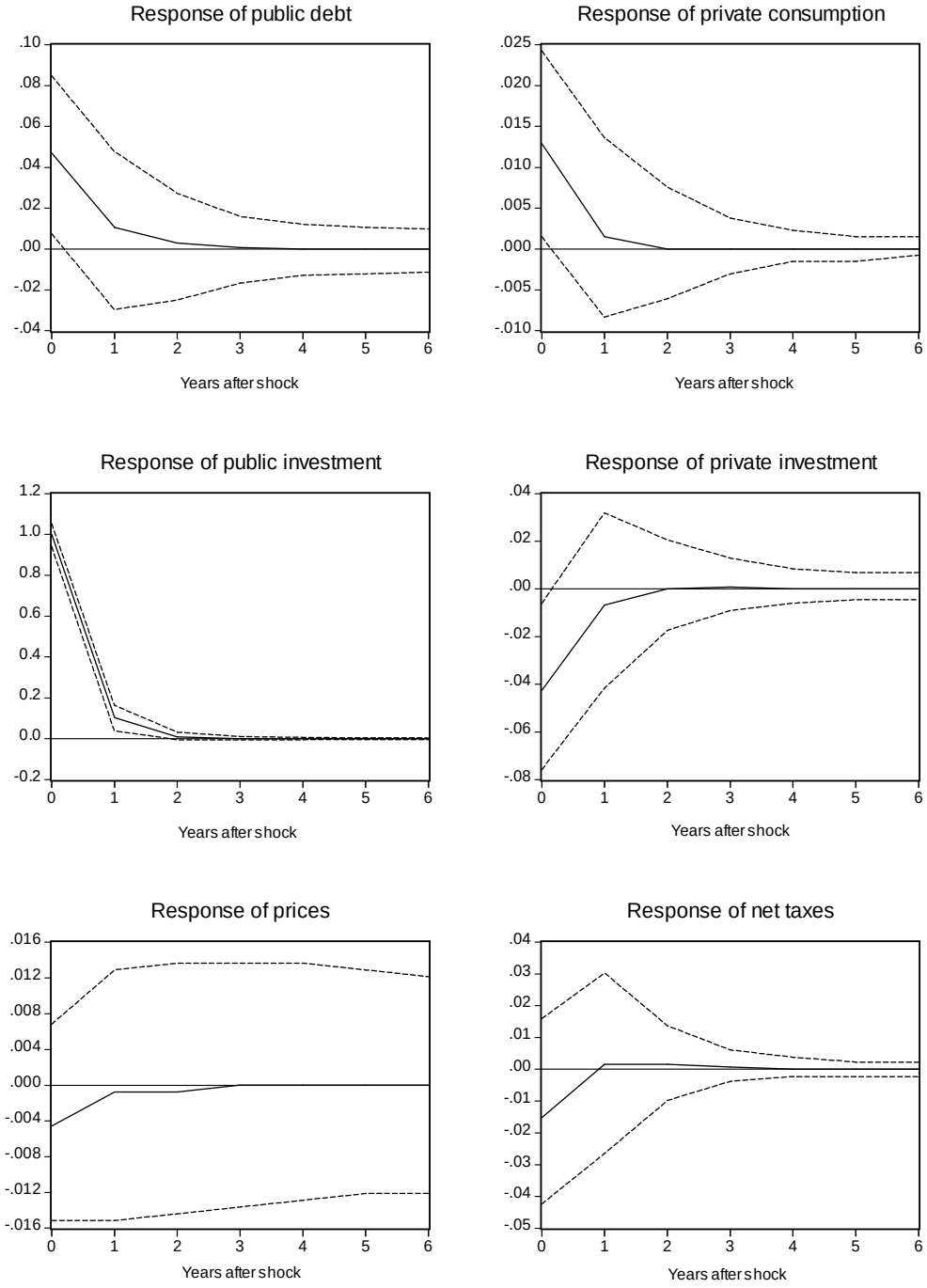
Figures

Figure 1: baseline impulse responses (shock in public spending)



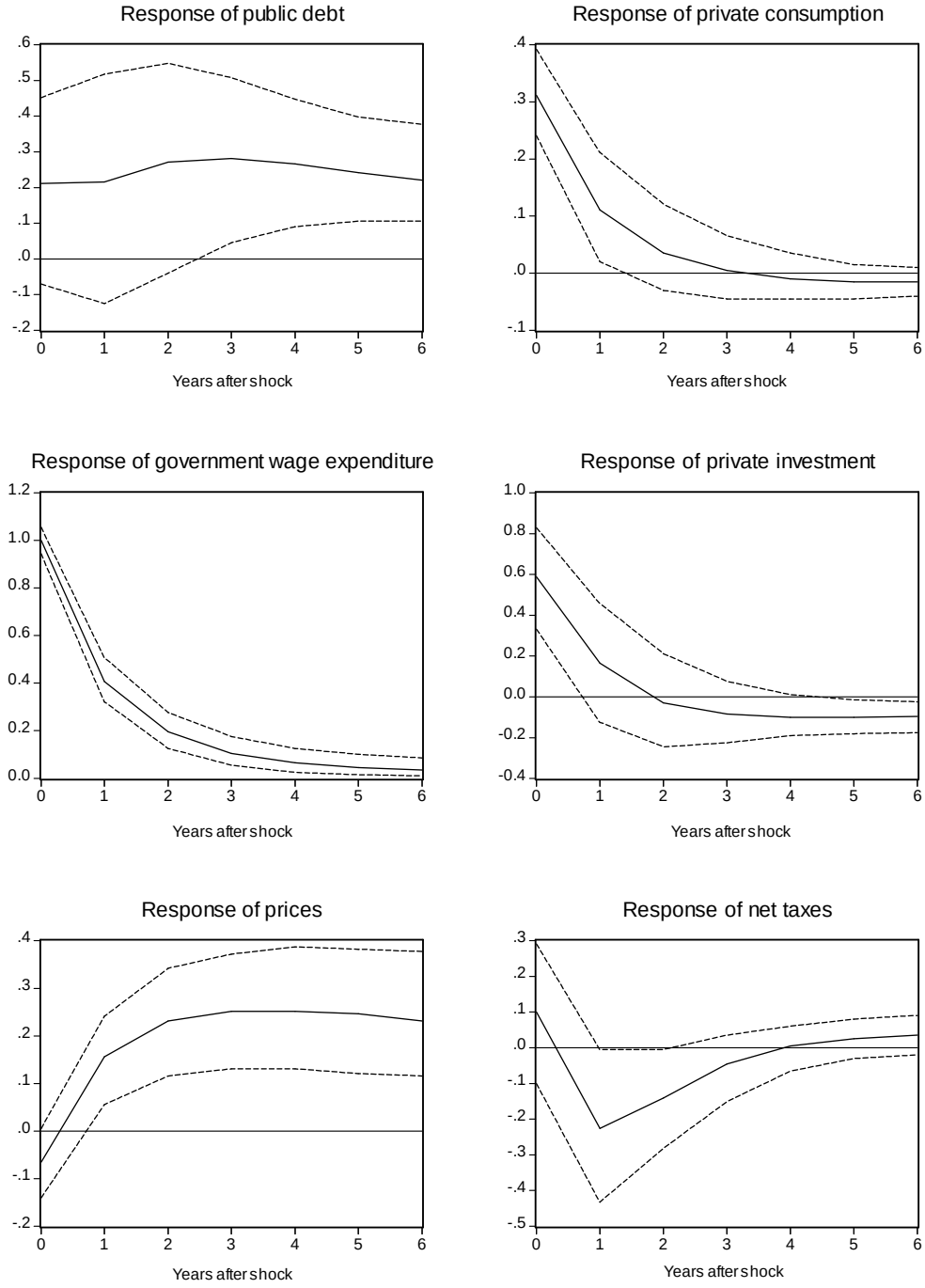
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications.

Figure 2: impulse responses (shock in public investment)



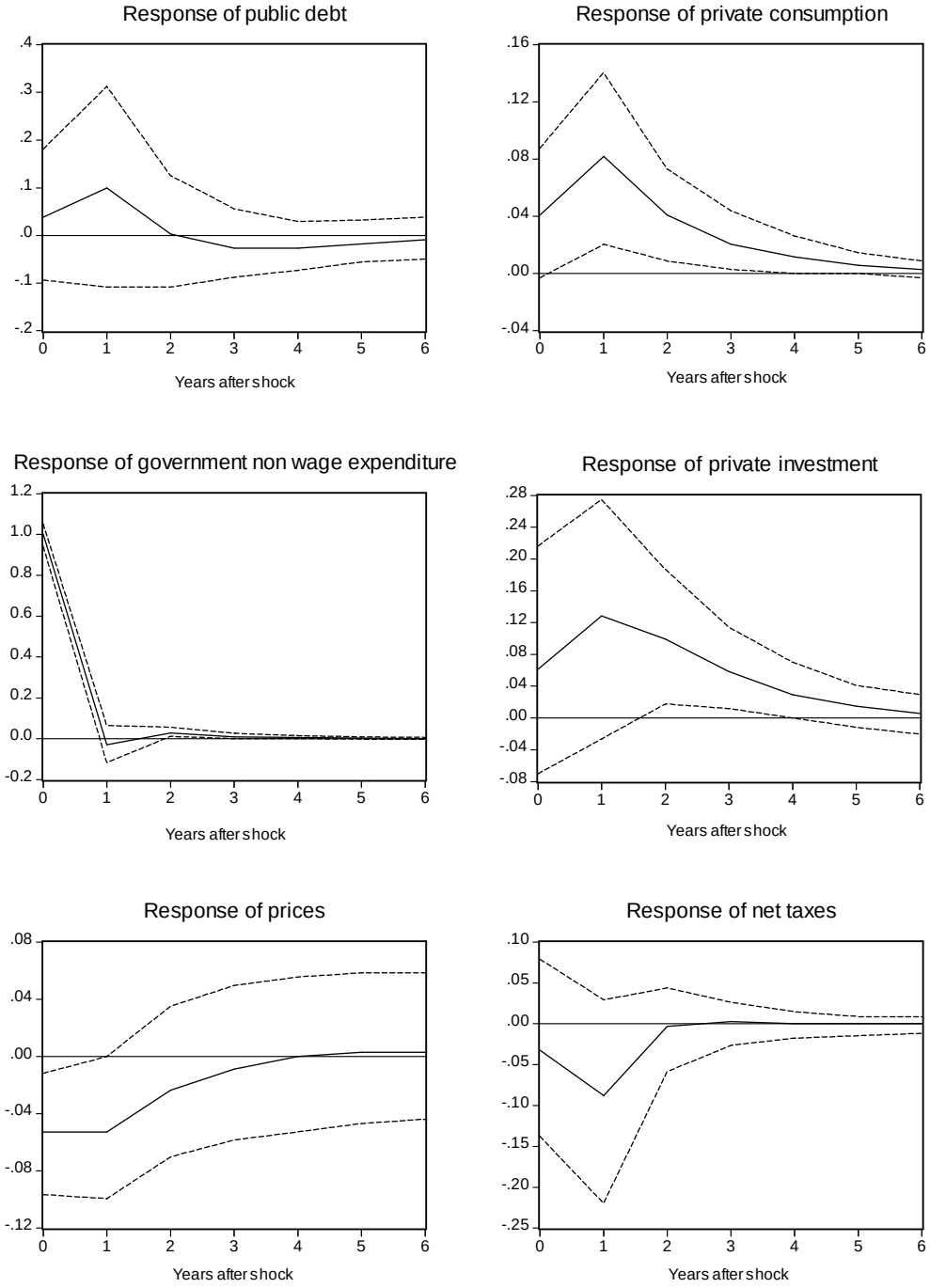
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications.

Figure 3: impulse responses (shock in government wage expenditure)



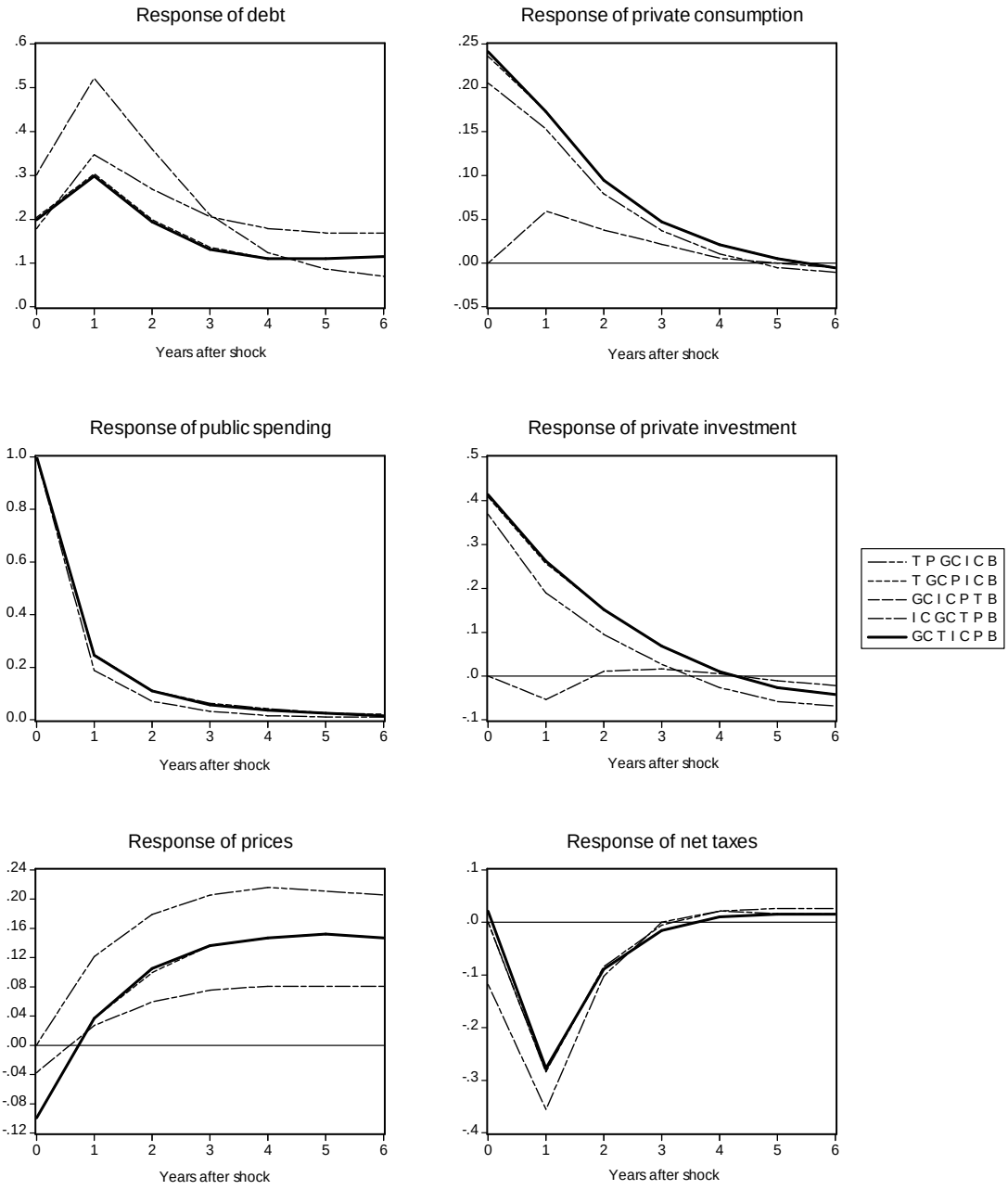
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications.

Figure 4**:** impulse responses (shock in government non wage expenditure)



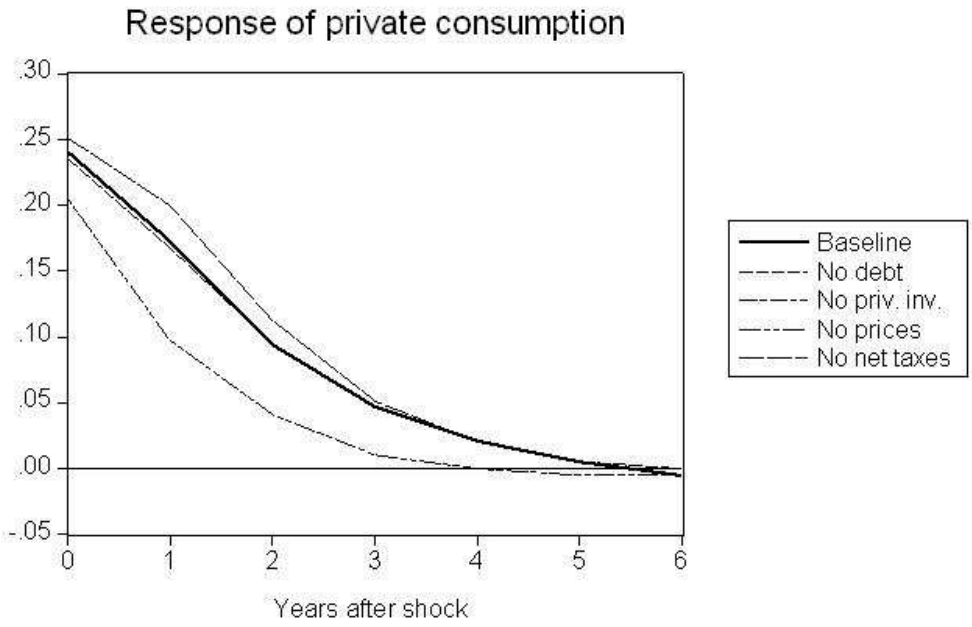
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications.

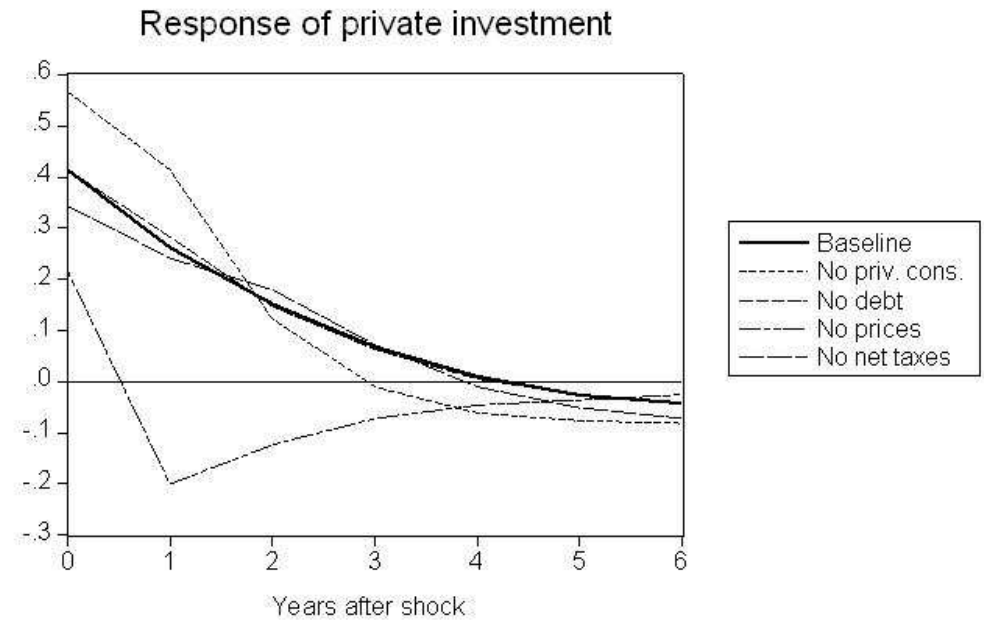
Figure 5**:** impulse responses (4 alternative Cholesky orderings)



Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications. The thick line is the point estimate of the baseline specification.

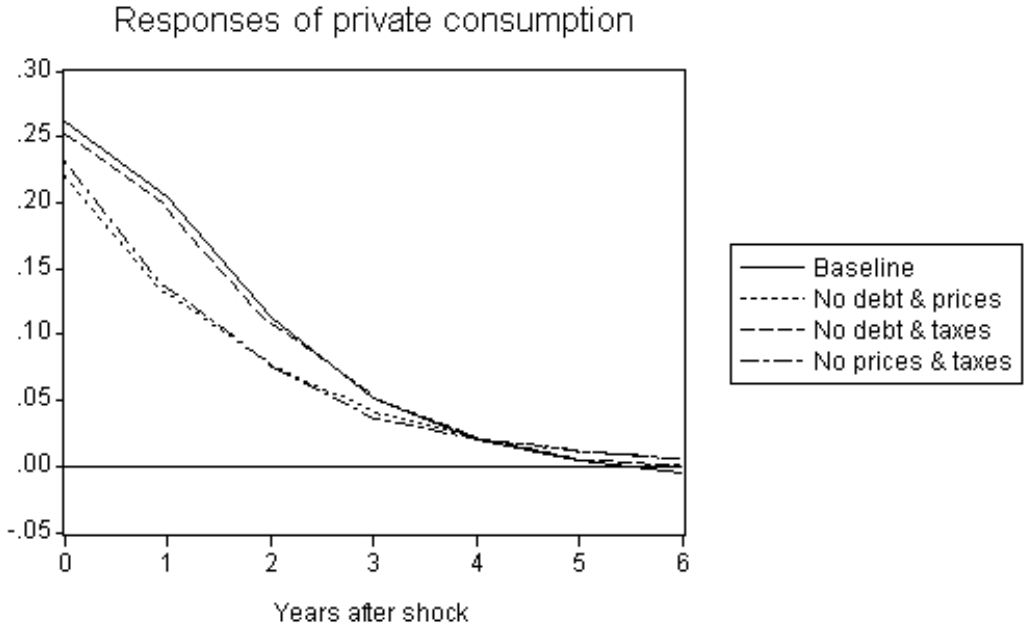
Fig. 6: robustness check, private consumption and investment responses (shock in public spending - point estimates only), 5-variables VARs

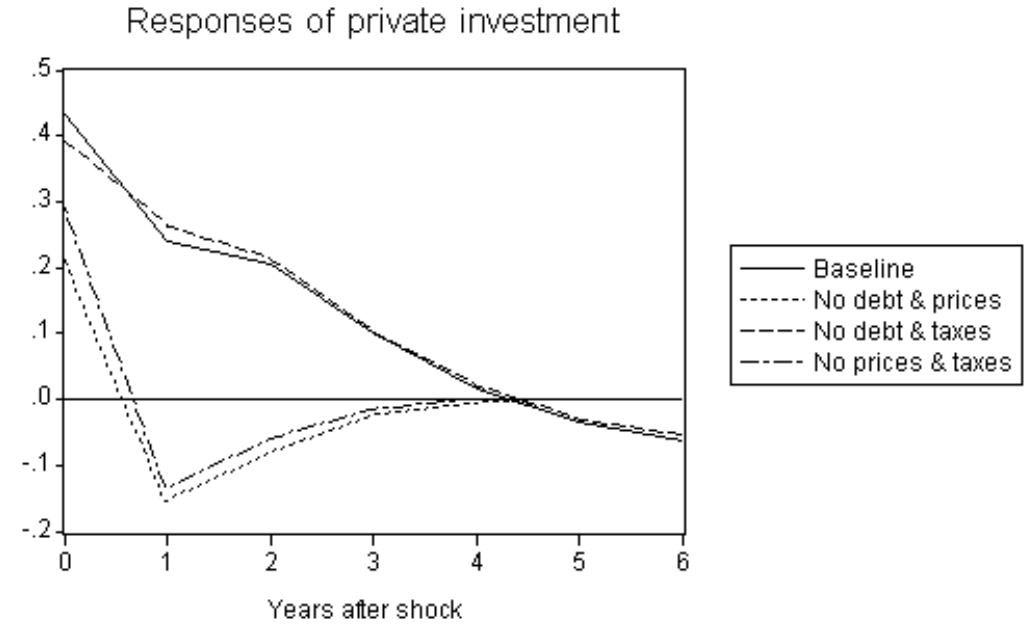




Note: the thick solid line is the baseline VAR point estimate; dotted lines are the point estimates of the impulse responses coming from five different 5-variables VARs obtained by excluding the indicated variables one at a time.

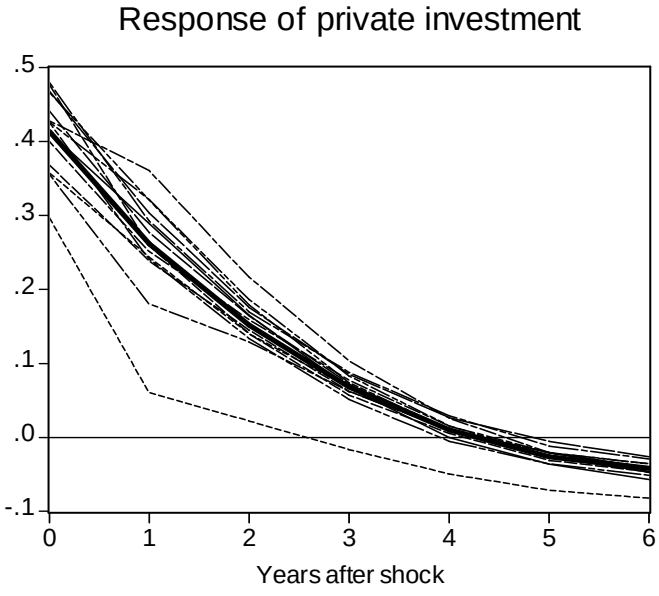
Fig. 7: robustness check, private consumption and investment responses (shock in public spending - point estimates only), 4-variables VARs





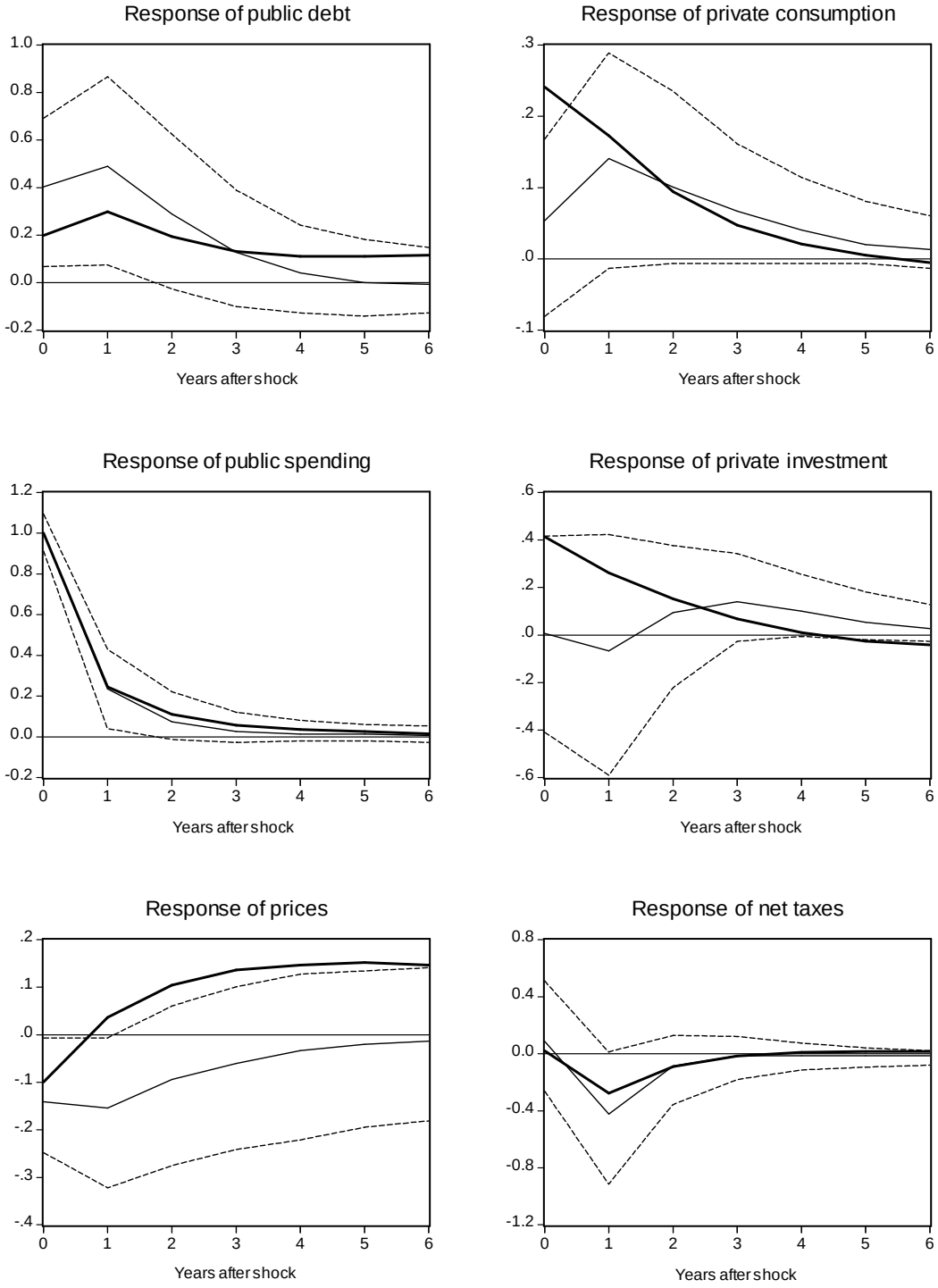
Note: solid lines are the baseline VAR estimates; dotted lines are the point estimates of the impulse responses coming from three different 4-variables VARs obtained by excluding the indicated pairs of variables one at a time.

Figure 8: robustness check, private consumption and investment responses (shock in public spending - point estimates only), sample variation



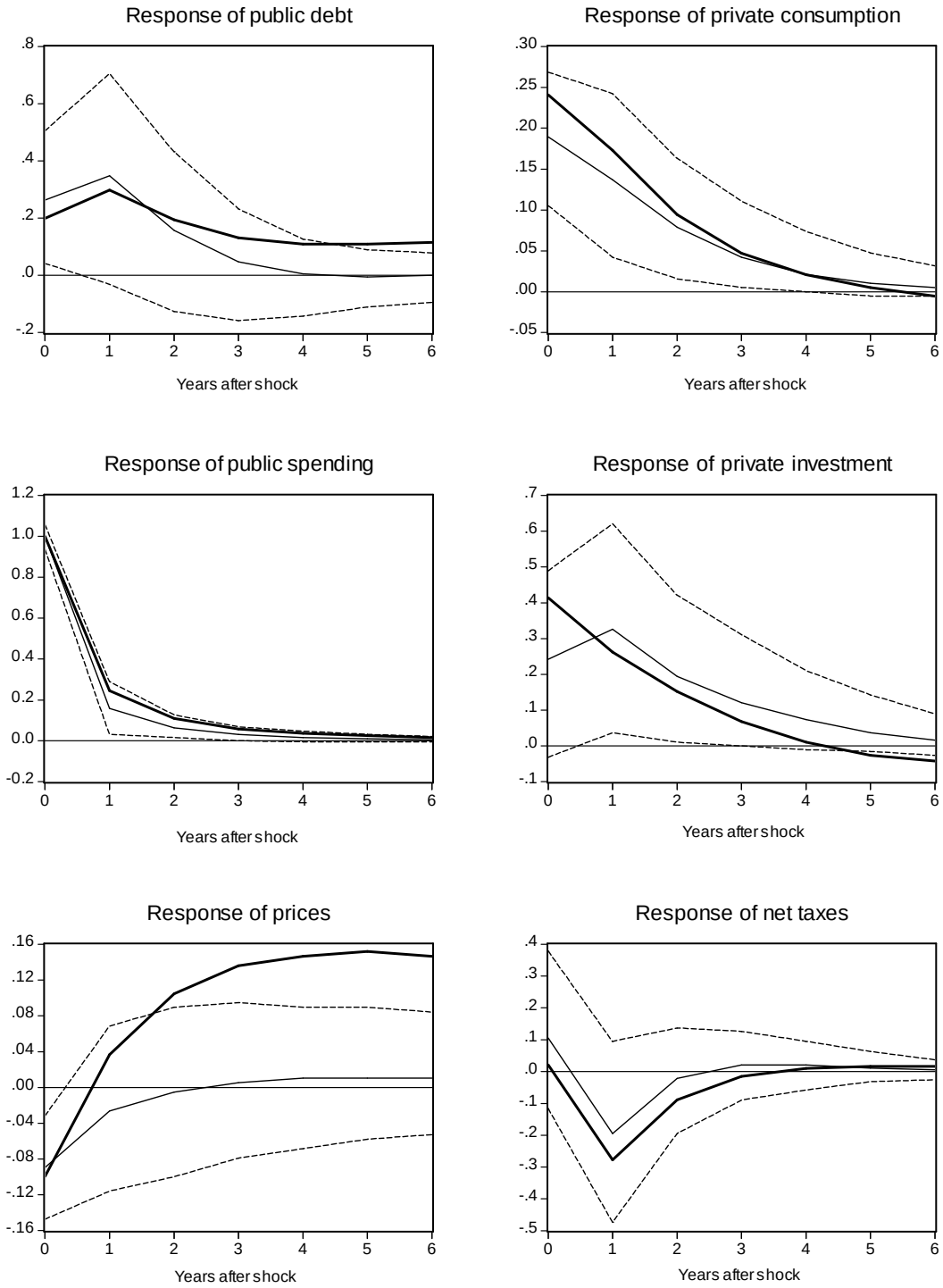
Note: solid lines are the baseline VAR estimates; dotted lines are the point estimates of the impulse responses coming from the fourteen different VARs obtained by excluding one country of the sample at a time. The thick line is the point estimate of the baseline specification.

Figure 9: impulse responses (shock in public spending), core countries only



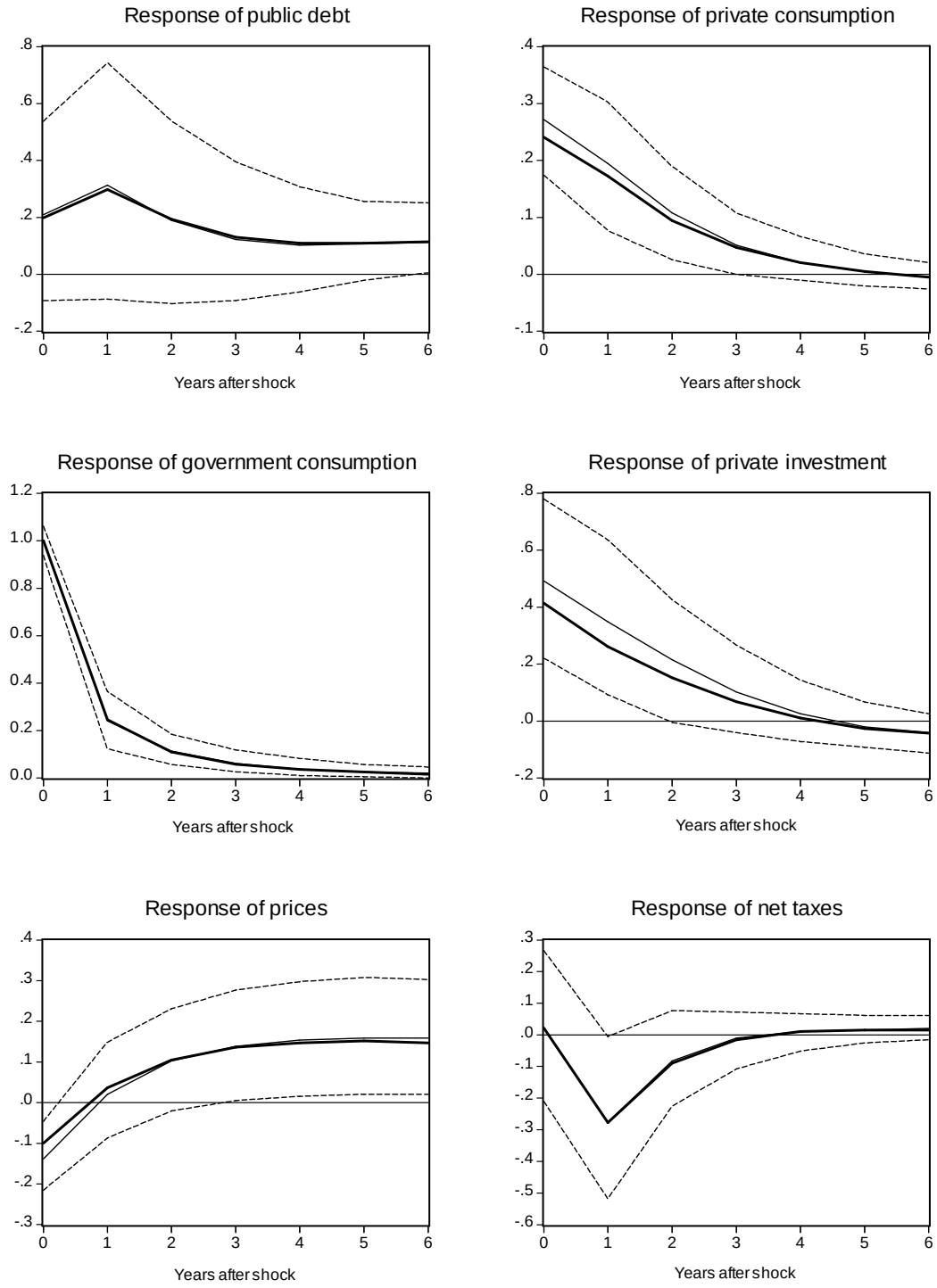
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications. The thick line is the point estimate of the baseline specification.

Figure 10: impulse responses (shock in public spending), post 1980 period



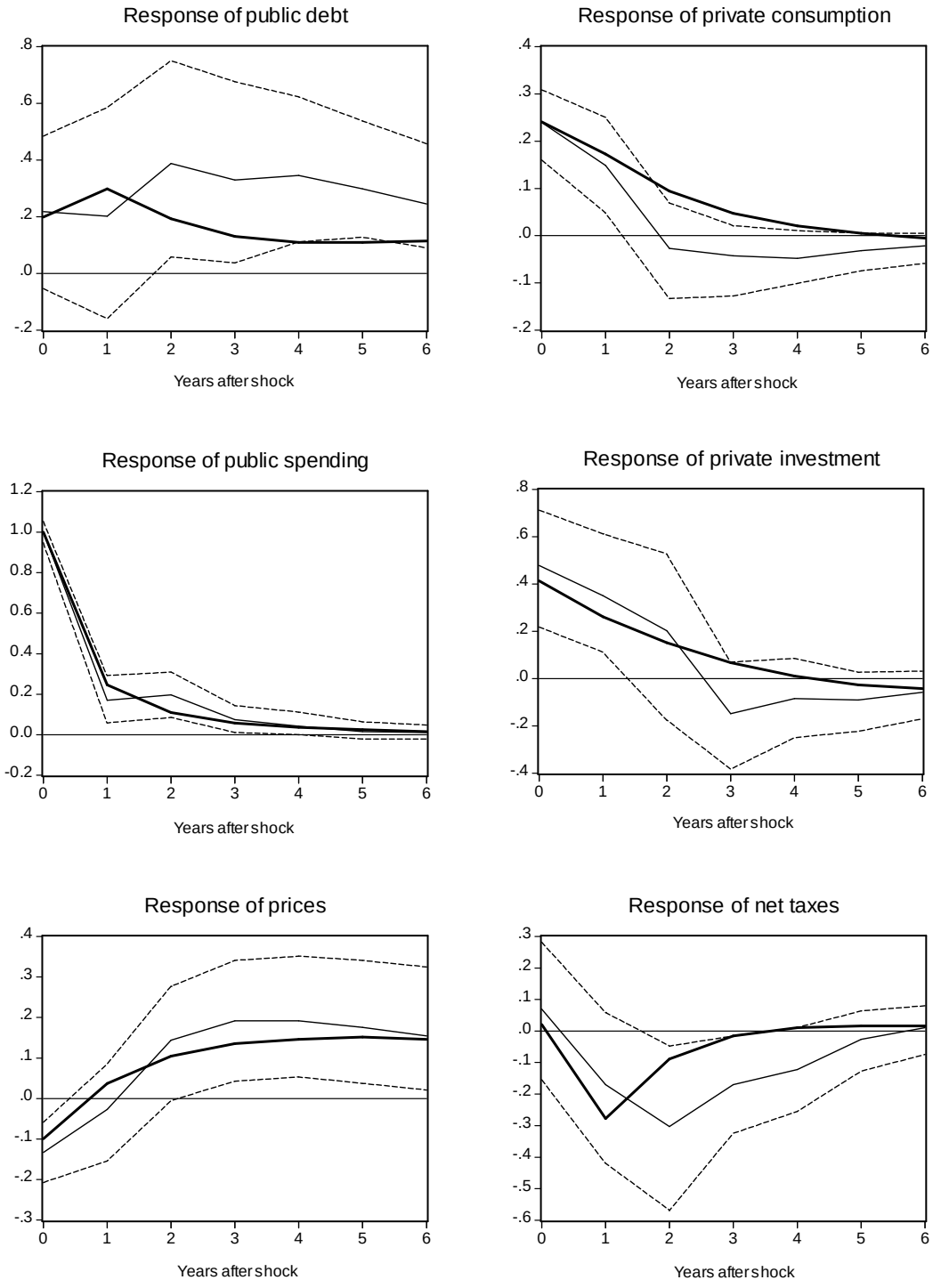
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications. The thick line is the point estimate of the baseline specification.

Figure 11: impulse responses (shock in public spending), pre-EMU period



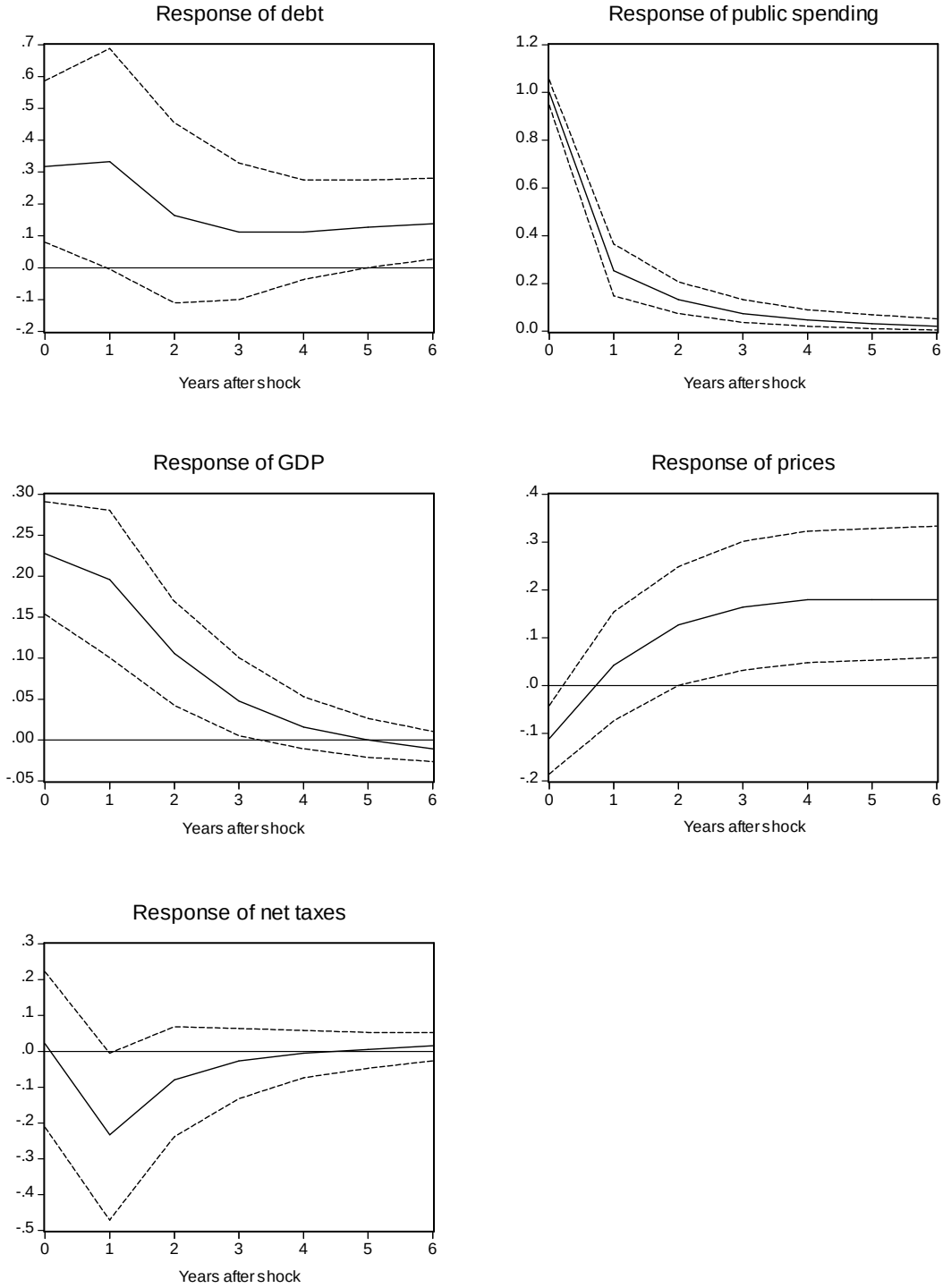
Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications. The thick line is the point estimate of the baseline specification.

Figure 12: impulse responses (shock in public spending), 2 lags



Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications. The thick line is the point estimate of the baseline specification.

Figure 13: impulse responses (shock in public spending), model with GDP



Note: Confidence bands are the 5th and 95th percentiles from Monte Carlo simulations based on 500 replications.

Tables

Table 1. Responses to a 1% fiscal spending (*gc*) shock

Response of →	*gc*	*t*	*i*	*c*	*p*	*b*
0	1.000***	0.021	0.414***	0.241***	-0.099***	0.199
1	0.246***	-0.277***	0.262*	0.173***	0.037	0.298
2	0.110***	-0.089	0.152	0.094***	0.105*	0.194
3	0.058***	-0.016	0.068	0.047*	0.136**	0.131
4	0.037***	0.010	0.010	0.021	0.147**	0.110
5	0.026**	0.016	-0.026	0.005	0.152**	0.110
6	0.016**	0.016	-0.042	-0.005	0.147**	0.115

***, **, *: significant at 1, 5 and 10%

Table 2. Responses to a 1% government investment (*gi*) shock

Response of →	*gi*	*t*	*i*	*c*	*p*	*b*
0	1.000***	-0.015	-0.042**	0.013**	-0.005	0.047**
1	0.103***	0.002	-0.007	0.002	-0.001	0.011
2	0.010	0.002	0.000	0.000	-0.001	0.003
3	0.001	0.001	0.001	0.000	0.000	0.001
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000

***, **, *: significant at 1, 5 and 10%

Table 3. Responses to a 1% government wage expenditure (*gw*) shock

Response of →	*gw*	*t*	*i*	*c*	*p*	*b*
0	1.000***	0.101	0.588***	0.312***	-0.065*	0.211
1	0.407***	-0.226**	0.166	0.111**	0.156	0.216
2	0.196***	-0.141**	-0.030	0.035	0.231	0.271
3	0.106***	-0.045	-0.085	0.005	0.251	0.281
4	0.065***	0.005	-0.101	-0.010	0.251	0.266
5	0.045**	0.025	-0.101	-0.015	0.246	0.241
6	0.035**	0.035	-0.095	-0.015	0.231	0.221

***, **, *: significant at 1, 5 and 10%

Table 4. Responses to a 1% government non-wage expenditure (*gnw*) shock

Response of →	*gnw*	*t*	*i*	*c*	*p*	*b*
0	1.000***	-0.032	0.061	0.041*	-0.053**	0.038
1	-0.029	-0.088	0.129*	0.082***	-0.053**	0.099
2	0.029***	-0.003	0.099**	0.041**	-0.023	0.003
3	0.009	0.003	0.058**	0.020**	-0.009	-0.026
4	0.006*	0.000	0.029*	0.012*	0.000	-0.026
5	0.003	0.000	0.015	0.006*	0.003	-0.018
6	0.000	0.000	0.006	0.003	0.003	-0.009

***, **, *: significant at 1, 5 and 10%