The Response of Private Consumption to Different Public Spending Categories: VAR Evidence from UK

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Abstract

Recent empirical evidence indicates that private consumption is crowded-in by government consumption, in contrast to neoclassical theory. However, the overwhelming majority of these studies are concerned with US economy, with scarce evidence collected for other countries. This paper focuses on UK economy, adopting a structural VAR approach with quarterly non-interpolated data 1981Q1 -2005Q4. The main novelty consists of the analysis of private consumption's response to different components of public expenditure (government consumption, social spending and wage component). We find that, while shocks to pure government consumption trigger a RBC-type reduction in private consumption, shocks to the non-systematic component of social spending generate a positive reaction, in line with the "credit-constrained agents" approach. The cumulative impact on consumption after three years of a government spending shock is twice as much the social spending shock, with opposite sign. Government wage shocks do not seem to have any significant effects on private consumption. Public expenditure composition, rather than level, seems to be actually playing the most crucial role when it comes to aggregate demand support via effects on private consumption. Our findings suggest that any empirical support of competing theoretical models on the issue would probably benefit from a disaggregation of government expenditure, rather than focusing on the aggregate measure.

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1. Introduction

The severity of the last economic downturn following the global financial crisis has intensified the search for the typology of public expenditure able to maximize the short-term impact on economic activity. As recovery plans' specifications differ across countries, the very basic question remained the same: which fiscal policy weapon is associated with the highest multiplier? The attempt to evaluate the fiscal policy's effectiveness has often resulted on the sign and magnitude of (actual or cyclically-adjusted) budget deficit's impact on GDP. Perotti (2007) provides a good review on the comparison between different theoretical models and their empirical predictions regarding the impact on income. In this paper, we investigate a slightly different question: how do different categories of public expenditure affect private consumption?

The relevance of the issue rests on private consumption's major weight among aggregate demand's components, as showed by Figure 1. This in turn is the reason why consumption's response to economic stimulus plans is the key determinant of output multipliers.

FIGURE 1 ABOUT HERE

In order to answer this question, we perform a structural VAR analysis on the UK economy, using quarterly non-interpolated data from 1981 to 2005. At the moment the evidence on this country is scarce, as only few studies have focused on it (Monacelli and Perotti, 2006 and Perotti 2004 and 2007). In line with some recent studies (Beetsma et al. 2006, Beetsma 2008, Giordano et al. 2007, Cavallo 2005 and 2007) we do not focus on public finance aggregates but rather on budget deficit's single components. Our disaggregation is mainly on the expenditure side, as we are primarily concerned with the aggregate consumption effects of different public expenditure categories. Unlike many of the above-mentioned contributions, we do not limit ourselves to the identification of wage and non-wage components of public expenditure, but rather distinguish among government consumption, government wage expenditure and social spending.

Our results, robust to a number of alternative specifications, show that the only component resulting in a positive and significant response of private consumption is social expenditure, defined as the sum of social security benefits and subsidies, net of social security contributions. On the other hand, government consumption seems to have a negative and significant effect, whereas wage expenditure has no impact. Regarding the magnitude of those effects, in our benchmark model the cumulative

impact on private consumption of a government spending shock equal to 1% of GDP is in absolute terms higher than the one (of the same magnitude) to the social expenditure component: while shocks to the former lead to a -0.9% impact on GDP, shocks to the latter cause a +0.5% cumulative response. A consequence of our analysis is that using total government expenditure (by aggregating the three components above) does not seem to be a reasonable simplification: in fact, when these three components of government expenditure enter the VAR in a unique aggregate measure, the result is a zero-impact on private consumption (see section 4), as also found by Perotti (2004).[1] Instead, disaggregating public expenditure conveys more detailed and differentiated information on its actual capabilities to affect private consumption. This result is particularly noteworthy as the empirical literature on UK economy has so far achieved mixed conclusions regarding the response of private consumption to government spending shocks (Perotti 2004, 2007, Monacelli and Perotti 2006), while we provide sufficiently robust evidence via our proposed disaggregation.

We also believe these results to be relevant for the theoretical debate between alternative and competing approaches modelling private consumption's impact of fiscal shocks. As it is well known, the standard neoclassical RBC model predicts a fall in consumption following a government expenditure shock, because of the Ricardian equivalence: higher public spending must be matched by an equivalent increase in taxation in present discounted terms, therefore intertemporal optimizing consumers suffer from a negative wealth effect that decreases consumption. Effects on output are positive due to increased labour supply, triggered by the wealth effect. Since virtually no study seems to confirm the prediction of the standard neoclassical model (as pointed out by Galì, Lopez-Salido and Valles 2007), the New Keynesian tradition attempted to reconcile theory with empirical evidence and rescued a consumption-enhancing role for fiscal policy. This has been accomplished either using finite-horizons frameworks (Blanchard 1985) or introducing credit-constrained agents and rule-of-thumb consumers (Mankiw, 2000, Galì et al 2004, 2007).[2] This latter approach has particularly gained considerable attention. It includes a fraction of non-Ricardian households who do not optimize over the life cycle and are thus forced to consume out of current income, so that their consumption responds promptly to a fiscal policy impulse.[3] A further research strand explicitly considers the *per se*

[1] Perotti finds a non-significant effect of fiscal shocks on consumption for the period 1980-2000. We confirm this finding, with an aggregate measure of consumption, over a 1981 – 2005 sample.

[2] As a matter of fact, there is also a third way to the same result. Ravn et al. (2004) obtain a positive effect on consumption without credit-constrained agents, but assuming that the representative individual forms consumption habits on the individual variety in a monopolistic competition setting, rather than on aggregate consumption.

[3] As discussed by Galì, Lopez-Salido and Valles (2007), the presence of non-Ricardian consumers must be coupled with sticky prices and imperfectly competitive markets in order to obtain a private consumption's positive response.

government expenditure's impact on consumption. This is often carried out by an ad-hoc utility function specification where private and public consumption are entered in a non-additive form, so to obtain a non-zero impact of one on the marginal utility of the other (Bouakez and Rebei 2003); on the other hand, there is a large non-VAR empirical literature attempting to assess the sign and the magnitude of the relationship (Aschauer 1985, Campbell and Mankiw 1990, Graham and Himarios 1991, Graham 1993, Karras 1994, Ni 1995, Amano and Wirjanto 1998, Okubo 2003, Fiorito and Kollintzas 2004) which however led to mixed and inconclusive evidence.

The present study can be relevant for all the above-mentioned theoretical discussions. We provide evidence that – at least in our case study – considering the indistinct aggregate of government expenditure can indeed be very misleading. The identification of social expenditure as the only government expenditure category which is effective in stimulating private consumption leads to two remarks: (i) the complementarity/substitutability issue cannot be discussed independently from a sufficient disaggregation of government expenditure (ii) the rule-of thumb-consumers approach can indeed be justified no longer on the assumption of an exogenous fraction of credit constrained agents, but on the existence of a precise portion of public expenditure that stimulates a fraction of consumers, specifically those who are the beneficial of social expenditure (presumably the lower part of income distribution), and who consume out of it.

The remainder of this paper is organized as follows. Section 2 presents the benchmark model, the data and discusses the identification procedure. Section 3 contains the estimation results (impulse response analysis and variance decomposition) with particular regard to the reaction of private consumption to different kinds of government expenditure shocks. Section 4 deals with robustness and sensitivity analysis, by estimating several different variations of the benchmark VAR model. Section 5 concludes and discusses policy implications.

2. Variables and model specification

The benchmark specification of our model is a seven-variables VAR, whose reduced form is defined by the following dynamic equation:

$$Y_t = c + A(L)Y_{t-1} + U_t \tag{1}$$

where $Y_t = \left[C_t, T_t, P_t, GC_t, GSS_t, GW_t, B_t\right]$ is the vector of variables composed by private consumption (C_t), net government taxes (T_t), consumer price index (P_t), government consumption (GC_t),

government outlays in social security (GSS_t), government wage expenditure (GW_t) and government financial liabilities (B_t). The variables are all integrated of order 1. $A(L)$ is an auto regressive lag polynomial, and U_t is the vector of reduced-form innovations. The VAR also includes a constant (c) and a linear time trend, although we omit the latter from the notation for convenience. We chose not to include public investment into the analysis as this component implies external effects (such as production externalities) that are not immediately associated with private consumption, which is the focus of this paper. We also do not explicitly consider tax shocks, as they are particularly hard to identify in a SVAR model.[4]

"The availability of quarterly fiscal variables represents the main constraint for the analysis of fiscal policy with VAR models" (Giordano et al. 2008, p. 6). Furthermore, Perotti (2004) correctly warns against the distortions coming from the usage of quarterly data set obtained by interpolation of yearly values. This remark makes the data availability constraint even more binding, and poses considerable limitations to the implementation of a fully-equipped large scale time series analysis. We have chosen to sacrifice the generality of our conclusions in favour of a complete non-interpolated quarterly data set; this paper focuses on United Kingdom, and uses data from 1981Q1 to 2005Q4.[5]

The source for almost all of the variables that we used is the OECD Economic Outlook No 83.[6] The benchmark specification includes: the log of real private final consumption expenditure per capita *C*, the log of real taxes per capita *T* (defined as the sum of direct and indirect taxes, other receipts and property income received by government), the harmonized consumer price index *P*,[7] the log of real government consumption per capita *GC* (defined as the sum of government final non-wage expenditure and other current outlays), the log of real government social expenditure per capita *GSS* (defined as the sum of net social security benefits and subsidies), the log of real government final wage expenditure per capita *GW*, the log of real government financial liabilities per capita *B*. Additional variables used for robustness checks include the log of real GDP per capita, the short term interest rate on government bonds, and the sum of the three components of government expenditure, *GTOT*. All real variables are deflated by the GDP deflator. Population data come from the World Development Indicators of the World Bank.

[4] In both cases we follow Perotti (2007).
[5] This period has been chosen because of the strong evidence that points towards a structural break between 1981 and the previous period (Perotti, 2004).
[6] The quarterly data of the Economic Outlook are normally obtained by interpolation, but not those of the UK.
[7] Here the source is UK National Statistics.

We estimate the seven equations of system (1) independently using least squares. The number of lags is set to five according to the Akaike Information Criterion and the absence of serial correlation in the residuals, positively checked with a Lagrange Multiplier test.[8] Moreover, we failed to reject the hypothesis of normality of residuals with the Jarque-Bera statistics and we checked the stability condition of the VAR, finding that all eigenvalues comfortably lie inside the unit circle. We also tested for the presence of cointegrating relationships among the variables, finding mixed evidence according to the rank and the maximum eigenvalue tests. Due to that, and given that our a priori did not include a meaningful long-run relationship among the variables, we decided not to impose any cointegrating restriction and, thus, estimate the VAR with the variables in levels (Sims et al. 1990, Giordano et al. 2008).

We turn now to the identification issue. The literature on fiscal policy VARs has traditionally adopted two alternative strategies in order to identify exogenous and unexpected fiscal shocks (Beetsma, 2008). The first one identifies deviations of fiscal policy from its systematic path by using dummy variables so to capture specific episodes that can reasonably be interpreted as exogenous and unforeseen (Ramsey and Shapiro 1999, Burnside et al 2004, Romer and Romer 2007, Monacelli and Perotti 2008). Such a strategy has the advantage of being simple and straightforward, as it is relatively easy to justify and does not require any additional assumption; on the other hand, it might lack the appropriate accuracy, since the resulting impulse response functions might be affected by the delayed effects of previous events who are not captured by the contemporaneous effect of the dummy. The second strategy – more widespread - imposes alternative types of structural restrictions: they can be sign restrictions on the impulse response functions (Uhlig 2005, Mountford and Uhlig 2005, Canova and Pappa 2007,Enders *et al* 2008), external and institutional information exploiting the quarterly nature of data and fiscal policy decision lags (Blanchard and Perotti 2002, Perotti 2004, Muller 2008, Monacelli and Perotti 2008), or restrictions on contemporaneous relations among variables and error terms in the structural form (Marcellino 2006, Beetsma *et al* 2006, Beetsma 2008, Benetrix and Lane 2009).

Our identification strategy is the latter. In particular, we adopt a Cholesky factorization so to recover the vector of structural shocks ε_t (and its variance Ω) from the reduced-form error U_t in (1), according to the following scheme:

[8] The chi-square statistics for autocorrelation up to first and second order and 2 are 54.0872 and 33.7088 which imply p-values, respectively, of 0.2863 and 0.9528. Different criteria for lag length selection (final prediction error, AIC, SIC) led to a number of lags smaller than three, but dealing with quarterly data on fiscal policy we decided to disregard these options as we preferred to include at least one year of observations.

$$\begin{bmatrix} \varepsilon_t^{C} \\ \varepsilon_t^{T} \\ \varepsilon_t^{P} \\ \varepsilon_t^{GC} \\ \varepsilon_t^{GSS} \\ \varepsilon_t^{GW} \\ \varepsilon_t^{B} \end{bmatrix} = \begin{pmatrix} 1 & \alpha_T^{C} & \alpha_P^{C} & \alpha_{GC}^{C} & \alpha_{GSS}^{C} & \alpha_{GW}^{C} & \alpha_B^{C} \\ 0 & 1 & \alpha_P^{T} & \alpha_{GC}^{T} & \alpha_{GSS}^{T} & \alpha_{GW}^{T} & \alpha_B^{T} \\ 0 & 0 & 1 & \alpha_{GC}^{P} & \alpha_{GSS}^{P} & \alpha_{GW}^{P} & \alpha_B^{P} \\ 0 & 0 & 0 & 1 & \alpha_{GSS}^{GC} & \alpha_{GW}^{GC} & \alpha_B^{GC} \\ 0 & 0 & 0 & 0 & 1 & \alpha_{GW}^{SS} & \alpha_B^{GSS} \\ 0 & 0 & 0 & 0 & 0 & 1 & \alpha_B^{GW} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{bmatrix} u_t^{C} \\ u_t^{T} \\ u_t^{P} \\ u_t^{GC} \\ u_t^{GSS} \\ u_t^{GW} \\ u_t^{B} \end{bmatrix} \qquad (2)$$

The Cholesky ordering as in (2) is equivalent to assuming the following set of conditions. Consumption is the most endogenous variable and it is therefore affected by all contemporaneous values of all the variables of the VAR; this is natural, as the present study is primarily concerned with the analysis of macroeconomic effects on private consumption. Tax revenue is allowed to depend on prices and all fiscal variables, assuming that the government operates under a balanced budget-like stance[9]. Nominal rigidities in the form of delayed price adjustments justify the fact that the general price index is not affected by demand conditions within the quarter. Fiscal variables are modelled as the most exogenous ones, starting from the real stock of government liabilities, which can legitimately be considered as given in a quarterly data set; government wage expenditure is assumed to be the most rigid among spending categories, as its dynamics are usually governed by collective contracts whose length is well beyond the quarter. Social expenditure and government purchases of goods and services are thought to be featured by lower degrees of exogeneity in the ordering. Note that all government expenditure categories are allowed to depend on debt. Although our scheme can be arguable (as it is often the case in a Cholesky ordering), we believe that the data frequency grants us a sufficient degree of flexibility in the choice; we also provide a number of robustness checks in section 5 so to strengthen the general validity of our benchmark estimation.

3. Estimation results

Impulse response analysis

Figures 2a-c display the results of our baseline model.

FIGURE 2a, 2b, 2c ABOUT HERE

Each figure displays the response of all the 7 variables of the model to each one of the three government spending variables shocks equal to 1 percent of GDP (Figures 2a, 2b and 2c display the responses to shocks in GC, GSS and GW respectively). In order to derive the 16th and 84th percentiles of the impulse-response distribution in the figures, we perform Monte Carlo simulations and assume normality in the parameter distribution. Based on that information, we construct *t*-tests based on 1000 different responses generated by simulations, and check whether the point estimates of the mean impulse-responses are statistically different from zero. The responses of private consumption are expressed as shares of GDP by multiplying the response from the VAR (which is expressed in logs) by the sample average share of private consumption in GDP (as in Monacelli and Perotti, 2006).

Notice, first, that shocks in government consumption and in social spending lead to opposite effects on private consumption: while the first depresses it, as predicted by neoclassical models, the second increases it, as assumed by the credit-constrained approach. Both responses are statistically significant at conventional levels, as shown in Tables 1a-c. Both shocks are very persistent, even though the effects are perceived after three and five quarters in case of, respectively, government consumption and social spending. The former reaches the peak after 9 quarters, with a cumulative (negative) impact of -0.7% of GDP; the latter after 10 quarters, with a cumulative (positive) impact of 0.4%. It is interesting to note that the cumulative impact after three years of a government spending shock is approximately double the one of social spending, with reversed signs: shocks to government consumption lead to a -0.9% reduction in GDP, whereas shocks to social spending cause a +0.5% cumulative output response. On the other hand, shocks in government wage expenditure have no significant effects on consumption. That result has at least two possible explanations: non-systematic changes in public wages are not perceived as modifications of life cycle income by public employees; or, changes in wage policy in the public sector are not followed by similar increase in the (much wider[10]) private sector, so they fail to trigger a general increase in aggregate wage. It is also worth mentioning the fact that a shock in net taxes seems to affect positively consumption, thereby implying a Ricardian effect of tax-based fiscal consolidation - but the effects are not statistically different from zero at conventional levels. It is important to stress that the benchmark model's results are not sensitive to alternative Cholesky orderings of the government spending variables.

[9] Automatic effects of VAT taxation within the quarter are neglected.
[10] In 2005 public sector employment was 20% of all in employment (National Statistics UK)

Variance Decomposition

The variance decomposition analysis is complementary to the impulse response analysis presented above, since it is informative on the relative power of each shock in explaining the forecast error variance of the VAR equations at different forecast horizons. In particular, we look at the contribution of innovations in the three components of government spending to the forecast error variance of the private consumption equation.

FIGURE 3 ABOUT HERE

Figure 3 shows that, consistently with the impulse response analysis, the proportion of the forecast error variance in the private consumption equation explained by government consumption and social spending is considerably larger than the one explained by the wage expenditure. Moreover, government consumption and social spending have a similar importance in explaining the variance of private consumption (they are both slightly below 20% after 15 periods). Finally, note that the forecast error variance attributable to the 3 components of government expenditure overwhelms even the variance attributable to private consumption itself after 10 periods. This is a confirmation of the importance of the role played by fiscal policy innovations in determining private consumption's dynamics.

4. Robustness

In order to check the robustness of our results, we estimated several different VARs to verify whether baseline model's response of private consumption to shocks in the government expenditure variables are confirmed within alternative specifications. Our robustness check proceeds along three steps.

The first one is made of three slight modifications of the baseline model. First we exclude the time trend from the estimation; then we add quarterly dummies, as conventional in the literature (Monacelli and Perotti 2006); finally we include (along with the time trend and seasonal dummies) an additional dummy accounting for Labour party terms in office (specifically, since 1997Q2). The motivation for this test lies in the nature of the relationship this paper investigates: given the non-negligible differences in the stance towards government expenditure by Conservative and Labour governments, we wanted to check whether any differences can be observed in the empirical analysis.

Figures 4 shows the point estimates of the impulse response functions related to the three above specifications of our first robustness step.

FIGURE 4 ABOUT HERE

As it can be easily seen, our results are robust to these changes to the baseline model (Table 2, 3 and 4 in the Appendix contains the details of the responses).

The second step includes the variation of the VAR dimension and/or variables. Again, the results hold across these different specifications. Figure 5 shows the impulse response functions of two alternative 7-variables VARs. The first has the short term interest rate in place of government financial liabilities (this alternative variable is taken into account in various previous studies, such as Marcellino 2006 and Monacelli and Perotti 2007). The second contains the log of real GDP per capita in place of government financial liabilities. Tables 5 and 6 contains the details of these two alternative specifications.

FIGURE 5 ABOUT HERE

Figure 6 (and Tables 7-9) shows the results of three 6-variables VARs resulting from the exclusion of, respectively, financial liabilities, net taxes and the price index. Once more, the negative effects of a government consumption shock and the positive effects of shocks in social spending are well supported by the data.

FIGURE 6 ABOUT HERE

As final exercise of this second step, we estimate a more parsimonious 5-variables VAR containing consumption, price index and the three components of government expenditure. Results in Figure 7 (and Table 10) are again confirmed.

FIGURE 7 ABOUT HERE

Our third and final step is maybe the most relevant. We estimate four 5-variables VARs where, compared to the baseline model, each government expenditure category is included separately as the only component; finally, we estimate a specification where we recompose our disaggregation by

including the total aggregate expenditure (*GTOT*) obtained by summing up the three components that we analysed separately so far[11].

FIGURE 8 ABOUT HERE

Figure 8 presents the impulse response functions of our third robustness step. In particular, we can notice that the effects of total government expenditure shocks on consumption are not significantly different from zero, thereby pointing to a general ineffectiveness of public spending in stimulating private consumption. However, each component has a different quantitative and qualitative impact on consumption, and results are the same as in our benchmark 7-variables model and throughout the robustness checks. A general point can be made about the lagged response of private consumption to *GC* and *GSS*, that we observe in virtually all our estimates: while the (negative) effect of the former is significant pretty soon after the shock, the (positive) effect of social spending becomes statistically significant later (after 5/6 quarters). This result might suggest a tempting interpretation, based on the theoretical debate we base our empirical analysis upon. Since credit-constrained agents consume out of the social expenditure they benefit from, it is plausible to observe a time lag between the moment when the spending decision is approved (when we observe the public expenditure shock), and the moment when the agents' disposable income is actually affected (when private consumption reacts). On the other hand, the quicker (negative) response to government consumption might suggest a RBC-like anticipation effect: the mere approval of an increase in that component triggers a reduction in private consumption, following the negative wealth effect.

5. Conclusions

This paper carried out an empirical analysis on UK economy using quarterly non-interpolated data from 1981 to 2005. Our objective was to verify and quantify the effects of different broad categories of government expenditure on private consumption, so to contribute to the empirical literature which has reported mixed evidence so far. Our findings, robust to a number of alternative specifications of the SVAR, can be summarized as follows. Private consumption seems to respond: i) negatively to government purchases of goods and services; ii) positively on social spending; iii) not significantly to government wage expenditure. While *i)* seems to confirm the standard neoclassical wealth effect, *ii*)

[11] Note that this aggregate variable adds up exactly to government expenditure net of debt service payments.

strengthens the competing theoretical approach, known as the “credit-constrained” agents (who, in our interpretation, can be identified as the individuals social expenditure is targeted to, as it provides them with the resources to consume out of). Quantitative estimates of the responses’ magnitude in our benchmark specification lead to an important policy implication: shocks to government consumption have a cumulative impact on GDP after three years – via private consumption - that is twice as much the one of social spending, with opposite signs. This suggests that any expansionary effect of social expenditure might be potentially offset by a parallel increase in pure government consumption, with a negative effect on aggregate demand even though a overall increase in aggregate government expenditure has occurred. This result is strengthened by our robustness tests, showing that trying to measure the fiscal multiplier on private consumption by considering the whole government expenditure aggregate – and not its decomposition according to features and goals – can indeed be misleading.

While we believe that this analysis can represent a useful contribution to a more effective management of fiscal policy tools on the expenditure side, the general validity of the findings is certainly limited by the closed-economy one-country investigation. A panel-VAR analysis on EMU countries would permit the use of easily-available annual data, allowing a more complete answer to our original question, would probably be the most rationale next step.

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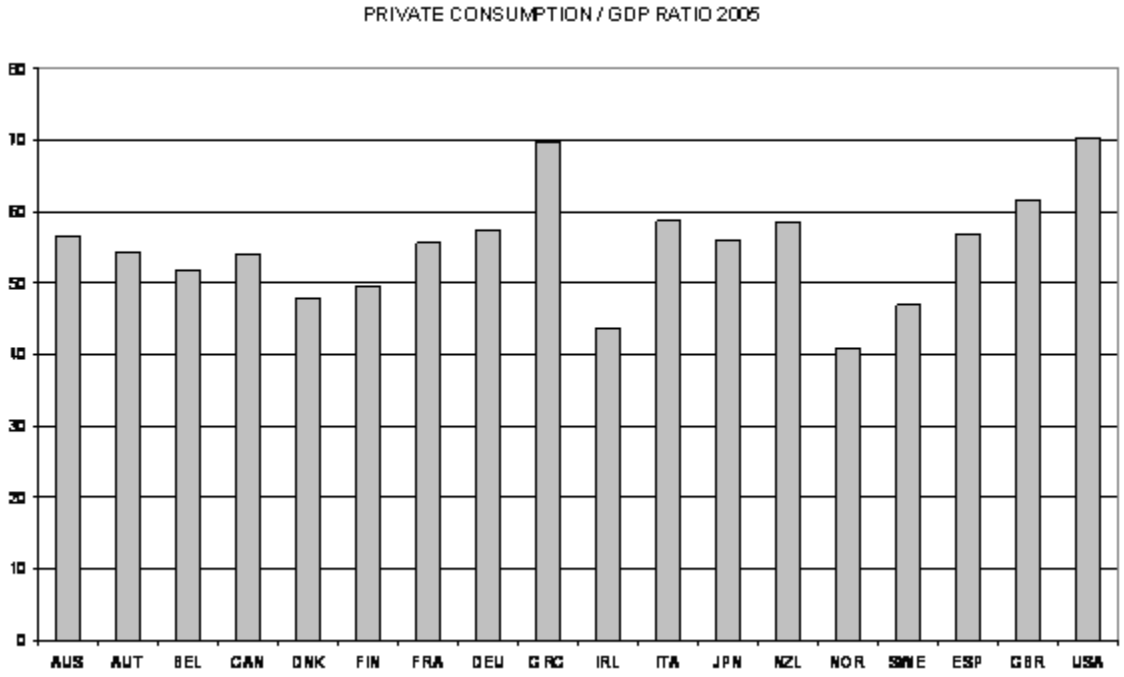
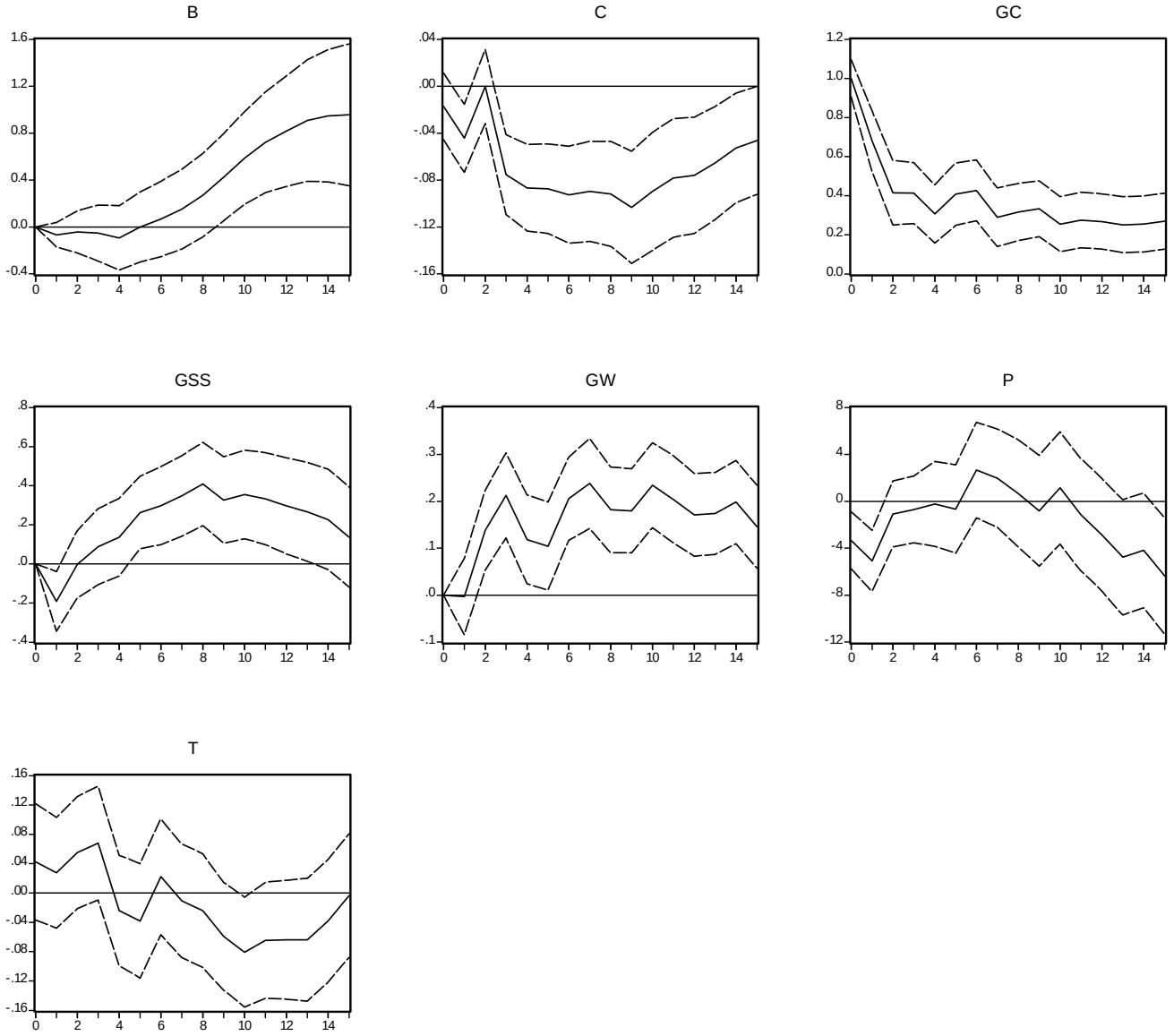
Figures

Figure 1: Private consumption as percentage of GDP in main industrialized countries



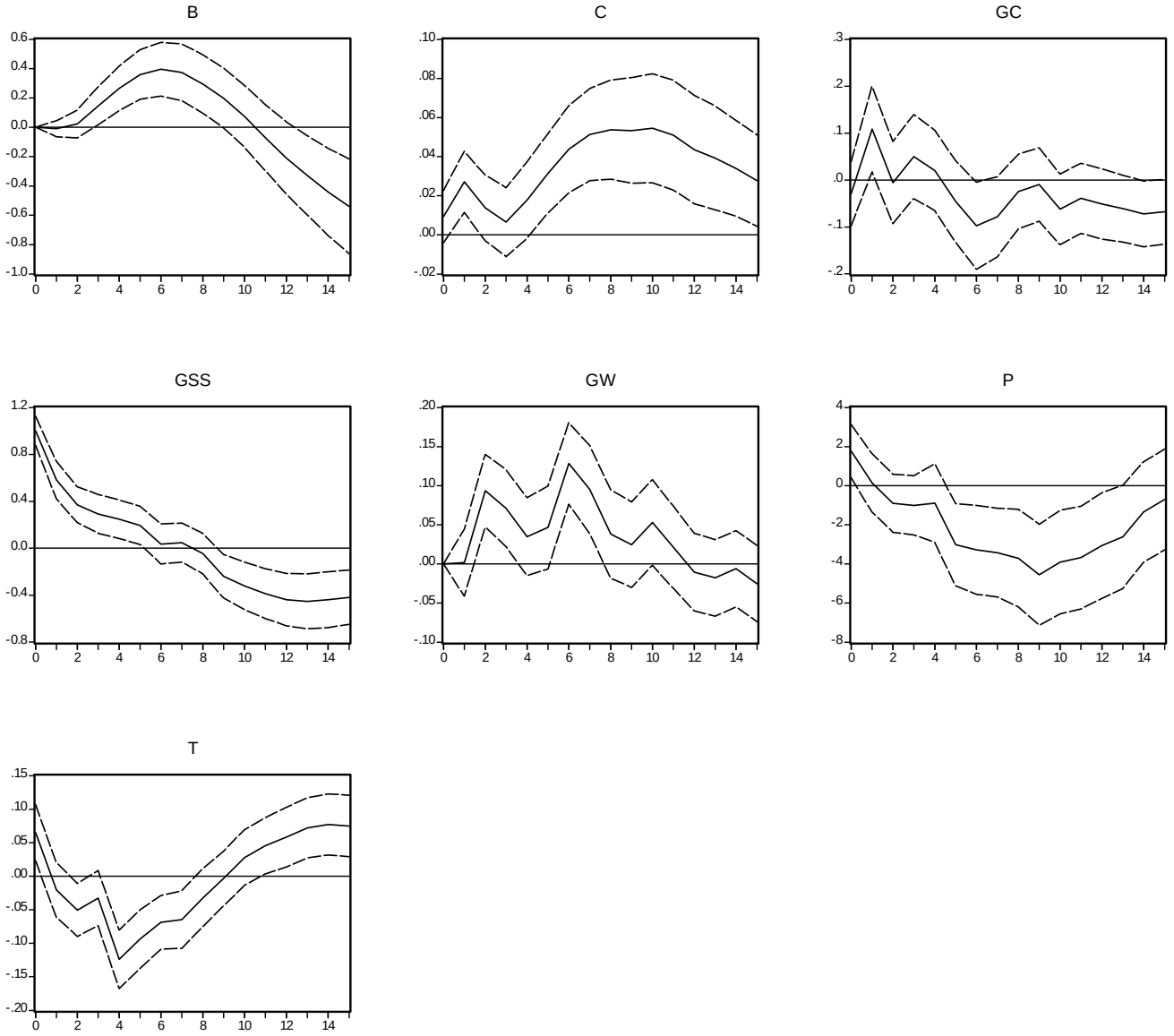
Source: OECD Economic Outlook 83

Figure 2a: responses of all variables to a shock of GC



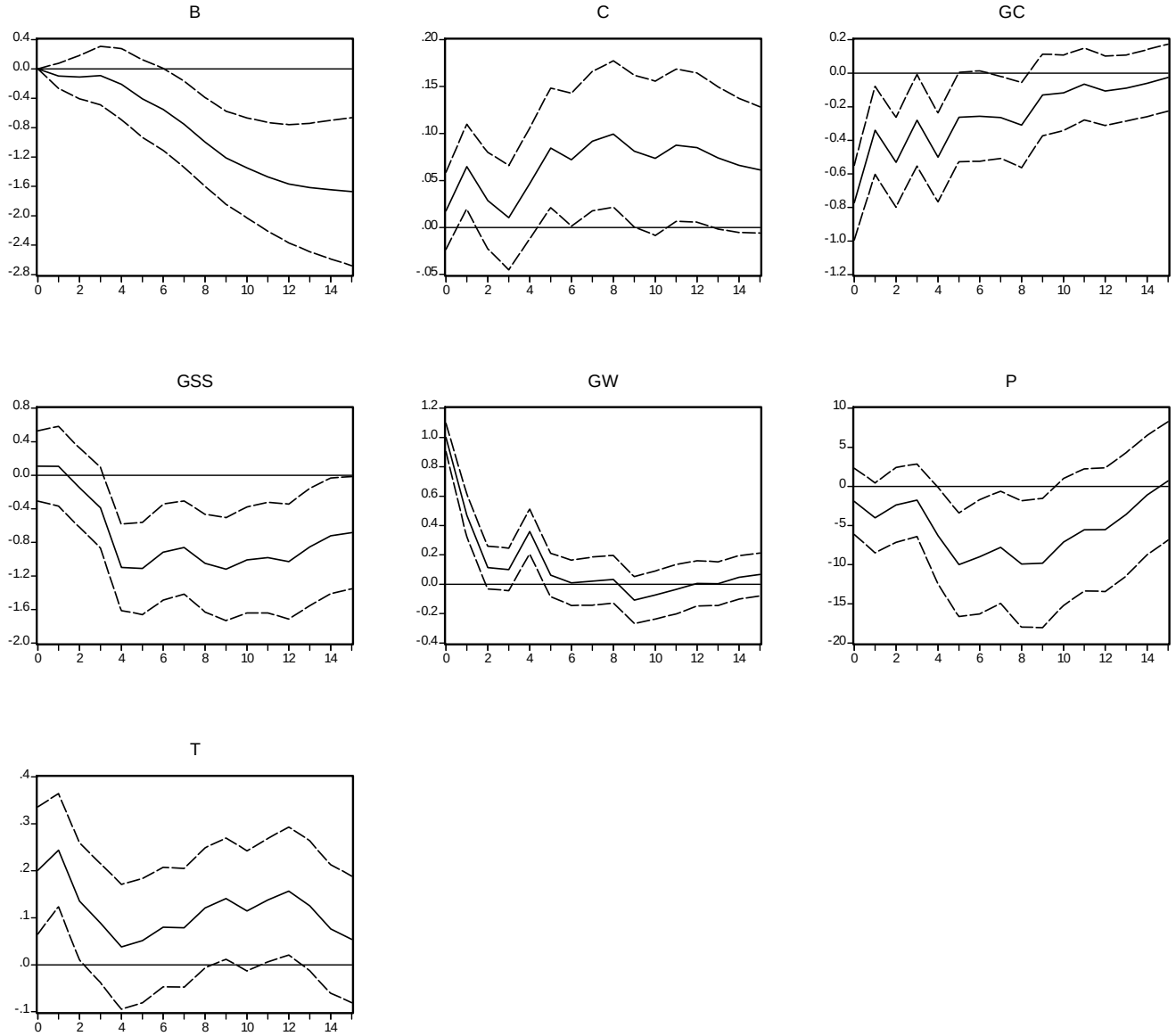
Note: solid lines are the point estimates of the impulse responses. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations (1000 replications).

Figure 2b: responses of all variables to a shock of GSS



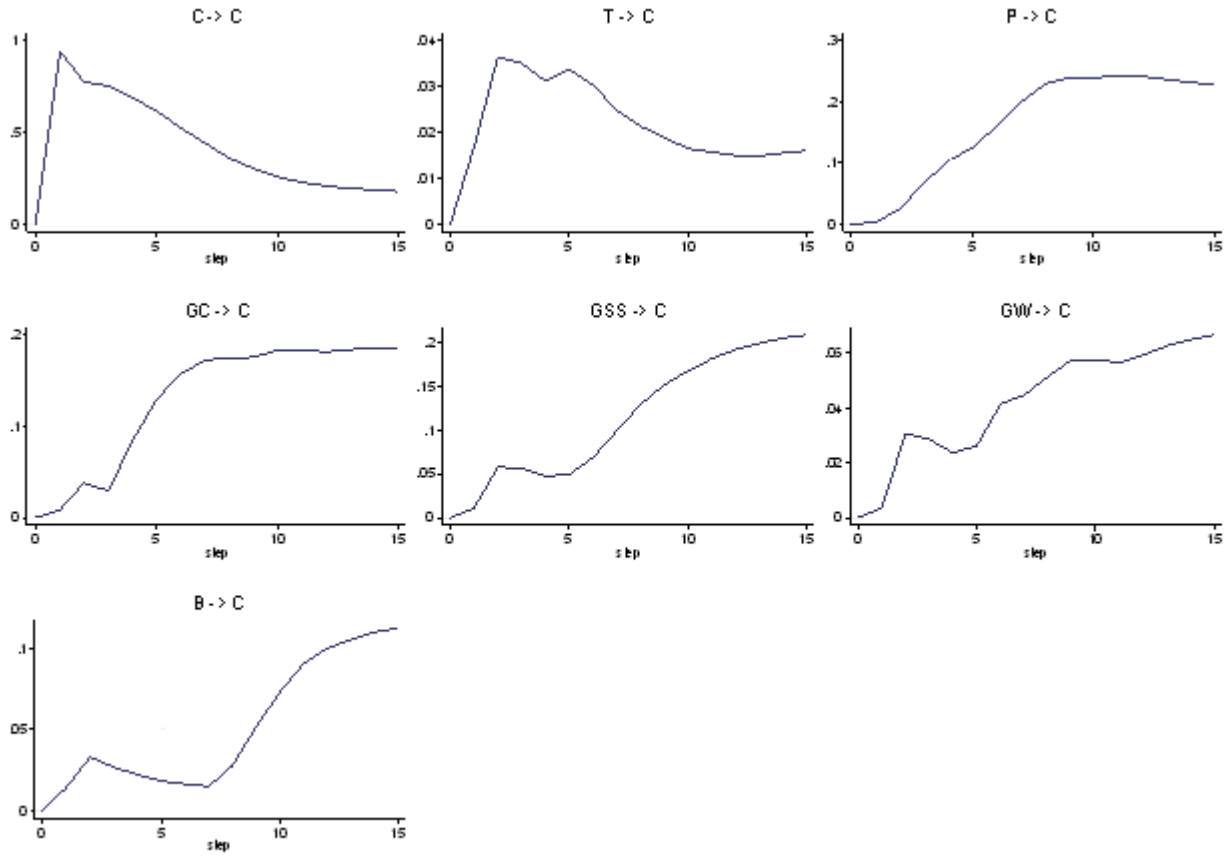
Note: solid lines are the point estimates of the impulse responses. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations (1000 replications).

Figure 2c: responses of all variables to a shock of GW



Note: solid lines are the point estimates of the impulse responses. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations (1000 replications).

Figure 3: forecast error variance decomposition, private consumption



Note: vertical axis measures the percentage of forecast error variance attributable to a shock in the plotted endogenous variable.

Figure 4: consumption responses (point estimates); baseline model without the time trend/with quarterly dummies/with quarterly and Labour dummies

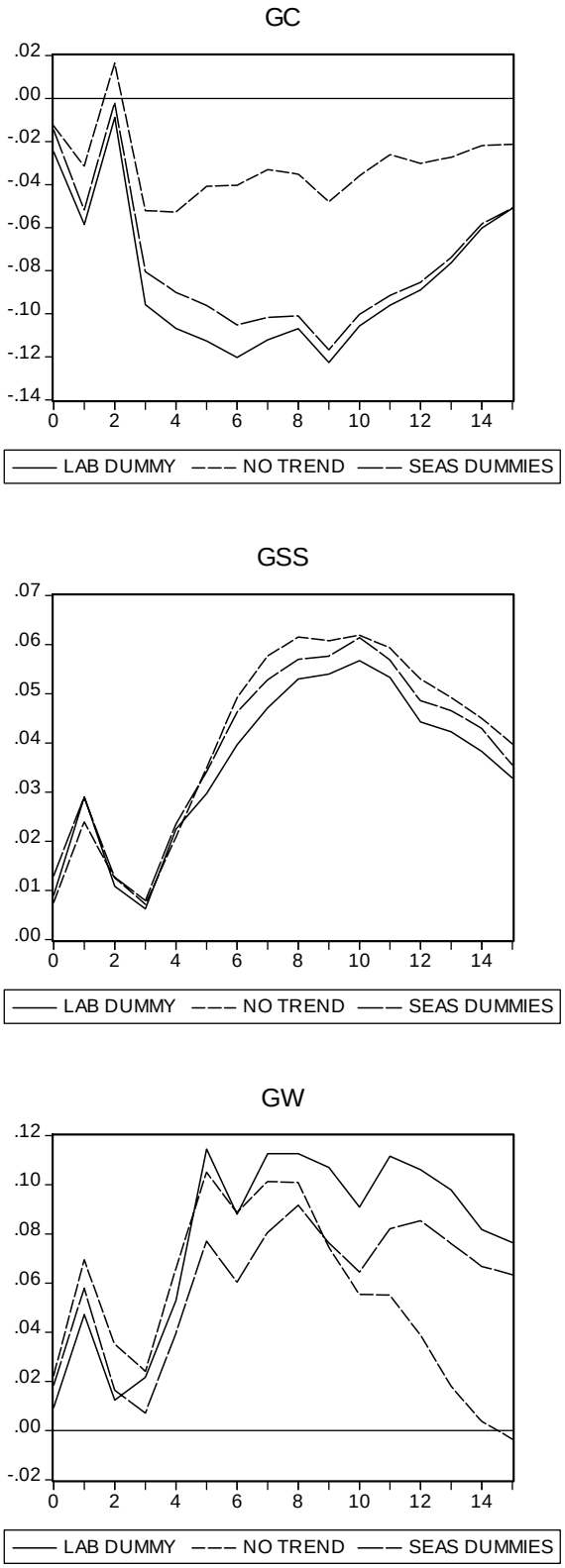


Figure 5: consumption responses (point estimates); 7-variables VAR with the short term interest rate/with the GDP in place of government financial liabilities

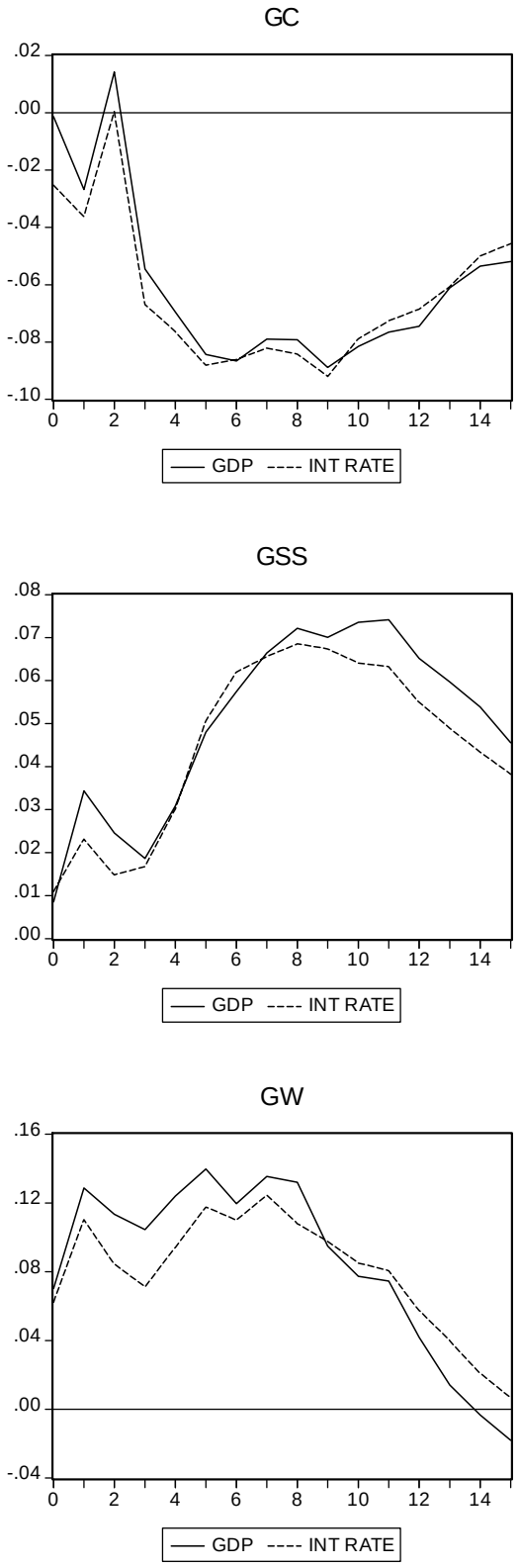


Figure 6: consumption responses (point estimates); 6-variables VAR with no financial liabilities/ no taxes/ no prices

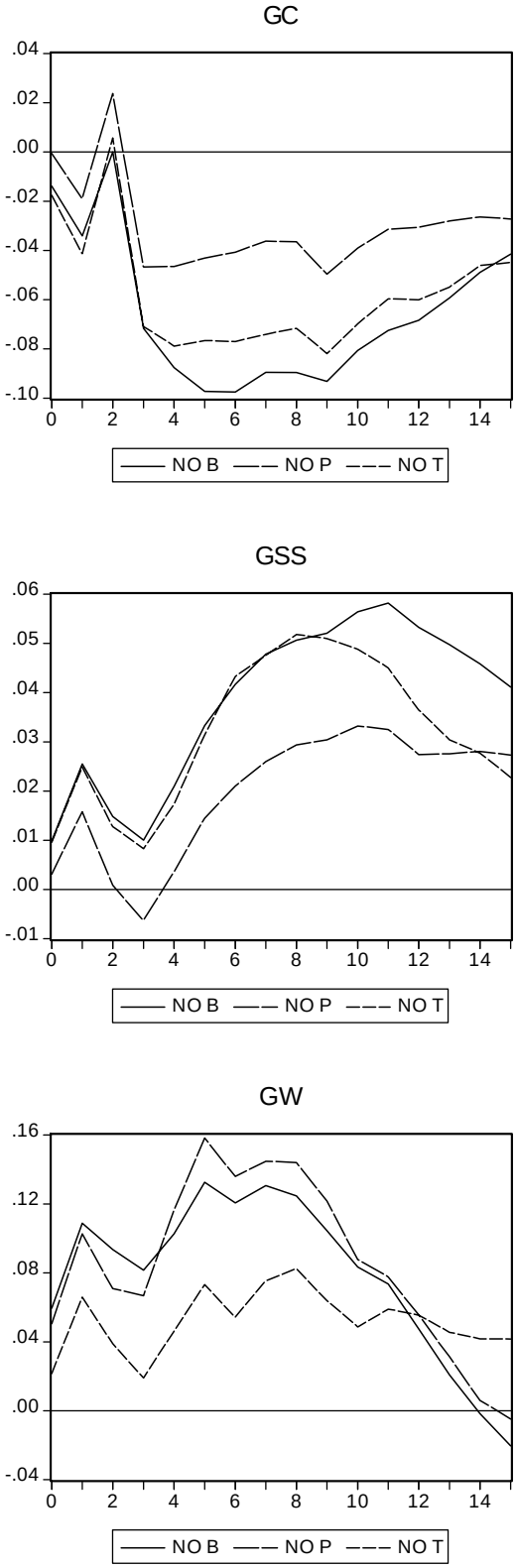
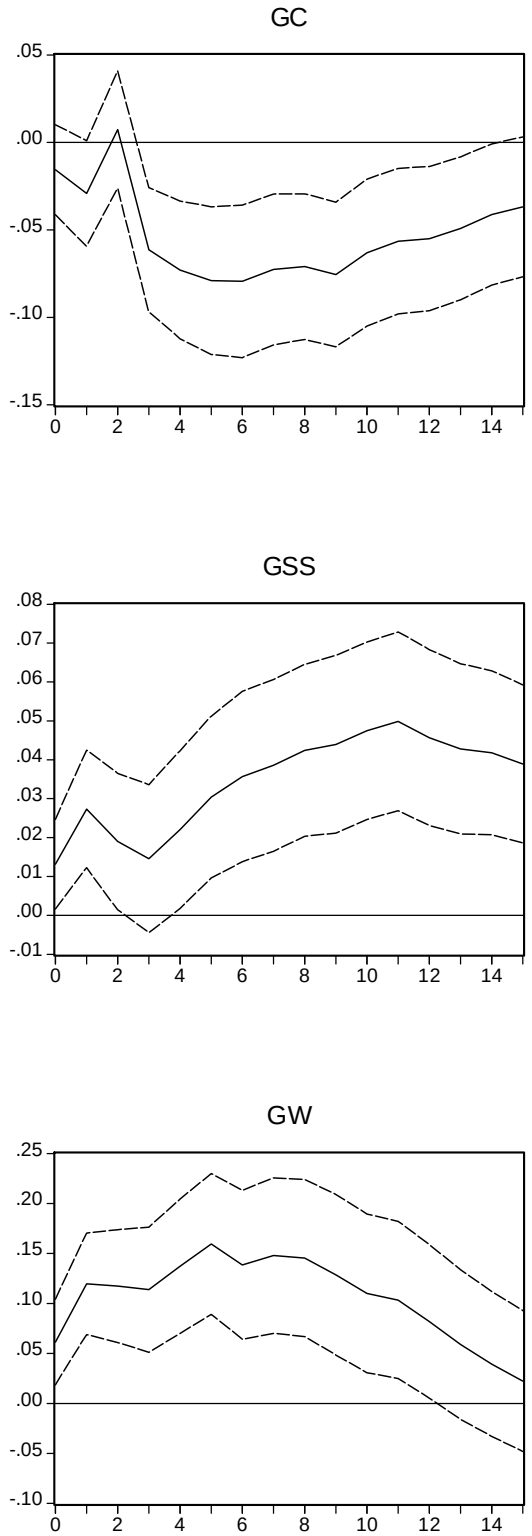
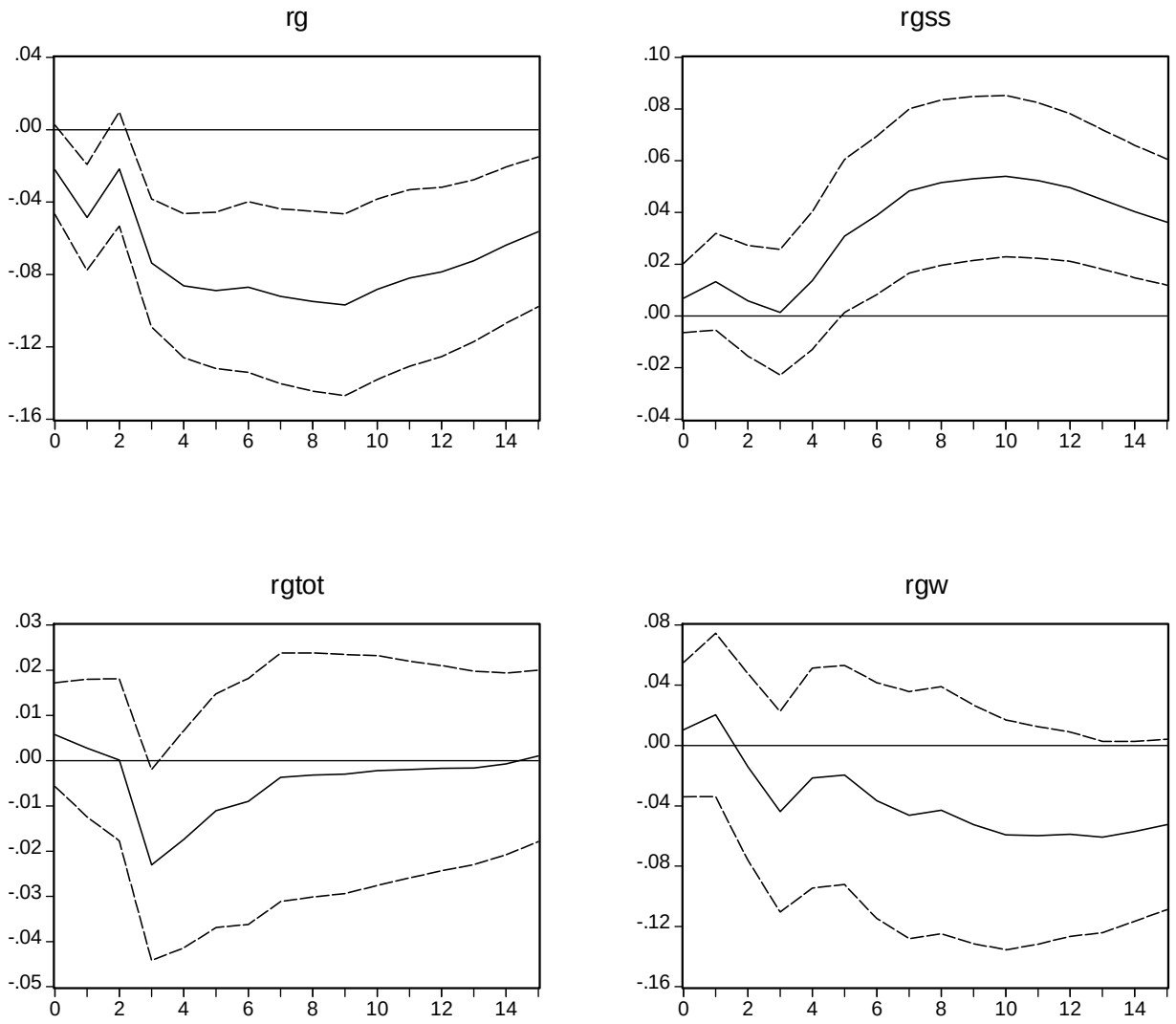


Figure 7: consumption responses, 5-variables VAR (with the three components of government expenditure)



Note: solid lines are the point estimates of the impulse responses. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations (1000 replications).

Figure 8: consumption responses, four 5-variables VARs, responses to one government expenditure variable at a time (note: differently from the previous figures, these are the results of 4 different VARs)



Note: solid lines are the point estimates of the impulse responses. Dotted lines are the 16th and 84th percentiles from Monte Carlo simulations (1000 replications).

Tables

Table 1a: responses of all variables to a shock of GC

	Shock in GC						
response of --->	C	T	P	GC	GSS	GW	B
0	-0.017	0.042	-3.328*	1.000***	0.000	0.000	0.000
1	**-0.044****	0.027	-5.081***	0.680***	-0.307*	-0.003	-0.067
2	0.000	0.055	-1.081	0.415***	-0.003	0.138**	-0.042
3	**-0.075*****	0.068	-0.692	0.414***	0.141	0.213***	-0.052
4	**-0.087*****	-0.024	-0.228	0.306***	0.218	0.119*	-0.093
5	**-0.087*****	-0.038	-0.662	0.408***	0.419**	0.104	0.000
6	**-0.093*****	0.022	2.659	0.427***	0.475**	0.206***	0.068
7	**-0.090*****	-0.011	1.973	0.290***	0.555**	0.238***	0.152
8	**-0.092*****	-0.024	0.650	0.317***	0.651**	0.182***	0.271
9	**-0.103*****	-0.059	-0.815	0.333***	0.521**	0.180***	0.424
10	**-0.090****	-0.081	1.140	0.254**	0.566**	0.234***	0.587
11	**-0.078****	-0.065	-1.139	0.276***	0.531**	0.204***	0.722
12	**-0.076****	-0.064	-2.860	0.268***	0.473*	0.171***	0.817
13	**-0.065***	-0.064	-4.770	0.251***	0.424	0.174***	0.908
14	-0.053	-0.038	-4.176	0.255***	0.362	0.199***	0.947
15	-0.046	-0.004	-6.355*	0.270***	0.218	0.146**	0.956

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

Table 1b: responses of all variables to a shock of GSS

	Shock in GSS						
response of --->	C	T	P	GC	GSS	GW	B
0	0.009	0.065**	1.767*	-0.029	1.000***	0.000	0.000
1	**0.027****	-0.021	0.139	0.109*	0.582***	0.002	-0.010
2	0.014	-0.051*	-0.900	-0.005	0.371***	0.094***	0.022
3	0.006	-0.033	-1.007	0.050	0.292**	0.071**	0.146
4	0.018	-0.124***	-0.894	0.020	0.247**	0.035	0.266**
5	**0.031****	-0.094***	-3.020**	-0.046	0.195*	0.047	0.360***
6	**0.044*****	-0.069**	-3.282**	-0.097	0.035	0.129***	0.396***
7	**0.051*****	-0.065**	-3.422**	-0.078	0.048	0.095***	0.374***
8	**0.054*****	-0.032	-3.710**	-0.025	-0.045	0.038	0.295**
9	**0.053*****	-0.003	-4.560**	-0.009	-0.240	0.025	0.198
10	**0.055*****	0.028	-3.911**	-0.062	-0.322**	0.053	0.074
11	**0.051****	0.045	-3.683**	-0.039	-0.387**	0.022	-0.071
12	**0.044****	0.058*	-3.066	-0.051	-0.439***	-0.011	-0.210
13	**0.039****	0.072**	-2.617	-0.061	-0.454***	-0.018	-0.328*
14	**0.034***	0.077**	-1.340	-0.072	-0.438***	-0.006	-0.441**
15	**0.028***	0.075**	-0.703	-0.068	-0.418**	-0.025	-0.540**

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

Table 1c: responses of all variables to a shock of GW

	Shock in GW						
response of --->	C	T	P	GC	GSS	GW	B
0	0.018	0.201**	-1.924	-0.772***	0.109	1.000***	0.000
1	0.065	0.244***	-4.025	-0.341*	0.107	0.470***	-0.096
2	0.029	0.135	-2.367	-0.531***	-0.148	0.113	-0.112
3	0.011	0.089	-1.756	-0.281	-0.388	0.101	-0.091
4	0.047	0.038	-6.273	-0.501***	-1.099***	0.359***	-0.209
5	0.085	0.051	-10.007**	-0.262	-1.113***	0.063	-0.407
6	0.072	0.080	-8.992*	-0.256	-0.918**	0.009	-0.550
7	**0.092***	0.079	-7.785	-0.265	-0.862**	0.021	-0.755*
8	**0.099***	0.121	-9.910*	-0.310	-1.050**	0.034	-0.996**
9	0.081	0.141	-9.799*	-0.131	-1.120**	-0.108	-1.212***
10	0.074	0.115	-7.101	-0.117	-1.010**	-0.074	-1.348***
11	0.088	0.138	-5.558	-0.066	-0.983**	-0.035	-1.470***
12	0.085	0.157	-5.530	-0.106	-1.031**	0.005	-1.566***
13	0.074	0.125	-3.573	-0.089	-0.855*	0.004	-1.617***
14	0.066	0.076	-1.110	-0.060	-0.724	0.047	-1.645**
15	0.061	0.054	0.696	-0.027	-0.685	0.066	-1.672**

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

Table 2: responses of private consumption, baseline model without the time trend

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.013	0.008	0.022
1	-0.031	**0.024****	**0.069***
2	0.016	0.013	0.035
3	**-0.052***	0.007	0.024
4	**-0.053***	0.021	0.066
5	-0.041	**0.035***	**0.105***
6	-0.040	**0.049****	0.089
7	-0.033	**0.058*****	0.101
8	-0.035	**0.062*****	0.101
9	-0.048	**0.061*****	0.075
10	-0.036	**0.062*****	0.055
11	-0.026	**0.059*****	0.055
12	-0.030	**0.053****	0.039
13	-0.027	**0.049****	0.018
14	-0.022	**0.045****	0.004
15	-0.021	**0.040*****	-0.003

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

Table 3: responses of private consumption, baseline model with quarterly dummies

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.015	0.013	0.018
1	**-0.052****	**0.029****	**0.058***
2	-0.002	0.013	0.016
3	**-0.081*****	0.008	0.007
4	**-0.090*****	0.024	0.040
5	**-0.096*****	**0.034****	**0.077***
6	**-0.105*****	**0.046*****	0.060
7	**-0.102*****	**0.053*****	0.081
8	**-0.101*****	**0.057*****	0.092
9	**-0.117*****	**0.058*****	0.076
10	**-0.100*****	**0.061*****	0.065
11	**-0.092****	**0.057****	0.082
12	**-0.085****	**0.049****	0.085
13	**-0.074****	**0.047****	0.076
14	**-0.058***	**0.043****	0.067
15	-0.259	**0.036****	0.063

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

Table 4: responses of private consumption, baseline model with quarterly dummies, trend and Labour dummy

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.025	0.009	0.009
1	**-0.059*****	**0.029*****	0.047
2	-0.009	0.011	0.012
3	**-0.096*****	0.006	0.022
4	**-0.107*****	0.022	0.053
5	**-0.113*****	**0.030****	**0.114****
6	**-0.120*****	**0.040****	**0.088***
7	**-0.112*****	**0.047*****	**0.113****
8	**-0.107*****	**0.053*****	**0.113***
9	**-0.123*****	**0.054*****	**0.107***
10	**-0.106*****	**0.057*****	0.091
11	**-0.096*****	**0.053*****	**0.112***
12	**-0.089****	**0.044****	**0.106***
13	**-0.076****	**0.042****	**0.098***
14	**-0.060***	**0.038****	0.082
15	-0.051	**0.033****	0.076

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

Table 5: responses of private consumption, 7-variables VAR with the short term interest rate

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.025	0.011	**0.062****
1	**-0.036***	**0.023****	**0.110*****
2	0.000	0.015	**0.084****
3	**-0.067*****	0.017	**0.071***
4	**-0.076*****	**0.030****	**0.094****
5	**-0.088*****	**0.051*****	**0.118****
6	**-0.086*****	**0.062*****	**0.110****
7	**-0.082*****	**0.066*****	**0.124****
8	**-0.084*****	**0.069*****	**0.108***
9	**-0.092*****	**0.067*****	**0.098***
10	**-0.079****	**0.064*****	0.085
11	**-0.073****	**0.063*****	0.081
12	**-0.069****	**0.055*****	0.057
13	**-0.061****	**0.049*****	0.040
14	**-0.050***	**0.043****	0.021
15	-0.046	**0.038****	0.006

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

Table 6: responses of private consumption, 7-variables VAR with GDP

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.001	0.009	**0.070****
1	-0.027	**0.034*****	**0.129*****
2	0.014	**0.025***	**0.113*****
3	**-0.055****	0.019	**0.105****
4	**-0.070****	**0.031***	**0.124*****
5	**-0.084*****	**0.048*****	**0.140*****
6	**-0.087*****	**0.057*****	**0.120****
7	**-0.079****	**0.066*****	**0.135****
8	**-0.079****	**0.072*****	**0.132****
9	**-0.089*****	**0.070*****	0.095
10	**-0.082****	**0.074*****	0.077
11	**-0.077****	**0.074*****	0.075
12	**-0.075****	**0.065*****	0.042
13	**-0.061****	**0.060****	0.014
14	**-0.054***	**0.054*****	-0.003
15	**-0.052***	**0.046****	-0.018

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

Table 7: responses of private consumption, 6-variables VAR (no financial liabilities)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.014	0.010	0.060
1	-0.034	**0.025****	**0.109*****
2	0.000	0.015	**0.094****
3	**-0.072*****	0.010	**0.082***
4	**-0.088*****	0.021	**0.103****
5	**-0.097*****	**0.033****	**0.132*****
6	**-0.097*****	**0.042****	**0.121****
7	**-0.089*****	**0.048*****	**0.131****
8	**-0.090*****	**0.051*****	**0.125****
9	**-0.093*****	**0.052*****	**0.104***
10	**-0.081*****	**0.056*****	0.083
11	**-0.072****	**0.058*****	0.074
12	**-0.068****	**0.053*****	0.048
13	**-0.059****	**0.050*****	0.021
14	-0.049	**0.046*****	-0.002
15	-0.042	**0.041****	-0.020

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

Table 8: responses of private consumption, 6-variables VAR (no net taxes)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.018	0.010	0.022
1	**-0.041****	**0.025****	**0.066***
2	0.006	0.013	0.039
3	**-0.071*****	0.008	0.019
4	**-0.079*****	0.017	0.046
5	**-0.077*****	**0.031****	0.073
6	**-0.077*****	**0.043*****	0.054
7	**-0.074*****	**0.048*****	0.075
8	**-0.072****	**0.052*****	0.082
9	**-0.082****	**0.051*****	0.064
10	**-0.070****	**0.049*****	0.049
11	**-0.060****	**0.045****	0.059
12	**-0.060***	**0.036****	0.055
13	-0.055	**0.030***	0.045
14	-0.046	**0.028***	0.042
15	-0.045	0.023	0.042

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

Table 9: responses of private consumption, 6-variables VAR (no price index)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.001	0.003	0.050
1	-0.019	0.016	**0.103*** **
2	0.024	0.001	0.071
3	-0.047	-0.006	0.067
4	-0.047	0.004	**0.116** **
5	-0.043	0.014	**0.158*** **
6	-0.041	0.021	**0.136** **
7	-0.036	0.026	**0.145** **
8	-0.037	0.029	**0.144** **
9	-0.050	0.030	**0.122* **
10	-0.039	**0.033* **	0.088
11	-0.031	**0.033* **	0.078
12	-0.031	**0.027* **	0.056
13	-0.028	**0.028* **	0.031
14	-0.026	**0.028* **	0.006
15	-0.027	**0.027* **	-0.005

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

Table 10: responses of private consumption, 5-variables VAR (with the three components of government expenditure)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.016	0.013	**0.219** **
1	-0.029	**0.027** **	**0.426*** **
2	0.007	0.019	**0.419*** **
3	**-0.061** **	0.015	**0.406*** **
4	**-0.073*** **	0.022	**0.490*** **
5	**-0.079*** **	**0.030** **	**0.569*** **
6	**-0.079** **	**0.036** **	**0.494*** **
7	**-0.073** **	**0.039** **	**0.527*** **
8	**-0.071** **	**0.042*** **	**0.518*** **
9	**-0.075** **	**0.044*** **	**0.459** **
10	**-0.063** **	**0.047*** **	**0.392* **
11	**-0.056* **	**0.050*** **	**0.369* **
12	**-0.055* **	**0.046*** **	0.292
13	**-0.049* **	**0.043*** **	0.210
14	-0.041	**0.042*** **	0.141
15	-0.037	**0.039*** **	0.080

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

Table 11: responses of private consumption, four 5-variables VARs with one government expenditure variable at a time

(note: differently from the previous tables, these are the results of 4 different VARs)

	Consumption responses			
shock in --->	GTOT	G	GSS	GW
0	0.006	-0.022	0.007	0.011
1	0.003	**-0.048****	0.013	0.020
2	0.000	-0.022	0.006	-0.014
3	-0.023	**-0.074*****	0.001	-0.044
4	-0.017	**-0.086*****	0.014	-0.022
5	-0.011	**-0.089*****	0.031	-0.020
6	-0.009	**-0.087*****	**0.039***	-0.037
7	-0.004	**-0.092*****	**0.048****	-0.046
8	-0.003	**-0.095*****	**0.052****	-0.043
9	-0.003	**-0.097*****	**0.053****	-0.052
10	-0.002	**-0.088****	**0.054****	-0.059
11	-0.002	**-0.082****	**0.052****	-0.060
12	-0.002	**-0.079****	**0.050****	-0.059
13	-0.002	**-0.072****	**0.045****	-0.061
14	-0.001	**-0.064****	**0.040****	-0.057
15	0.001	**-0.056***	**0.036****	-0.052

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