Keynesian spending

SUMMARY

The global financial crisis has led to a renewed interest in discretionary fiscal stimulus. Advocates of discretionary measures emphasize that government spending can stimulate additional private spending – the Keynesian multiplier effect. Thus, we investigate whether the spending package announced by euro area governments for 2009 and 2010 is likely to boost GDP by more than one for one. Because of modelling uncertainty, it is essential that such policy evaluations be robust to alternative modelling assumptions and parameterizations. We use five different empirical macroeconomic models with Keynesian features such as price and wage rigidities to evaluate the impact of the fiscal stimulus. Four of them suggest that the planned increase in government spending will reduce private consumption and investment significantly. Only a model that largely ignores the forward-looking behavioural response of consumers and firms implies crowding-in of private spending. We review a range of issues that may play a role in the recession of 2008–2009. Implementation lags are found to reinforce crowding-out and may even cause an initial contraction. Zero-bound effects may lead the central bank to abstain from interest rate hikes and increase the GDP impact of government spending. Crowding-in, however, requires an immediate anticipation of at least two years at the zero bound. Using a multi-country model, we find that spillovers between euro area countries are negligible or even negative, because direct demand effects are offset by the indirect effect of a euro appreciation. New-Keynesian dynamic stochastic general equilibrium (DSGE) models provide a strong case for government savings packages. Announced with sufficient lead time, spending cuts induce a significant short-run stimulus and crowding-in of private spending.

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Keynesian government spending multipliers and spillovers in the euro area

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1. INTRODUCTION

In 2008 and early 2009 governments around the world announced major fiscal stimulus packages. Resorting to discretionary fiscal policy to an unprecedented degree, they hoped to alleviate the recessionary impact of the global financial crisis. US Congress, for example, approved $787 billion of additional spending, transfers and tax reductions with the 2009 American Recovery and Reinvestment Act (ARRA). The European Union initiated the European Economic Recovery Plan (EERP) while national European governments announced their own fiscal stimuli. The German government, which was initially criticized

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for not spending enough, eventually announced two 'Konjunkturpakete' in a row.[1]

The impact of such announcements and the implied measures is difficult to assess, because many factors play a role. Proponents of fiscal stimulus emphasize the Keynesian multiplier effect. It follows from the national accounts' spending identity when combined with the textbook Keynesian consumption function. A country's gross domestic product is equated with total spending, which consists of private consumption, investment, net exports and government expenditures. Consumption is believed to increase with after-tax income. Consequently, a debt-financed increase in government spending boosts total spending (and therefore total GDP) more than one for one.[2] Since spending may partly be diverted to imports, proponents have lobbied for coordinated stimulus packages across Europe. Critics of fiscal stimulus, however, argue that government spending will displace private consumption and investment (cf. Barro, 2009). Consumers will anticipate future tax burdens and save rather than spend, while government borrowing will drive up interest rates and crowd out private investment.

In January 2009, Christina Romer, Chair of the US President's Council of Economic Advisers, and Jared Bernstein, Chief Economist of the Office of the Vice-President, provided numerical estimates of the impact of an increase in government spending on GDP and employment in the United States.[3] They estimate that an increase in government purchases of 1% of GDP would induce an increase in real GDP of 1.6% compared to what it otherwise would be. Given this multiplier effect they project that a package similar in size to the ARRA legislation would boost US GDP by 3.6% by the end of 2010. Cogan *et al.* (2010), however, showed that this conclusion is not robust.[4] Government spending multipliers in alternative, empirically estimated New-Keynesian models are much smaller. For example, estimates of the GDP effects of ARRA legislation obtained with the model of Smets and Wouters (2007) are only one-sixth as large as the estimates of Romer and Bernstein (2009).

This paper aims to assess the magnitude of the stimulus programmes announced by euro area governments in 2008 and 2009 and to quantify their effect on

[1] A prominent critic was Paul Krugman, who accused the German government of 'boneheadedness' in an article in the *New York Times* of 12 December 2008, entitled 'The economic consequences of Mr. Steinbrueck'. He wrote: The world economy is in a terrifying nose-dive, yet Mr. Steinbrueck [the German finance minister] is standing firm against any extraordinary fiscal measures ... In Europe it is very hard to do a fiscal expansion unless it is coordinated ... The reason is that the European economy is so integrated ... As a result, the multiplier on fiscal expansion within any given European country is much less than the multiplier on a coordinated fiscal expansion. ... if Germany prevents an effective European response, this adds significantly to the severity of the global downturn. ... in short, there's a huge multiplier effect at work; unfortunately, what it's doing is multiplying the impact of the current German government's boneheadedness.'

[2] The national accounts spending identity is given by $Y = C + I + EX - IM + G$. The Keynesian consumption function implies that consumption increases with after-tax income: $0 < dC/d(Y - T) < 1$. It is then concluded that a debt-financed increase in government spending boosts total spending by more than one for one: $1 < dY/dG = 1/(1 - dC/d(Y - T))$.

[3] See Romer and Bernstein (2009), Appendix 1, p. 12. This paper was written during the transition period in early January before Christina Romer was sworn in as Chair of the Council of Economic Advisers.

[4] The working paper version of Cogan *et al.* (2010), appeared shortly after the ARRA had passed the House and the Senate.

economic activity. A macroeconomic model is needed to distinguish the impact of government actions on the economy from other factors. Because of modelling uncertainty, it is essential that policy evaluations be robust to alternative assumptions. For this reason, we compare the impact of the fiscal packages using several empirically estimated macroeconomic models of the euro area. The main focus is on model simulations of the planned increase in government purchases rather than additional transfers or tax cuts, because purchases are expected to display the largest Keynesian multiplier effect.

The models considered in this comparison are due to Smets and Wouters (2003), Laxton and Pesenti (2003), Ratto *et al.* (2009), Taylor (1993) and Fagan *et al.* (2005).[5] All five models exhibit Keynesian features such as sluggish adjustment due to price and wage rigidities. Thus, they are well-suited to investigate possible rationales for Keynesian demand management. Several of these models have been developed at important policy institutions such as the European Central Bank, the International Monetary Fund and the European Commission, and used for monetary and fiscal policy analysis. The first four models are best described as New-Keynesian models. These models account for forward-looking decisions by households and firms that anticipate future changes in government policies. The models of Smets and Wouters (2003), Laxton and Pesenti (2003) and Ratto *et al.* (2009) also belong to the class of models often referred to as New-Keynesian dynamic stochastic general equilibrium (DSGE) models. Such models fully incorporate recent advances in terms of microeconomic foundations, originally developed for real-business-cycle models, and combine them with Keynesian-style rigidities.

In the baseline scenario, New-Keynesian models provide no support for a traditional Keynesian multiplier effect. The European government spending plans would result in a reduction in private sector spending for consumption and investment purposes. Households and firms reduce spending in anticipation of future tax burdens and higher interest rates. By contrast, the model of Fagan *et al.* (2005) largely ignores forward-looking motives for private decision-making and provides a more traditional Keynesian perspective. This model supports a strong short-term multiplier effect. However, the boom is followed by a bust that causes the cumulative effect on private spending to turn negative eventually. More importantly, this model may not be as well suited to gauge the effects of major policy changes than the

[5] The models are made available in a new macroeconomic model archive for comparative analysis described in more detail in Wieland *et al.* (2009). While macroeconomic model comparison projects have helped produce some very influential insights such as the Taylor rule, they have been infrequent and costly, because they require the input of many teams of researchers and multiple meetings to obtain a limited set of comparative findings (see, for example, Taylor, 1999 and Hughes-Hallett and Wallis, 2004). The new comparative approach to model-based research and policy analysis presented in Wieland *et al.* (2009) instead enables individual researchers to conduct model comparisons easily, frequently, at low cost and on a large scale. Note, the models collected were not available 'off-the-shelf'. Rather the above-mentioned project involved a substantial work effort in order to create such a 'shelf' with models that have been checked for replicability and augmented with a common variable, shock and policy rule space to allow proper comparative exercises. For analysis of monetary policy in the United States and the euro area see Taylor and Wieland (2009) and Kuester and Wieland (2010), respectively.

New-Keynesian models, because it ignores their effects on market participants' expectations.

We then discuss a number of factors that may have played a role in the recession of 2008 and 2009. Time lags arise because of the steps needed to move from a timely announcement to actual implementation of government spending plans. Such implementation lags induce additional crowding-out of private spending and may even cause an initial contraction. In a deep recession, the zero-bound on nominal interest rates may induce the central bank to abstain from interest hikes in response to a fiscal stimulus, because its notional interest rate target is below zero. Such implicit monetary accommodation increases the GDP impact of government spending. Crowding-in, however, requires an immediate anticipation of at least two years at the zero bound.

In addition, we use the multi-country model of Taylor (1993) to assess the likely spill-over effects within the euro area. Since half of the euro area stimulus is derived from the German stimulus plan, we investigate the spill-over effect of German spending in the absence of similar measures in other euro area countries. We find that the positive direct demand effect of German spending on other euro area economies is largely offset by the indirect negative effect of a euro appreciation.

We also investigate the implications of government investment and transfers in one of the above-mentioned models. Then, we review recent data on government spending and the recovery from recession, and finally turn to the question of fiscal consolidation. We illustrate that New-Keynesian DSGE models provide a strong case for government savings packages. Announced with sufficient lead time, anticipated future spending cuts induce a significant short-run stimulus and sustained crowding-in of private spending.

2. EURO AREA FISCAL STIMULUS PACKAGES FOR 2009 AND 2010

As the first step of this project, we investigated the magnitude of the different stimulus measures announced by national euro area governments under the auspices of the European Economic Recovery Plan. To this end, we reviewed the stability programmes that national finance ministries publicly submitted to the ECOFIN Council in line with the Stability and Growth Pact in 2008 and 2009. On this basis, we obtained numerical estimates of the amounts to be allocated to additional government purchases, transfers and tax reductions for 2009 and 2010. In doing so we compared our estimates against those obtained by Saha and von Weizsäcker (2009) for spending, transfers and tax measures in 2009.[6]

The total sum of measures we were able to identify for the eleven largest economies of the euro area comes to €95.5 billion in 2009 and €78.6 billion in 2010.

[6] Thus, Cwik and Wieland (2009) provided the first set of such estimates covering both years of the stimulus plan.

This is 1.04% of euro area GDP in 2009 and 0.86% in 2010. Indeed, the euro area stimulus package is much smaller than the ARRA legislation in the United States that amounts to roughly 5% of GDP.[7] However, the European package is concentrated on two years and front-loaded in 2009, while the US stimulus is spread over five years building up towards a peak in 2010 and declining slowly over 2011 and 2012 (see Cogan *et al.*, 2010). In this manner, the European authorities appeared to adhere more closely to the notion of temporary stimulus supported by institutions such as the International Monetary Fund, rather than the sustained spending stimulus advocated by advisers of the US administration.

Table 1 provides an overview of our findings of discretionary measures by country. In terms of GDP, these 11 economies account for 99% of the euro area. More detailed information on the specific measures in each country and a breakdown in terms of government spending, transfers, tax cuts and other measures is provided in the Web Appendix to this paper. Since we focus on studying the effect of discretionary measures, changes in fiscal balances resulting from automatic stabilizers are not included. Table 1 reports information on the total amount of the respective fiscal package and the implied increase in government spending separately. The total also includes temporary tax cuts and transfers. The amounts are reported in billions of euro and in relative shares in percentage of 2008 GDP.

The fiscal stimuli differ substantially in terms of magnitude and composition. By far the largest stimulus package has been enacted in Germany: €88.8 billion spread

Table 1. Overview of the fiscal stimulus packages in the euro area

	Total fiscal package (€bn)		Spending (€bn)		Total fiscal package (% of GDP)		Spending (% of GDP)	
Country	2009	2010	2009	2010	2009	2010	2009	2010
Austria	4.9	4.6	1.4	1	1.71	1.63	0.48	0.35
Belgium	1.3	1.2	0.7	0.7	0.36	0.33	0.20	0.20
Germany	39.4	49.4	17	11.7	1.58	1.97	0.68	0.47
Greece	0	0	0	0	0.00	0.00	0.00	0.00
Spain	26.8	14.7	11	0	2.44	1.34	1.00	0.00
Finland	2.4	2.4	0.4	0.4	1.25	1.25	0.23	0.23
France	17	4	12.4	4	0.87	0.2	0.63	0.2
Ireland	0	0	0	0	0.00	0.00	0.00	0.00
Italy	−0.3	−0.8	0.2	0.1	−0.02	−0.05	0.01	0.00
Netherlands	3.1	2.9	0	0	0.53	0.49	0.00	0.00
Portugal	1	0.4	0.6	0.4	0.60	0.21	0.36	0.21
EU-11	95.5	78.6	43.6	18.3	1.04	0.86	0.48	0.20

Sources: Saha and von Weizsäcker (2009) and the stability programmes provided by the national finance ministries for the European Commission and authors' calculations. For references to the documents of national finance ministries and details of their plans see the Web Appendix to this paper.

[7] The working paper version of Cogan *et al.* (2010) (NBER Working Paper No. 14782, March 2009) offered a first estimate of quarterly spending, transfers and tax measures from the ARRA shortly after it became law. Romer and Bernstein (2009) used different numbers from the Administration's plan before it passed Congress.

over 2009 and 2010. In relative terms these measures amount to 3.55% of GDP. Thus, the German package is approaching the magnitude of the ARRA stimulus in the United States adjusted for the size of the economy. However, the US measures are spread over four years. The German stimulus corresponds to 51% of the total EU-11 stimulus according to the information we have been able to put together. In terms of government expenditures, the German share in the EU-11 stimulus comes to 46%.

The second largest package was announced by the Spanish government, roughly €41.5 billion, and the third largest is the French stimulus of about €21 billion. Measures in some smaller countries such as Austria and Finland are also significant relative to GDP. Other countries launched smaller fiscal measures. Some countries that were in a particularly weak fiscal position such as Greece or Ireland initiated no significant stimulus. Also, Italy apparently planned for very little additional spending, while raising some taxes and launching measures to improve tax collection.

The fiscal stimulus packages vary in terms of the measures to be undertaken. Finland and the Netherlands mainly adopted measures on the revenue side whereas Portugal and France increased government spending. In the euro area as a whole roughly 36% of the fiscal stimulus packages imply increases in government purchases. Roughly 9% are transfers and 55% are attributed to tax cuts.

The largest multiplier effect is to be expected from government purchases. Purchases and similar expenditures in the euro area stimulus come to 0.48% of 2008 GDP in 2009 and 0.20% in 2010. Among such purchases those with an investment character offer the possibility of a longer-term improvement in the productive capacity of the euro area economy. Of course, national authorities may have a tendency to describe as many government spending initiatives as possible as a form of investment. Thus we try to separate out measures that are clearly aimed at creating new infrastructure which may help develop private business. Such infrastructure spending amounts to 0.19% and 0.13% of GDP in 2009 and 2010 respectively. Country-specific breakdowns are reported in the Web Appendix.

3. ESTIMATING THE GDP IMPACT OF ANNOUNCED GOVERNMENT SPENDING

A macroeconomic model is needed to evaluate the impact of government policy measures on economic activity in isolation from other disturbances that may currently influence actual economic outcomes. Structural models make it possible to identify the role of market expectations, the effect of announcements of plans for future fiscal policy measures, and the impact of these measures under alternative assumptions of likely monetary policy responses. In their analysis of the US stimulus, Cogan *et al.* (2010) considered two empirically estimated macroeconomic models of the US economy, one developed by Taylor (1993) and the other one by Smets and Wouters (2007). The Smets and Wouters model, in particular, is

representative of current thinking in macroeconomics. It is very similar to, and 'largely based on' according to Smets and Wouters, another well-known empirically estimated New-Keynesian DSGE model developed by Christiano *et al.* (2005).

In a related paper that came out of a new modelling effort at the European Central Bank, Smets and Wouters (2003) estimated such a model for the euro area. This paper has received much attention in the literature because it showed that the current generation of DSGE models with sticky prices and wages is able to capture the time series properties of the data as long as a sufficient number of structural shocks is considered. The model includes a persistent autoregressive process for government spending. Government spending shocks are serially correlated. They explain 25% of current quarter variation in euro area GDP. Their effect dissipates over time. At a four quarter horizon they only account for about 8% of output variance.

The euro area is still a young monetary union. Historical relationships may have changed due to the shift in monetary regime and comparable cross-country data series are limited and short. The euro area model of Smets and Wouters (2003), for example, is estimated with historical, pre-EMU data. Their euro area measures are artificial aggregates obtained by adding up national data from a period of differential monetary policies and fixed but adjustable exchange rates. As shown by Kuester and Wieland (2010) modelling uncertainty is particularly pronounced in the euro area and comparative analysis is crucial to obtain robust policy conclusions. To this end we make use of the new database of macroeconomic models designed explicitly with the purpose of doing such policy evaluations and robustness studies (see Wieland *et al.*, 2009 and Taylor and Wieland, 2009). In addition to the Smets–Wouters (SW) model developed at the European Central Bank, we also consider two New-Keynesian DSGE models developed at the European Commission and the International Monetary Fund, by Ratto *et al.* (2009) and Laxton and Pesenti (2003), respectively.

The open-economy model of the euro area by Ratto *et al.* (2009) is estimated with quarterly euro area data from 1981Q1 to 2006Q1 thereby including a large part of EMU history. They named their model 'QUEST III' and we refer to it as the 'EU-Quest' model. This model was built specifically for the joint analysis of fiscal and monetary policy and provides a thorough treatment of the government sector. It includes policy rules for government consumption, government investment and government transfers and uses data on these variables in estimation. It also accounts for distortionary taxes on consumption, capital and labour income. Another important departure from the assumptions made by Smets and Wouters (2003) concerns the treatment of households. The SW model has been criticized for assuming that all households are forward-looking and optimize their spending decisions. Instead, it has been proposed to allow for the possibility that many households follow 'rules of thumb' like the original Keynesian consumption function with a constant marginal propensity to consume, or that they are constrained to

consume all their current income (see, for example, Gali *et al.*, 2007). Ratto *et al.* (2009) estimate that 35% of euro area households are liquidity-constrained in this manner.[8]

Critics of fiscal stimulus in Europe often point towards the risk that part of the additional demand is diverted towards cheaper imports in place of domestic goods. We include the Laxton and Pesenti (2003) model in the analysis, because it is a two-economy model that accounts for an endogenous response of exports and imports. The Laxton and Pesenti (2003) model was created at about the same time as the SW model and similarly includes government consumption. Government purchases are assumed to fall on non-traded goods, but the multiplier effect may be reduced because the additional private spending may partly fall on traded goods. Model parameters were not estimated with macroeconomic data but calibrated to values considered reasonable in light of other studies. Certain parameters and shock variances were to match euro area and Czech macroeconomic volatility. Thus, it is a model of the euro area and the Czech Republic. It is likely to understate the risk spending diversion to imports because of the relatively small size of the Czech economy. In our model comparison it is termed the 'Small IMF model' because IMF researchers have also developed several larger macroeconomic models of the world economy.[9]

All three models assume forward-looking (rational) expectations by individuals and firms, monopolistic competition and nominal rigidities in goods and labour markets. Price and wage rigidities are motivated with Calvo-style staggered contracts (SW model) or adjustment costs (Small IMF and EU-Quest models). The models fully incorporate microeconomic foundations consistent with the optimizing decision-making of representative households and firms, similar to earlier real-business cycle models that assumed fully flexible prices. The models have in common that they include a number of additional constraints or frictions that help in matching the dynamics and persistence of some key macroeconomic time series. These frictions include price and wage indexation, habit-persistence in consumption, investment adjustment costs, serially correlated shocks and costs related to variable capital utilization (SW and EU-Quest models).

Text-book Keynesian analysis suggests that direct government purchases have a greater multiplier effect than tax reductions or additional transfers. Thus, we start by comparing the estimated impact of the additional spending announced by national governments (7th and 8th columns in Table 1) on euro area GDP in the

[8] This finding is similar to euro area estimates of 25–35% by Coenen and Straub (2005) and 30–40% by Forni *et al.* (2009). For the United States Cogan *et al.* (2010) obtained an estimate of 27% of rule-of-thumb households.

[9] One such model is MULTIMOD, a dynamic multi-country macro model of the world economy (see Laxton *et al.*, 1998 for an introduction). Its companion model with microeconomic foundations is called Global Economy Model (GEM) and described in Pesenti (2008). More recently, IMF researchers developed another structural model for the analysis of fiscal and monetary policy called GIMF that is described in Kumhof and Laxton (2007) and used in recent contributions to the policy debate. Unfortunately, the parameters of the GIMF model are also calibrated and not estimated.

three medium-scale New-Keynesian DSGE models. Figure 1 reports the increase in government spending (bar chart) together with the resulting effect on euro area real GDP in each of the three models. It is assumed that governments are able to start spending immediately in the first quarter of 2009. The initial increase is phased in below the average of 0.48% of GDP for 2009 and increases above the average level in the second part of the year.

Euro area GDP increases as a result of additional government purchases. However, the model simulations do not exhibit the textbook multiplier effect. GDP does not increase by more than one-for-one with government spending. Instead, the increase in GDP is significantly smaller than the boost to government expenditures. When government spending returns to baseline by the end of 2010, GDP falls below baseline in the SW and Small IMF models. By implication, the increase in government spending must be displacing rather than multiplying private spending. As shown in Figure 2, the dynamic response of private sector demand for consumption or investment purposes is negative in all three models. Private consumption and investment decline immediately and stay below baseline until well after the end of the fiscal stimulus. The simulation assumes that consumers' and firms' expectations incorporate the time profile of government spending as announced by national governments.

These findings on European stimulus are similar to the results for the US economy reported by Cogan *et al.* (2010). The mechanism of private sector displacement is related to the forward-looking perspective of households and firms. Households and firms anticipate from the start that government expenditures increase for two years in a row. They also anticipate that debt-financed expenditures will ultimately lead to higher taxes in the future. The negative wealth effect on private consumption of higher anticipated future taxes reduces the positive impact of the stimulus.

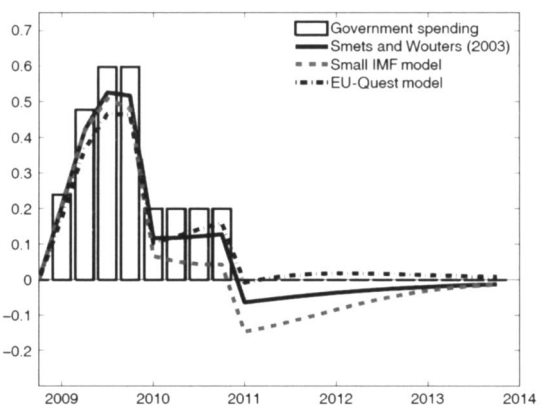

Figure 1. Estimated GDP impact of government spending stimulus

Notes: New-Keynesian DSGE models of ECB, IMF and EU researchers. Quarterly annualized government spending is depicted by the bars in percentage of GDP: 0.24 in 2009Q1, 0.48 in 2009Q2, 0.60 in 2009Q3 and 2009Q4 and 0.20 in 2010.

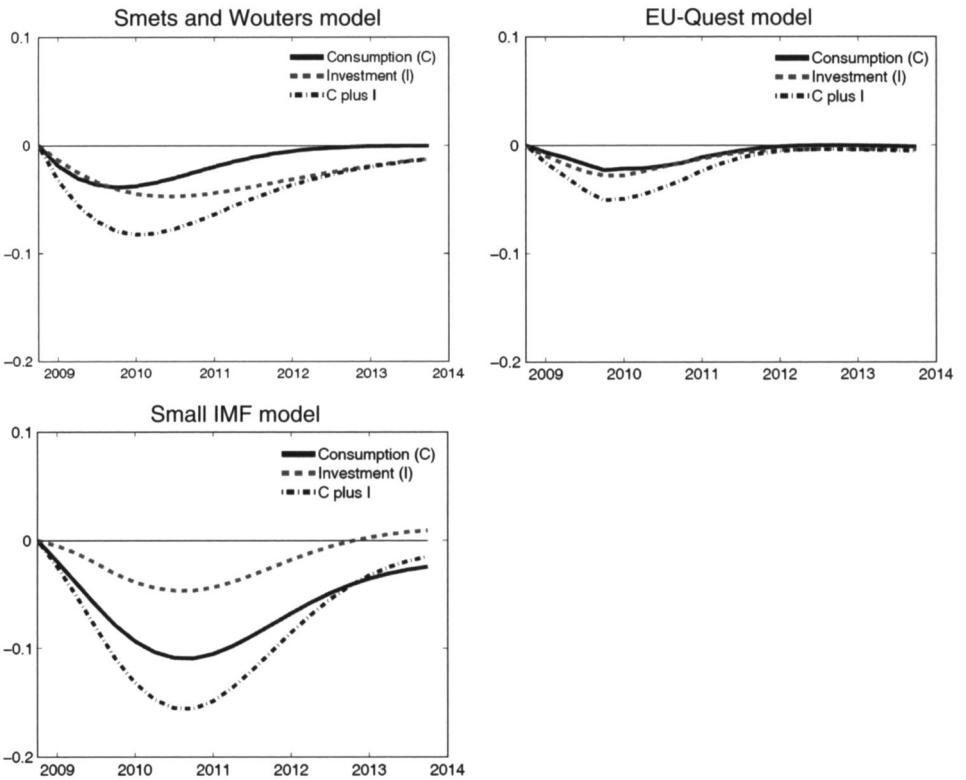

Figure 2. Consumption and investment responses to government spending stimulus

Notes: Consumption and investment deviations from steady-state are in percentage of GDP.

In the SW and Small IMF models, the increase in future taxes falls entirely on lump-sum non-distortionary taxes. In the EU-Quest model the response of consumption, capital and labour income tax rates is modelled with reaction functions but lump-sum taxes are also introduced to guarantee convergence of the debt-income ratio. To the extent lump-sum taxes play an important role in stabilizing debt dynamics after fiscal stimulus, these models understate the longer-term negative effect on growth coming from higher distortionary taxes (see Uhlig, 2010).

All three models also exhibit a decline in investment following the government spending stimulus. Investment demand is influenced by the price of capital, expectations and adjustment costs. The mechanics of crowding-out of investment may be understood as follows. The government increases demand for final goods and firms respond by increasing production and employing more labour and capital. Wages and the rental rate of capital rise to bring about greater labour supply and capital utilization in equilibrium. Along with marginal cost inflation also rises. Monetary policy responds to higher output and inflation by raising nominal interest rates enough to achieve higher *ex-ante* real interest rates. Expected higher real-interest

rates depress the price of capital and discourage new investment. Though future increases in the rental rate of capital tend to boost the price of capital, the interest rate effect is found to dominate in the model simulations reported in Figure 2.

The crowding-out effect in 2010 and 2011 is largest in the Small IMF model, perhaps because it is a two-country model in which households have the option to buy more foreign goods if the price of domestic goods is pushed up by government demand. The EU-Quest model with 35% rule-of-thumb households also exhibits crowding-out of consumption and investment. Output in EU-Quest increases initially even a bit less than in the other two models, but is slightly higher in 2010 and 2011. This finding may appear surprising, because it has been suggested that the presence of liquidity-constrained households can induce crowding-in of consumption following a government spending shock in New-Keynesian DSGE models (see for example Gali *et al.*, 2007). Indeed, if one takes a given model and increases the share of rule-of-thumb households while keeping all other parameters constant, the GDP effect of government stimulus increases, and with a large enough share consumption is crowded-in and a textbook Keynesian multiplier effect is realized. However, Coenen and Straub (2005) have shown that the empirically estimated share of constrained households is not sufficient to overturn the negative wealth effects that are internalized by the forward-looking households. This finding is confirmed by the EU-Quest model. Furthermore, Cogan *et al.* (2010) also estimate a model with rule-of-thumb households and find that the GDP impact of the ARRA government spending only increases by a small amount relative to a simulation with the model of Smets and Wouters (2007).

3.1. Other Keynesian-style models

Some have criticized New-Keynesian DSGE models for being too similar to real business cycle models and incorporating too little of the lessons derived from earlier New Keynesian models with rational expectations or more traditional Keynesian models with backward-looking dynamics. Thus, we introduce two more models in the comparison, the model of the G7 economies by Taylor (1993) and the ECB's area-wide model of Fagan *et al.* (2005).

The structure of the Taylor model, estimation methods and findings are laid out in detail in Taylor (1993). The model was built to study monetary and fiscal policy. Taylor (1993) provides a detailed quantitative assessment of the macroeconomic consequences of temporary as well as permanent changes in government spending in the G7 economies. The multi-country nature of this model offers an interesting opportunity for extending our analysis. It allows us to look at euro area member economies such as France, Germany and Italy, separately. The model is best characterized as a New-Keynesian model because it combines forward-looking, rational expectations with nominal rigidities due to overlapping wage contracts. The model equations exhibit many similarities to those in the above-mentioned

current-generation New-Keynesian DSGE models, but they are not derived as stringently from the optimization problems of representative households and firms. Consumption demand is with the exception of Germany and Italy disaggregated into durable, non-durable and services consumption. Demand for these components is then modelled as a function of lagged consumption, current income and expectations of future income and real interest rates over the next two years. The sensitivity of consumption demand to current income has an equivalent effect to the presence of rule-of-thumb consumers in the EU-Quest model. Fixed investment demand is also modelled as a function of lagged values, current and expected future demand and real interest rates over the next two years. The Taylor model assumes that monetary policy is set independently from seigniorage and government finance considerations and successfully controls inflation in the long run. Thus, implicitly it is assumed that the long-run government budget constraint is satisfied, but tax and debt dynamics are not modelled explicitly as in the EU-Quest model. Output is assumed to return to its long-run potential that is treated as exogenous to monetary policy and government spending.

We simulate a euro area-wide fiscal stimulus for Germany, France and Italy combined. The exchange rates between these three economies are fixed. Short-term nominal interest rates are identical and set according to a policy rule with area-wide targets.[10] As shown in Figure 3, the initial boost to GDP in the first three quarters of 2009 is slightly greater than in the SW, Small IMF and EU-Quest models. In 2010, the effect on GDP is smaller than in the SW and EU-Quest models and slightly more negative in 2011. The left panel in Figure 4 depicts the response

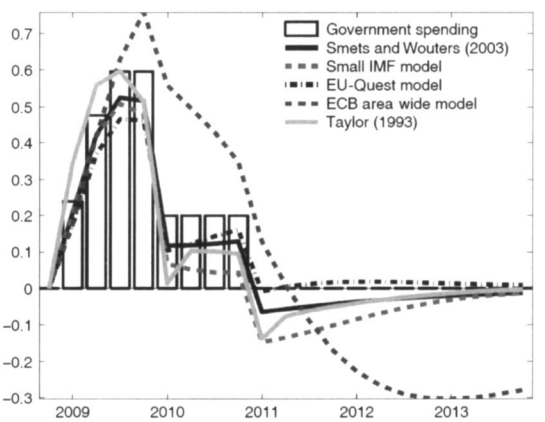

Figure 3. The Taylor (1993) G-7 model and the ECB's area-wide model

[10] Wieland (1996) previously used the Taylor model to study the implications of a shift from the Bundesbank-dominated European Monetary System with policy focused on German targets to a monetary union with area-wide targets. Here, we use a linearized version of this model that is identical to the one used in Levin *et al.* (1999).

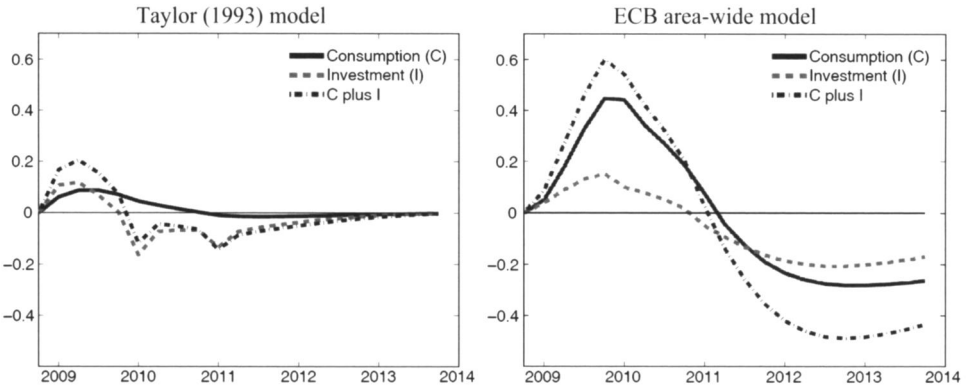

Figure 4. Consumption and investment responses in the Taylor and ECB area-wide model

Notes: Consumption and investment deviations from steady-state are in percentage of GDP.

of consumption and investment. A small crowding-in effect materializes in the first two quarters, but is quickly overwhelmed and followed by a decline in consumption and investment. Some of the stimulus dissipates towards greater demand for imports from countries outside the euro area.

The ECB's area-wide model of Fagan *et al.* (2005)[11] provides a more traditional Keynesian outlook on fiscal stimulus. ECB staff used versions of this model for many years as an important element in the construction of their euro area forecasts for policy purposes. Furthermore, the model has been used to analyse the macroeconomic consequences of changes in monetary and fiscal policies. An important study of the effects of government spending and taxes using the ECB's area-wide model is Henry *et al.* (2004).

We find that the ECB's area-wide model exhibits significant crowding-in of consumption and investment (right panel in Figure 4). As a consequence, the increase in output in 2010 is almost twice as large as the increase in government spending in that year (see Figure 3). This result is obtained because the model assumes backward-looking behaviour. Expectations are represented by lagged values of the variables to be forecasted. Furthermore, private consumption is modelled as a function of disposable income and wealth, with the latter defined as cumulative savings. Thus, households are not modelled as forward-looking decision makers. The simulation of the ECB's area-wide model indicates that the Keynesian multiplier effect in the first two and a half years will be followed by a significant slump in subsequent years. Such an oscillatory response is common to dynamic models with backward-looking dynamics. For example, a simple dynamic model of output with two lags can exhibit a hump-shaped response with subsequent overshooting with a coefficient above unity on the first lag and a large enough negative coefficient on

[11] We use the linearized version of Dieppe *et al.* (2005).

the second lag. A possible source of these output dynamics are accelerator effects in investment. The potential for such an oscillatory response of GDP to government spending is ignored by the textbook analysis of the Keynesian multiplier discussed in the introduction of this paper.

We conclude from this comparison that significant short-run Keynesian multiplier effects appear in models with backward-looking dynamics but disappear if forward-looking, optimizing motivations for households' and firms' decision making are considered in the analysis. It is noteworthy that models such as the ECB area-wide model have been criticized for assuming backward-looking, adaptive behaviour. Fagan *et al.* (2005) themselves consider the backward-looking approach as adequate for short-term forecasts, but unsatisfactory with regard to the evaluation of major policy changes. Henry *et al.* (2004) show that introducing more forward-looking elements in the ECB area-wide model induces a substantial reduction in the government spending multiplier.[12] Interestingly, the comparison of euro area macroeconomic models in Kuester and Wieland (2010) suggests that models which allow for an important influence of forward-looking decision-making by households and firms have fared better in terms of fitting euro area inflation and output dynamics since the start of monetary union. Recently, ECB staff started using a new-area-wide DSGE model in the forecasting process that is more similar to the Smets and Wouters and EU-Quest models (see Christoffel *et al.*, 2008).

4. ISSUES REGARDING FISCAL STIMULUS IN THE CURRENT RECESSION AND FINANCIAL CRISIS

Recently, some commentators requested that policymakers disregard analysis with current-generation macroeconomic models, in particular DSGE models, because they failed to predict the global financial crisis and the ensuing recession of 2008 and 2009. Truth is that these models did not only fail to predict this recession, but would also have failed to predict most if not all previous recessions. Wieland and Wolters (forthcoming) have investigated the forecasting performance of such models in the five most recent NBER-dated US recessions based on the historically available data vintages. None of the models succeeds in predicting one of these recessions. However, this negative finding also applies to earlier generation macroeconomic models and to structural VAR models. The models considered tend to attribute the onset of recessions to unexpected negative macroeconomic shocks.

Interestingly, Wieland and Wolters (forthcoming), also find that expert forecasts available from the Federal Reserve Staff and the Survey of Professional Forecasters fail to predict recessions. While experts can improve current quarter estimates of

[12] Interestingly, the comparison of euro area macroeconomic models in Kuester and Wieland (2010) suggests that models which allow for an important influence of forward-looking decision-making by households and firms have fared better in terms of fitting euro area inflation and output dynamics since the start of monetary union.

output relative to the macroeconomic models by using higher frequency information available prior to the release of quarterly GDP data, their forecasts of GDP perform similarly to model forecasts when the models use expert 'nowcasts' as initial conditions. Wieland and Wolters (forthcoming), find that mean model forecasts compare particularly well to professional forecasts at a horizon of three to four quarters and during recoveries, including the current recovery phase. Thus, we conclude that state-of-the-art macroeconomic models should not be ignored when analysing policy measures such as fiscal stimulus that are part of the economic recovery from recession.

A related criticism points to the lack of a fully developed banking sector in DSGE models that have been used in past years including the three New Keynesian DSGE models used in our study. It is argued that these models do not help in understanding the aggregate consequences of the risks faced by banks in the current crisis. Indeed, it is true that the models we consider have nothing to say on the effects of government actions such as credit guarantees or re-capitalization measures for struggling banks. Thus, our paper remains silent on such policy initiatives, except for noting that if they achieve their aim, they will enhance the predictive power of such models regarding the speed of recovery and the return to more normal growth conditions. The government spending multiplier effect we aim to quantify, however, works directly via purchases of goods and services. These purchases generate additional demand that firm's satisfy by increasing labour input and capital utilization. This non-financial channel of transmission is very well captured in the models we consider in our analysis. To the extent that these models predict crowding-out of private investment due to the increase in government debt and expected future taxes, potential difficulties in obtaining bank-based credit for new private sector investments affect a smaller number of firms than in models that would imply a crowding-in effect. A risk of greater-than-expected crowding-out, however, may exist.

Another concern regarding the relevance of the findings in the preceding section is that these simulations are initiated from the steady-state of the model instead of a deep recession state that would be more similar to the situation at the beginning of 2009. In fact, in linear models or the linearized versions of non-linear models, there is no difference between an impulse response simulation initiated at the steady-state and one initiated at any other state. The marginal response of endogenous variables is independent of the state. To give an example, the marginal increase in the nominal interest rate in response to a given increase in output and inflation due to fiscal stimulus is the same, whether it occurs below, at, or above the neutral steady-state level of the nominal interest rate.

Of course, such a linear approach may not be considered fully satisfactory. Fortunately, however, we employ non-linear solution techniques for rational expectations models in our simulations.[13] The non-linear approach makes it possible to

[13] The particular methodology we use is described in Juillard (1996) and implemented in DYNARE. This solution approach builds on earlier work by Laffarge (1990) and Fair and Taylor (1983).

account for the anticipation of the announced time profile of the fiscal stimulus. Thus, our simulations do not treat each quarter increase to spending as a separate unexpected shock, nor are expectations computed based on the assumption of a simple auto-correlated process as in typical linear fiscal impulse simulations. Instead, households and firms anticipate the announced plan as of the first quarter of 2009. With the help of the non-linear solution approach we will also address other non-linearities that appear particularly relevant to this recession.

In the following we investigate three issues in further detail, the possibility of implementation lags in the execution of government purchases, the possibility of an increase in so-called rule-of-thumb or liquidity-constrained households and the implications of the zero bound on nominal interest rates.

4.1. Implementation lags and negative stimulus

A great advantage of automatic fiscal stabilizers such as unemployment insurance or the tax system is that they respond immediately to cushion the effects of a recession on households and firms. Indeed, they may even become active before the decline in economic activity has become widely apparent in macroeconomic data. Timely planning and execution of discretionary stimulus measures, however, is more difficult to achieve. For example, the current recession in the euro area started in January 2008 according to the CEPR Business Cycle Dating Committee's judgement published in March 2009. The EERP and national stimulus were only announced by the end of 2008 or the beginning of 2009, once the recession had been going on for a year. Given the difficulties of business and government experts in predicting recessions, this is not surprising.

More importantly, even if governments may be able to rush through legislation and make a rapid announcement, the actual implementation of the stimulus will still take more time. While certain increases in transfers, such as the US tax rebates in 2008 and 2009, may be delivered effectively within a few months of the announcement, it is more difficult to execute major new purchases in a short time. Certainly, getting started with building new infrastructure such as roads, bridges or canals, with improving facilities for delivery of government services, with repairing educational institutions and with hiring new professional staff requires at least several months if it is to be done in an effective manner. Once government authorities have decided and planned specific budgets, the particular work projects still need to be selected. Companies need to submit offers that will have to be evaluated and compared by the authorities. If spending decisions are hurried along too quickly, wastage is likely to increase as projects are contracted without soliciting sufficiently competitive offers. In an attempt to recognize such practical limitations to the execution of the 2009 euro area stimulus, we simply shift the execution of planned government spending two quarters into the future in our simulations. Thus, the bulk of additional spending occurs from the third quarter of 2009 onwards with the

time profile otherwise unchanged. The resulting impact on GDP in all five models is shown in Figure 5.

Due to the implementation lag the three New-Keynesian DSGE models (Smets–Wouters, Small IMF, EU-Quest) project a small decline of GDP in the first half of 2009. Thus, negative stimulus would occur just at the time when positive stimulus is most needed. This finding may be particularly disconcerting to proponents of fiscal stimulus, because this class of model is judged by many to be the best currently available framework for policy evaluation (see for example Woodford, 2008). By contrast, the more traditional backward-looking features of the ECB's area-wide model ensure that output remains unchanged in the first two quarters of 2009. In this model, output is stimulated to rise above baseline once government authorities succeed in implementing purchases from summer 2009 onwards. Nothing happens before their execution. Interestingly, the model of Taylor (1993) indicates the possibility of a slight boost ahead of the delayed stimulus.

Further insight regarding these differential results may be obtained from a comparison of consumption and investment responses. In the Smets-Wouters model and the Small IMF model the delay of government spending and the negative wealth effect on private consumption that is due to higher anticipated future taxes combine to slow down the economy. Households and firms see through the future discretionary spending stimulus. They reduce spending immediately to save for higher taxes later. This effect also dominates in the EU-QUEST model even though one-third of the households are constrained to consume current income. Similarly, the expectation of higher real interest rates down the line triggers a decline in investment demand following the announcement of fiscal stimulus, even though government spending is only implemented by the third quarter of 2009.

In the earlier-generation New-Keynesian model of Taylor (1993), Ricardian effects on private consumption are not as strong as in state-of-the-art New-Keynesian DSGE models. Households and firms in that model make forward-looking decisions with a forecast horizon of only two years. Thus, their expectations are

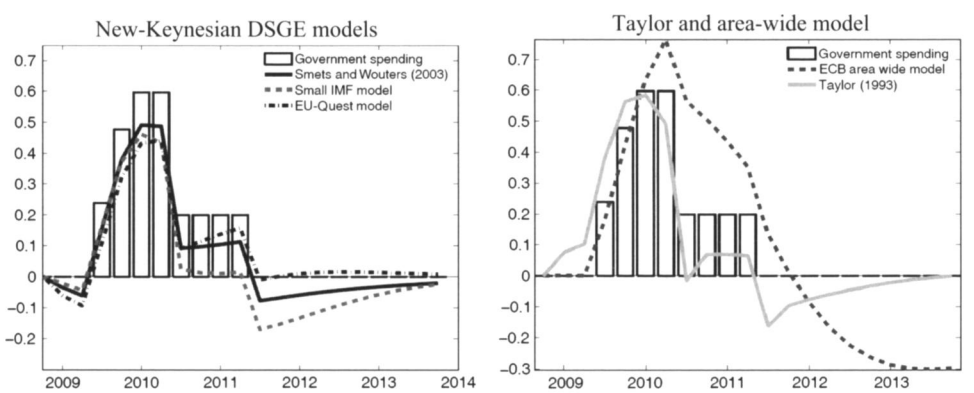

Figure 5. Implementation lags and anticipation effects

influenced more by the positive impact of additional government spending in the near term. This expectation leads to additional spending in the first two quarters. Finally, the ECB's area-wide model delivers the same assessment as in the simulation without implementation lag, except that the crowding-in of consumption and investment is delayed by two quarters. Again, backward-looking dynamics induce a big oscillatory effect. The boost is followed by a slump.

4.2. The share of rule-of-thumb households in the recession

So far we have treated the parameters of the models as constant throughout the analysis. Instead, one might argue that some of those parameters have changed in such an unusually deep recession as observed in 2008 and 2009, in particular, the share of rule-of-thumb or liquidity-constrained households. This share is defined explicitly in the EU-Quest model and implicit in the consumption response to current income in the Taylor (1993) and ECB area-wide model. Theoretically, one motivation for including such behaviour in general equilibrium models is to approximate the behaviour of households that would like to increase consumption in the current period, but are not able to borrow against their future expected income. These households would tend to consume any additional increase in current income that might obtain due to fiscal stimulus.

A possible concern is that the share of constrained households has increased in the course of the financial crisis because banks were more reluctant to extend credit. Increasing the share of constrained households in the DSGE models considered previously while keeping all other parameters constant would reduce the crowding-out effect on consumption. As a result, the GDP impact of government spending would increase. The greater the share of rule-of-thumb consumers the more consumption demand in DSGE models behaves as in the textbook Keynesian consumption function. With a share of 50% or more a model such as the one by Smets and Wouters would imply that government spending increases output by more than one for one, because consumption also rises.

By contrast, it is also possible that the share of consumers that desire to borrow declined during the 2008–2009 recession. In particular, households who expect a lasting reduction in income, because of less promising job opportunities, asset losses, sustained unemployment, or higher taxes may decide to save more. Thus, some of the households that were borrowing-constrained before the recession may rather want to save any additional income they might receive due to government stimulus.

The share of rule-of-thumb consumers ranges from 0% to 35% in the three New-Keynesian DSGE models that we have considered. How does this range compare to recent empirical evidence on household behaviour during this recession? The tax rebates by the Bush and Obama administrations in spring 2008 and 2009 constitute natural experiments that may help reveal the share of households that consume temporary increases in disposable income during this period. Taylor

(2009) and Taylor (2010a) compare disposable personal income and household consumption during this period on an aggregate level. The rebate payments are clearly visible as upward spikes in personal income in May–June 2008 and 2009 respectively. At the same time, however, aggregate household consumption grows rather smoothly. It displays no upward spikes that would mirror the rebate-induced increase in disposable household income as it should be the case for rule-of-thumb consumers. Thus, aggregate data does not indicate an inconsistency with forward-looking consumption-smoothing behaviour by optimizing households faced with temporary windfall income. A recent survey by Sahm and Slemrod (2010) sheds additional light on this issue. They find that 25% of households reported that the one-time economic stimulus payment in 2008 led them mostly to increase their spending. In 2009, it was 13% of households that reported to have mostly spent the extra pay from the lower withholding.

Another US policy initiative, the 'Cash for Clunkers' programme in 2009, may also generate insights regarding optimizing versus rule-of-thumb behaviour by households. Mian and Sufi (2010) claim evidence that almost all of the additional purchases under the programme were pulled forward from the very near future, and that the effect was almost completely reversed by March 2010. This finding may also be interpreted as evidence of largely forward-looking optimizing consumption behaviour.

Turning to Europe, interesting survey evidence has been collected by Boersch-Supan *et al.* (2010). They survey households in Germany. About a third of these households respond that they have received additional income from the 'Konjunkturpaket II' and have spent about 75% of this additional income on consumption. Asked whether they would spend a possible 'consumption voucher' on goods that they would have bought anyway, or whether they would use it to increase their consumption, 73% of households answered that they would not increase overall consumption if they were to receive such a voucher. Finally, this survey also included a question aimed to elicit the extent of Ricardian effects such as an expectation of increased taxation following a rise a government spending. Interestingly, 75% of surveyed households answered that they expect tax increases in the near future, and an additional 15% expected such tax increases somewhat later in the future.

We conclude from this recent empirical evidence regarding the consumption behaviour of US and German households during the financial crisis, that the range of assumptions regarding the share of rule-of-thumb consumers in the models used in our analysis already brackets the likely extent of such behaviour during the crisis and recession. Thus, we see no need to further modify our simulation results in this regard.

4.3. Monetary policy and the zero bound on nominal interest rates

While fiscal policy is subject to political approval and suffers from implementation lags if additional spending is to be used effectively, the central bank can react

immediately by lowering nominal interest rates with the onset of recession. Thus, monetary policy has a natural advantage over fiscal policy as a tool for recession fighting. However, monetary policy also faces certain constraints regarding the use of its most popular instrument. Currency provides savers with a non-interest bearing nominal store of value. The resulting zero-lower-bound on nominal interest rates puts a limit on the extent of interest rate easing. The implications of this constraint for monetary policy were analysed almost 14 years ago by Fuhrer and Madigan (1997), Krugman (1998) and Orphanides and Wieland (1998). Orphanides and Wieland (1998)[14] evaluated the impact of this constraint on output and inflation variability in an estimated macroeconomic model of the US economy with rational expectations and nominal rigidity similar to the Taylor (1993) model. They showed that recessions would be deeper and inflation would decline further whenever the zero-lower-bound were to bind. However, the central bank is not powerless. Orphanides and Wieland (2000) find that optimal monetary policy in the presence of the zero bound involves preemptive interest rate reductions followed by quantitative easing. Direct asset purchases work to reduce risk and term premia and exploit real-balance and portfolio-balance effects in order to stimulate inflation and lower real interest rates. McCallum (2002), Svensson (2001) and Coenen and Wieland (2003) emphasized exchange rate policy as an additional tool when the space for interest rate easing is exhausted. Reifschneider and Williams (2000) showed how an announcement extending the period over which nominal interest rates are kept at zero in the future reduces the recessionary and deflationary consequences of the zero bound.

The zero-bound becomes a binding constraint when the central bank's notional operating target for the interest rate turns negative. This notional interest rate target can be modelled with a reaction function that describes the central bank's desired response to macroeconomic conditions. Cogan *et al.* (2010) have investigated to what extent the notional target for the US federal funds rate turned negative in 2009. They simulated the Smets–Wouters (2007) model with US data through the first quarter of 2009. Then, they computed projections of the recovery using a version of the model that incorporated the non-negativity restriction on the federal funds rate. Whether or not the federal funds rate endogenously visits the zero bound is found to depend on the monetary policy rule that captures the Federal Reserve's response to economic developments. Under the well-known Taylor rule the simulated recovery is sufficiently quick so that Taylor's rule would prescribe an interest rate tightening away from zero. Under the estimated policy rule in the Smets–Wouters model the endogenous visit at the zero bound lasts two quarters.

The euro area model simulations presented so far have been conducted under the assumption that ECB monetary policy follows an interest rate rule that

[14] A revised version was published as Coenen *et al.* (2004).

stabilizes output and inflation. The particular policy rule that we have implemented in all the models considered in this paper is taken from Gerdesmeier and Roffia (2004). Including the same rule for monetary policy in each model guarantees that differences in the effect of fiscal stimulus can be attributed to differences in economic structure rather than different responses of monetary policy across models. This rule is estimated with euro area data. It was also used by Kuester and Wieland (2010) in a comparative study of the first generation of euro area models developed at the ECB, including among others the ECB's area-wide model and the Smets–Wouters model. It is a rule for setting the short-term nominal interest rate, r_t, as a function of inflation, output and the lagged interest rate:

$$r_t = 0.66r_{t-1} + 0.66\pi_t + 0.10y_t$$

Here, r_t is the quarterly nominal interest rate (annualized), π_t is the year-on-year inflation rate and y_t is the output gap. Monthly data from 1985 to 2002 was used in estimation.

Next, we consider the possibility that the euro area recession is deep enough to ensure that the zero bound is binding for one year. This assumption introduces an important non-linearity in the model simulation. Because the notional interest rate target of the central bank is below zero, the nominal interest rate does not rise in response to fiscal stimulus. Instead, the nominal interest rate remains constant. As a result, the real interest rate falls somewhat during the first few quarters. The zero-lower-bound implicitly causes monetary accommodation of the increase in government spending. The simulation is identical to a scenario in which the ECB is assumed to promise keeping the nominal interest rate constant throughout 2009. In 2010 interest rates are assumed to return to the value prescribed by policy rule, thereby keeping inflation under control in the longer run.

The effect of euro area government spending on GDP with constant interest rates in 2009 is shown in the left panel of Figure 6. Only the outcome for the three New-Keynesian DSGE models is shown and there is no implementation lag. GDP

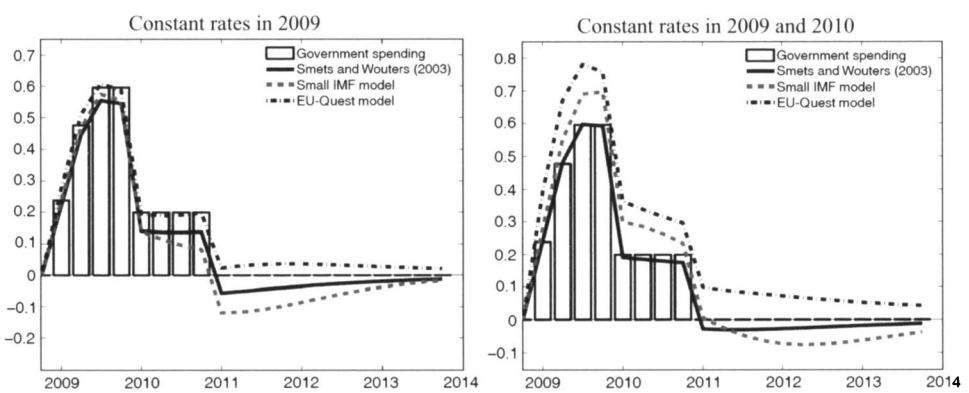

Figure 6. GDP impact of stimulus when nominal interest remains constant

increases a bit more in response to the spending stimulus than in the baseline scenario reported in Figure 1. Declining real interest rates support investment and consumption in the first few quarters and reduce the crowding-out effect. Even so, crowding-out still dominates for the SW and Small IMF model. In the EU-Quest model, output roughly moves one-for-one with government spending.

The right panel in Figure 6 displays simulations, in which households and firms anticipate that the zero bound remains binding for two years. Thus, the nominal interest rate is anticipated to remain constant and does not rise in response to the fiscal stimulus until the first quarter of 2011. The expectation of rising inflation and falling real interest rates boosts consumption and investment and induces a noticeable crowding-in effect in 2009 and 2010 in the EU-Quest and Small IMF models. In the SW model output roughly mirrors the movement in GDP. It is important to point out that this boost relies on the anticipation of two years of constant rates as of the first quarter of 2009. For example, if private sector participants anticipate interest rates to rise at the end of 2009 and only realize towards the end of that year that the zero bound will remain binding throughout 2010, the GDP impact of the government spending stimulus will turn out more similar to the simulations in the left panel.

Recently, other studies have investigated the consequences of fiscal policy when monetary policy is constrained at the zero bound (see Christiano *et al.*, 2009 and Bodenstein *et al.*, 2009). Christiano *et al.* (2009), in particular, have emphasized that under certain conditions fiscal multipliers can get very large, with the GDP impact being three or four times as large as the increase in government spending. The differences between their findings and ours are not due to fundamental differences in the models, but to the nature of the question that is posed. While Cogan *et al.* (2010) and the present paper focus on the expected outcome in scenarios we consider most likely at the current juncture, Christiano *et al.* (2009) ask what conceivable scenarios would generate a very large multiplier. Such cases arise in situations when the zero bound is binding for a much longer time, or in the case of deflation scares that may then be averted by fiscal stimulus. Consider a deflation scare that implies an expected inflation rate of −4%. If fiscal stimulus is effective in reversing inflation expectations, real interest rates drop dramatically and induce a large multiplier effect.[15] However, such outcomes are contingent on the absence of any other monetary policy action that would avert deflation and deflation scares. Examples would be quantitative easing by outright asset purchases as proposed in Orphanides and Wieland (2000) and Coenen and Wieland (2003). Given that the Federal Reserve used asset purchases aggressively to avoid sustained deflation expectations in the United States and euro area inflation expectations largely remained positive,

[15] Similarly, Coenen *et al.* (2004) assumed an endogenous response of government spending to deflation below a certain threshold to rule out the possibility of deflationary spirals.

neither the ARRA legislation nor the EERP stimulus should be expected to deliver multiplier effects of the magnitude studied in Christiano *et al.* (2009).

5. MODEL UNCERTAINTY AND POLICY DECISION CRITERIA

What should policymakers make of these differential assessments with multiple macroeconomic models? We propose to focus on the cumulative effect of government expenditures on GDP relative to the resources spent by the government. This difference provides a sharp distinction between crowding-in and crowding-out effects and should be of particular interest to policymakers. If increased government spending is likely to stimulate additional private spending, the case for discretionary stimulus is strengthened. But if on top of the recessionary impact on consumption and investment, private spending is pushed further down by crowding-out effects from government spending, such policy action would appear much less attractive. Policymakers might then prefer direct transfers or tax cuts that would avoid reducing private spending, or they might forego discretionary stimulus altogether and rely on automatic fiscal stabilizers and monetary policy for cushioning the recession, thereby avoiding additional increases in government debt.

We will abstain from an analysis of economic welfare. Although, the three DSGE models would allow us to calculate the utility of the representative household in these models, we would be forced to ignore the Taylor (1993) model and the ECB's area-wide model in such a welfare comparison. While we have previously noted a number of good arguments for assigning a greater weight to state-of-the-art DSGE models that are built on explicit microeconomic foundations, we believe that more traditional macroeconomic models should not be completely ignored. They can still play a useful role in rendering policy recommendations more robust to modelling uncertainty. Similarly motivated by such robustness considerations, Cogan *et al.* (2010) criticized Romer and Bernstein (2009) for ignoring state-of-the-art DSGE models and relying exclusively on traditional Keynesian-style macroeconomic models in evaluating the likely impact of the ARRA stimulus for the US Administration. However, we agree with Romer and Bernstein (2009) that the magnitude of the GDP impact of fiscal stimulus should be a key factor in formulating a practical policy recommendation. To the extent economic activity is correlated with unemployment, a recession imposes an asymmetric cost on the newly unemployed. Thus, GDP impact estimates provide a useful indication to policymakers whether discretionary fiscal policy is likely to benefit those affected most strongly by the recession. The welfare measures derived in the three New-Keynesian DSGE models considered in this paper do not capture these benefits because they apply to representative households.

We calculate the cumulative GDP effect net of government resources spent over two and four years respectively. It may be of particular interest to governments that initiated fiscal stimulus and face elections within that time frame. The summary

measures are reported in Table 2 for the case of the baseline simulations displayed in Figures 1 and 3. The first column shows the cumulative effect from the first quarter of 2009 to the first quarter of 2011. Over this period, the three New-Keynesian DSGE models and the Taylor (1993) model indicate significant private spending displacement. Only the ECB's area-wide model suggests a small net increase. Over a four-year horizon all five models agree that government spending will crowd-out private spending to a significant extent as shown in the second column of Table 2.

How should these simulation results be used in providing advice to policymakers? First, presenting quantitative findings from five distinct models that are empirically estimated or calibrated and that take into account different theoretical perspectives and assumptions helps inform policymakers about a relevant range of model uncertainty. Secondly, the stimulating effect of government spending on private spending is regularly used as an argument in favour of fiscal stimulus packages in actual policy deliberations and advice. In 2009, for example, advisers to the US Administration (Romer and Bernstein, 2009) and the German government (Sachverständigenrat, 2009) have referred to quantitative multiplier estimates in making the case for discretionary fiscal policy. Thus, our range of estimates of the cumulative government spending multiplier is directly relevant for practical policy analysis. All five models indicate an economically significant reduction of private sector consumption and investment spending over a horizon of four years. On this basis, we would recommend against legislating additional government purchases for the purpose of stimulating the economy.

Proponents of fiscal stimulus might argue instead that some of our models indicate a positive effect over a shorter horizon, that a larger fiscal package such as the US ARRA would deliver better results, and that the multiplier effect would be bigger in certain scenarios, which are particularly relevant to the 2009 recession. We address these arguments in turn.

Table 2. Cumulative GDP net of government spending: range of model uncertainty. Baseline scenario: no implementation lag and no constant interest rate

Percentage increase in real GDP

	EU fiscal package (2011Q1)	EU fiscal package (2013Q4)	US fiscal package (2013Q4)
Smets and Wouters (2003)	−0.15	−0.24	−1.35
Small IMF model	−0.26	−0.43	−1.79
EU-Quest model	−0.18	−0.14	−1.28
Taylor (1993)	−0.13	−0.21	−0.79
ECB area-wide model	0.31	−0.32	−0.18

Notes: The cumulated euro area stimulus amounts to 0.68% of euro area GDP (see Table 1) and the cumulated US government purchases to 2.2% of US GDP.

Source: Authors' calculations.

To the extent that the five models do not agree about the sign of the multiplier effect over a shorter time horizon it would be natural to consider the average effect. Since only one of the models – the ECB's area-wide model – indicates crowding-in of private sector spending over two years, the average effect over this shorter horizon remains negative. More sophisticated approaches to decision-making under uncertainty could also be implemented. For example, Bayesian decision making would imply using model probability weights in averaging. These probabilities could be updated over time as we learn more about the relative empirical fit of these models. An example is provided in Kuester and Wieland (2010) for the case of monetary policy. They show that updating with data from the first 10 years of European Monetary Union implies greater probability weights for forward-looking DSGE models such as Smets and Wouters (2003) than for the ECB's area-wide model.

An alternative approach to decision-making under uncertainty that does not rely on probability weights is worst-case analysis. This approach is also sometimes referred to as robust control or Minimax control. It is meant to help policymakers guard against worst-case outcomes. Kuester and Wieland (2010) consider the application of Minimax control with multiple competing reference models for monetary policy in the euro area.[16] They show that it implies assigning a greater weight to the model in which policy outcomes are least desirable. Technically, Minimax control minimizes losses for the case that nature chooses the model that implies maximum loss. Thus, in the context of this paper, worst-case analysis would emphasize guarding against the possibility that the model with the smallest fiscal multiplier is closest to the truth.

Would the results be better if only the euro area governments would have enacted a greater and longer-lasting fiscal stimulus as recommended by the US administration? As a counterfactual we consider the case in which euro area governments implement a package similar in magnitude and length to the ARRA legislation. To this end, we study the impact of the government purchases simulated by Cogan *et al.* (2010) for the United States in the models of the euro area economy. This package implies significant additional spending for four years. The cumulative impact on GDP net of government spending by the end of the fourth year is shown in the third column of Table 2. The four New Keynesian models indicate that a longer-lasting fiscal stimulus will cause greater crowding out of private consumption and investment. Thus, the preference of euro area governments for temporary stimulus is supported by these models. In the ECB's area-wide model the negative overshooting effect is delayed resulting in a smaller crowding-out effect than under the two-year euro area package.

[16] For applications of worst-case analysis to insure monetary policy against perturbations of a single reference model see for example, Sargent (1999), Hansen and Sargent (2007) and Zakovic *et al.* (2007).

Finally, we turn to a consideration of the scenarios with implementation lags and zero bound effects that may be particular relevant to the 2009 recession and have been highlighted in the preceding section. These scenarios may alter the GDP effect of government purchases. Table 3 indicates the range of cumulative multiplier estimates under these scenarios taking into account all five models of the euro area.

Implementation lags clearly reinforce the message of the baseline simulations. Crowding out of consumption and investment dominates all cases over the four-year horizon, and for all four New-Keynesian models over the two-year horizon. The cumulative reduction in private-spending in the three DSGE models is noticeably greater than in the baseline scenario in Table 2.

Table 3. Cumulative GDP net of government spending: scenario analysis and model uncertainty

EU fiscal package: Percentage increase in real GDP		
	Cumulated to 2011Q1	Cumulated to 2013Q4
Implementation lag EU fiscal package		
Smets and Wouters (2003)	−0.25	−0.33
Small IMF model	−0.32	−0.54
EU-Quest model	−0.30	−0.24
Taylor (1993)	−0.10	−0.21
ECB area-wide model	0.20	−0.16
Implementation lag and constant interest in 2009		
Smets and Wouters (2003)	−0.22	−0.30
Small IMF model	−0.26	−0.48
EU-Quest model	−0.16	−0.07
Taylor (1993)	0.02	−0.09
ECB area-wide model	0.22	−0.11
Implementation lag and constant interest in 2009–2010		
Smets and Wouters (2003)	−0.11	−0.16
Small IMF model	0.10	−0.10
EU-Quest model	0.35	0.61
Taylor (1993)	0.51	0.45 0.21
ECB area-wide model	0.32	0.34
Implementation lag and constant interest in 2009 anticipated 09Q1 and constant interest in 2010 anticipated in 10Q1		
Smets and Wouters (2003)	−0.19	−0.25
Small IMF model	−0.16	−0.33
EU-Quest model	−0.01	0.16
Taylor (1993)	0.20	0.14
ECB area-wide model	0.29	0.29

Notes: The table includes robustness scenarios. We consider monetary accommodation of 1 and 2 years and an implementation lag of 2 quarters. The cumulated euro area stimulus amounts to 0.68% of euro area GDP (see Table 1).

Source: Authors' calculations.

If the notional interest rate target implied by the reaction function of the central bank moves below zero during the recession and stays there long enough for the zero bound to bind throughout all of 2009, interest rates would not rise as usual in response to output improvement throughout that year. This effect is taken into account in our simulations by the anticipation of constant interest rates throughout 2009. As a result, the initial GDP effect of government spending is somewhat greater because the usual increase in real interest rates is delayed. The cumulative sums net of government spending in the five models are reported in the second set of rows in Table 3. Again, crowding-out of private spending occurs in the three state-of-the-art New-Keynesian DSGE models over two- and four-year horizons, and in all five models over the four-year horizon.

Crowding-in of private consumption and investment is only achieved if interest rates are anticipated to remain constant till the end of 2010 as early as the first quarter of 2009 (third set of rows in Table 3). Of course, in this simulation inflation also increases more. In the New-Keynesian models the date and extent of the anticipation of households and firms play an important role. We illustrate the effect of anticipations by analysing the following scenario. Initially market participants expect monetary accommodation in 2009 but a return to the policy rule in 2010. New information on the central bank's intentions then leads them to update their expectations for another year of monetary accommodation at the beginning of 2010. The resulting outcomes for the GDP impact of fiscal stimulus in the DSGE models are closer to the case with one year of constant interest rates with crowding out of private consumption and investment.[17] Thus, considering the range of scenarios and the range of model uncertainty displayed in Tables 2 and 3, we maintain our earlier conclusion to advise against the use of discretionary government purchases for recession fighting.

6. OTHER APPROACHES IN THE LITERATURE

In the preceding analysis of the effects of government spending, we have focused on estimates obtained with structural models of the euro area. Structural models are needed to dissect the effects of anticipations by market participants under alternative assumptions regarding the timing of fiscal stimulus and the interaction with monetary policy. We found that such anticipation effects have important implications for the degree of crowding-out of private spending by increased government purchases.

[17] As to actual developments in the euro area, the ECB stopped lowering its overnight lending rate at 1% and its deposit rate at 0.25% in May 2009 calling this an appropriate level. As of September 2009 it already started to lay out its strategy for exit from this monetary policy stance. The advent of the European sovereign debt crisis in spring 2010 provided a new motivation for maintaining the low level of nominal policy rates.

However, there also exists a large empirical literature that utilizes reduced-form methods in order to identify the likely effects of government spending shocks. Many of these studies focus on US data, but others also cover a wide range of OECD economies. As emphasized by Ramey (2009) the US studies remain divided on central questions such as whether the GDP effect is greater than unity and whether private spending rises or falls in response to additional government purchases. VAR techniques, in which identification is achieved by assuming that government spending is predetermined within the quarter, typically find a larger effect of government spending on GDP and crowding-in of consumption (e.g. Blanchard and Perotti, 2002; Fatas and Mihov, 2001; Beetsma *et al.*, 2006; or Gali *et al.*, 2007) while studies using the Ramey–Shapiro 'war dates' (e.g. Ramey and Shapiro, 1998; Burnside *et al.*, 2004; Ramey, 2009) indicate a smaller GDP effect and crowding-out of consumption. Indeed, these studies and other more recent ones reflect a wide range of estimates of the GDP impact of government spending due to difficulties in identifying the presumed government spending shocks. Using VAR techniques, Blanchard and Perotti (2002) find a government spending multiplier close to one, Fatas and Mihov (2001) estimate it to be greater than one, Beetsma *et al.* (2006) put it at 1.5 by the second year for a range of European economies, while Gali *et al.* (2007) obtain a high-end estimate of 1.7 after two years. These studies suggest that private consumption increases following a government spending shock. Perotti (2005) looks at data from five OECD countries including Germany. He finds that the effects of government spending on GDP tend to be small and below unity except for the US data. Furthermore, the GDP effect of government spending appears to have become weaker since the 1980s. Using a different identification approach based on sign restrictions, Mountford and Uhlig (2009) estimate a multiplier well below one for a deficit-financed government spending shock with substantial crowding-out of investment.

Clearly, identification is a problem. Ramey (2009) shows that increases in US military spending and non-defence spending are anticipated several quarters before they occur. Consequently, it is important to capture the timing of the news about future increases in government spending correctly. Her multiplier estimates based on war dates and defence news lie between 0.6 and 0.8 when World War II is excluded, and near unity with World War II included. Similar empirical findings are reported by Barro and Redlick (2009). They identify a defence spending multiplier of 0.6 to 0.7 including the World War II period and find a significant negative effect of defence-spending shocks on private investment. A recent paper by Afonso *et al.* (2010) analyses empirically if the impact of government spending on GDP differs in crisis and non-crisis times. They employ data of OECD and non-OECD countries for the period 1981–2007 and use panel regression techniques. To overcome endogeneity problems they use the distance to next and past elections and lagged budget-balance-to-GDP ratios as instruments for government spending. They cannot reject the hypothesis that crisis spending and regular spending have

the same impact on GDP and find an average fiscal multiplier between 0.6 and 0.8 for the full sample.

How does this work relate to our analysis of the US and euro area stimulus packages with structural models? The timing and nature of the anticipation of fiscal spending packages due to the ARRA and EERP is known and need not be identified from macroeconomic time series. Of course, in estimating the structural models one also obtains empirical monetary and fiscal policy reaction functions. In Cogan *et al.* (2010) we use them to conduct simulations that are similar to the experiments in VAR studies, namely a one-time surprise increase in government spending that dies out slowly according to an anticipated autoregressive process. We show that the effect of a typical government spending shock in the DSGE models with and without rule-of-thumb consumers estimated for the United States is about 0.8 averaged over the first year, and thus similar to several of the above-mentioned reduced-form studies. The euro area DSGE models considered in this paper fit well in this range.

Following the 2009 working papers by Romer and Bernstein (2009), Cogan *et al.* (2010) and Cwik and Wieland (2009), an increasing number of studies have used other structural macroeconomic models to assess the impact of different fiscal policy tools. An interesting extension of the EU-Quest model by Roeger and in't Veld (2009) includes a third type of households that are credit-constrained. Their benchmark calibration apparently has 40% of liquidity-constrained households and another 20% of credit-constrained households, which would be too high relative to the survey evidence available regarding the share of such households during the financial crisis. The IMF's new preferred model for fiscal policy analysis, the so-called GIMF model, has been used by Freedman *et al.* (2010) to analyse the consequences of different fiscal measures. An innovative feature of this model is the presence of overlapping generations of households with finite horizons. As shown by Taylor (2010b) the GDP effect of long-lasting or permanent fiscal stimuli in the GIMF model is very close to the effect reported by Cogan *et al.* (2010) for New-Keynesian DSGE models. A short-term government spending shock in GIMF has a multiplier of unity which is somewhat larger than in the DSGE models considered in Cogan *et al.* (2010) and this paper. Unfortunately, the GIMF model is calibrated and not estimated with state-of-the-art methods to fit US or euro area data. It would be very useful to see how it fares in estimation relative to the estimated models we have used.

Recently, a very commendable model comparison study was executed by 17 researchers from the IMF, OECD, ECB, Federal Reserve and European Commission in Coenen *et al.* (2010). It covers seven structural models used at policy institutions including GIMF, the modified version of EU-Quest with additional constrained households, the Fed's SIGMA and FRB-US models, the OECD Fiscal Model, the Bank of Canada-GEM model and the ECB's New Area-Wide Model. The study refers to Cogan *et al.* (2010) but ignores the model comparison for the

euro area by Cwik and Wieland (2009) from July 2009. They mostly find somewhat higher short-run government purchases multipliers than Cogan *et al.* (2010) and attribute this difference to the assumption of rule-of-thumb households. Indeed, three of these models include shares of 40% or 50% that are higher than the 28% share estimated by Cogan *et al.* (2010) and the shares of 13–25% reported by the survey studies cited earlier. Coenen *et al.* (2010) tend to put greater emphasis on the simulations with anticipation of two full years of monetary accommodation right at the start of 2009 when fiscal stimulus was announced. However, they ignore the possibility of even moderate implementation lags.

Further comparison of our findings with those by Coenen *et al.* (2010) would be very useful. Unfortunately, Coenen *et al.* (2010) employ a traditional model comparison approach similar to Taylor (1999). Separate teams of researchers conduct a specific set of experiments, each team in their own model and report outcomes. It would be very useful if the policy institutions that are represented by these researcher teams would choose to create a platform for model comparison as in Wieland *et al.* (2009) or add their models to this new model database. Such a platform would render their model simulations also directly replicable and transparent to researchers outside these teams and institutions. Replicability is a basic scientific standard that ensures that correct comparisons can be made and policy recommendations can be properly scrutinized. Several of these institutions have already made earlier models publicly available for such purposes and the publication of the Coenen *et al.* (2010) study would seem to provide a perfect occasion to proceed accordingly.

7. GOVERNMENT SPENDING SPILLOVER EFFECTS IN THE EURO AREA

Advocates of fiscal stimulus in the euro area were particularly concerned with spillover effects and the potential for 'free-riding'. The rationale was that unilateral stimulus in one country, for example in Spain, would partly be diverted to a greater demand for import goods. As a result, other euro area trading partners, say Germany, France or Italy, would benefit from Spanish fiscal stimulus. They would even have an incentive to go slow on domestic stimulus while encouraging other countries, a behaviour that could be defined as free-riding. This criticism was directed in particular at the German government that was perceived to have most room for additional fiscal spending thanks to past budget consolidation.

As indicated by our review of announced fiscal packages in the euro area, the German government eventually announced by far the largest plan accounting for 51% of the total euro area stimulus. Thus, the question now is whether the effect of German government spending increases will pull along other euro area countries. Analysing this question requires an estimated macroeconomic multi-country model that accounts for a sufficient number of euro area member economies separately. Unfortunately such models are still relatively rare. One model at our disposal is the

Taylor (1993) model of the G7 economies. We use it to quantify the effect of the spending measures announced by the German government on the German, French and Italian economies.

Table 4 reports the respective GDP impacts from the first quarter of 2009 to the fourth quarter of 2012. The first three rows indicate the outcome when Germany, France and Italy form a monetary union, in other words, when the exchange rates are fixed and monetary policy aims at stabilizing union-wide targets. Interestingly, the spill-over effects are rather small. In Italy they even turn negative by the end of 2009. This finding is obtained even though the estimated export demand equations for Italy and France indicate an economically significant direct foreign demand effect with Germany as an important trading partner. This direct demand effect is overwhelmed by the indirect effect of a real appreciation of the euro. The fiscal expansion in Germany puts upward pressure on the euro relative to the currencies of countries outside the monetary union (United States, Canada, United Kingdom and Japan). As a result, France and Italy lose competitiveness and exports to countries outside the euro area decline.

Our findings differ from estimates of intra-European spillover effects obtained by Beetsma *et al.* (2006). They estimate reduced-form trade equations and link them to VAR-based estimates of domestic demand effects of government spending. A government spending increase of 1% of GDP in Germany is then estimated to raise output in other euro area countries by 0.05 to 0.45%. However, Wieland (2006) points out that the sample period considered by Beetsma *et al.* (2006) that is 1965 to 2004, spans several monetary and exchange rate regime changes. At the beginning, exchange rates were still fixed vis-à-vis the US dollar in the Bretton Woods system. From 1973 onwards European currencies floated relative to the US dollar but their central banks intervened to manage intra-European exchange rates. With the start of the European Monetary System (EMS) in 1979, European exchange

Table 4. Impact of German government expenditures

Percentage increase in real GDP

	2009Q1	2009Q4	2010Q4	2011Q4	2012Q4
Monetary union					
France	0.037	0.035	0.010	−0.009	0.002
Germany	0.700	0.645	0.368	−0.078	−0.136
Italy	0.014	−0.009	−0.046	−0.052	−0.018
Flexible exchange rates					
France	0.053	0.060	0.019	−0.018	−0.012
Germany	0.636	0.493	0.224	−0.112	−0.063
Italy	0.043	0.052	0.023	−0.014	−0.015

Notes: The impact of the German fiscal stimulus package is simulated with the Taylor model. Euro area inflation and output gap are defined as a weighted average of German, French and Italian values. In the case of the monetary union simulation the euro area nominal interest rate reacts to euro area inflation and output gap. We assume no change in the fiscal policy of France and Italy.

Source: Authors' calculations.

rates were temporarily fixed but adjustable. Exchange rate realignments occurred regularly until rates were permanently fixed with European Monetary Union (EMU). Over time, monetary policy changed from independent national monetary policies, followed by a period of Bundesbank leadership in the latter part of the EMS to a single euro area policy. Thus, the estimates obtained by Beetsma *et al.* (2006), may be unduly biased by ignoring these regime changes. In particular, positive spillovers in periods of fairly flexible exchange rates contrast with small or even negative spillovers in periods of fixed exchange rates as shown in Wieland (1996).

To further explore the role of the exchange rate in fiscal stimulus we conduct a counterfactual simulation with flexible exchange rates between France, Germany and Italy and independent monetary policies. In this case, the effect of fiscal stimulus in Germany is reduced, because it is faced with a larger appreciation of its currency vis-à-vis others. The spillover effects to France and Italy, however, would be positive. As emphasized by Wieland (1996) it is important to account for this regime change in assessing the extent of likely spillovers between euro area member economies. The exchange rate appreciates on impact of the stimulus, because interest rates are expected to rise and capital flows into the country. Empirical VAR studies that use data from before and after monetary union will confound differential spillover effects from these two periods, while a structural model can be used to distinguish different regimes. It would be of interest to estimate a New-Keynesian DSGE model of the G-7 economies with more recent data and investigate the robustness of our findings with Taylor's model.

8. GOVERNMENT INVESTMENT AND TRANSFERS

Advocates of fiscal stimulus often praise the additional benefits of government spending on infrastructure and other private-sector productivity-enhancing investments. Indeed, government expenditure on such infrastructure may improve overall productivity. However, it may not be advisable to tie such construction to stimulus packages that need to be executed rapidly. Implementation lags are sure to be most pronounced with regard to major new infrastructure construction. Leeper *et al.* (2009), for example, argue that due to implementation lags expansionary government investment can cause a short-run contraction of output. Furthermore, if pressure is applied to accelerate spending of allocated funds, wastage due to inadequate planning and insufficient competition is likely to be the result.

We have reviewed the stability programmes of national governments from 2008 and 2009 to separate spending on infrastructure from other spending measures. We have focused on infrastructure rather than simply checking whether the label 'investment' is assigned to a particular measure, because there may be a natural tendency to qualify government initiatives as a form of investment rather than consumption for public relations purposes. In some cases, in which measures were targeted only partly at building new infrastructure without specification of the

share, we assumed a share of 50%. Further details for each country are reported in the Web Appendix.

To investigate the potential GDP impact of government investment, we turn to the EU-Quest model. This model assumes that government investment helps to raise overall production in the longer run. The extent of this effect is shown in the top right panel of Figure 7.

The bars in Figure 7 refer to the amount of infrastructure spending as a percentage of GDP. The solid line depicts the impact of this spending on GDP in the EU-Quest model. In this simulation, we abstract from implementation lags or monetary accommodation. For comparison, the effect of the non-infrastructure component of spending is simulated in the top left panel. Throughout 2009, government investment has a similar effect on GDP as government consumption. In subsequent years the productivity-enhancing effect kicks in and output rises permanently due to greater private sector productivity. It has to be acknowledged, however, that the effect of public capital on overall output in the economy is introduced by assumption. Further research on the impact of government investment in private-sector production would be needed to ascertain the empirical relevance of this finding.

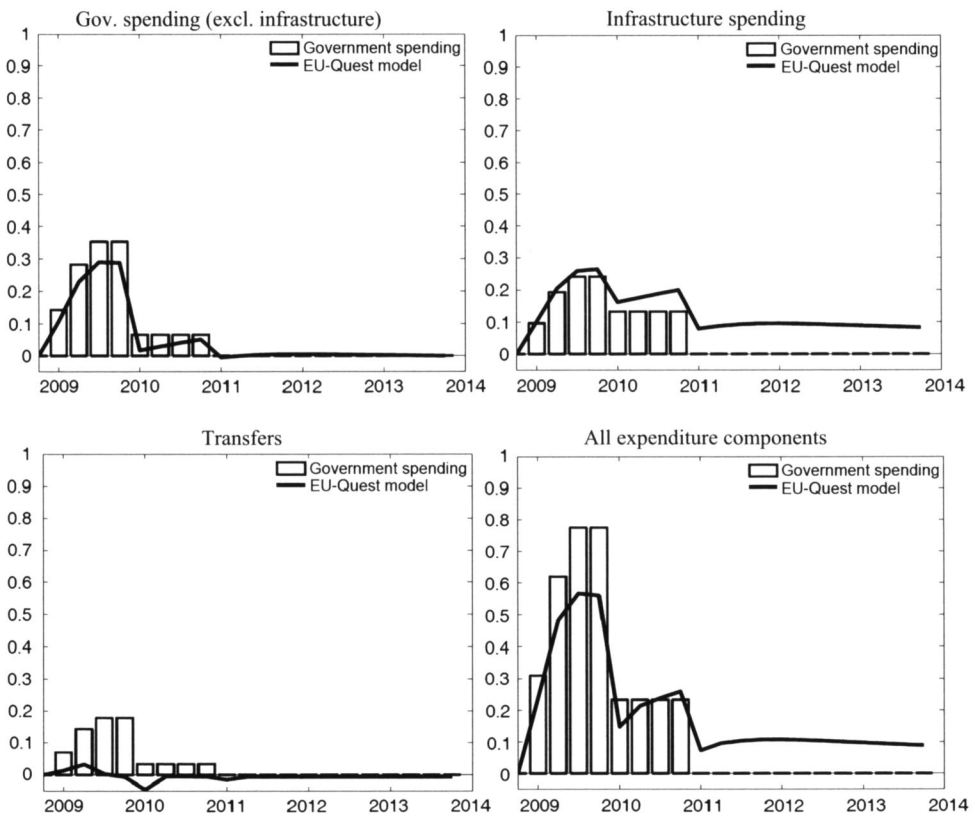

Figure 7. GDP impact of expenditure-side stimulus in EU-Quest Model

Notes: Baseline scenario without delay and without monetary accommodation.

So far, we have not discussed the likely impact of the transfer increases and tax cuts in the euro area stimulus package. One reason is that several of the models we have considered attribute no aggregate GDP impact to these measures. Specifically, the SW and Small IMF model assume non-distortionary lump-sum taxation and transfers. Furthermore, these models only contain optimizing households. As a consequence of these assumptions, temporary tax cuts and transfer increases will not affect household life-time income. In the Taylor model, temporary changes in transfers would have a small effect on GDP because current disposable income appears in the consumption function. For example, a one-quarter increase in US household income would boost US GDP by 0.15% in the same quarter in that model (see Wieland, 2008).

The EU-Quest model provides a good vehicle for analysing the impact of transfers in the euro area stimulus package. It has an explicit share of 35% of rule-of-thumb households who would consume any government-induced increase in their disposable income. It also includes reaction functions for government spending, tax rates and transfers. The lower left panel of Figure 7 depicts the magnitude of these transfers (bars) and the resulting impact on GDP in the EU-Quest model (solid line). The effect on GDP remains very small. The lower-right panel reports the total euro area measures on the expenditure-side of the government budget and their impact on GDP in the EU-Quest model.

9. WHAT HAS HAPPENED SO FAR? A 2010 PERSPECTIVE

Having investigated the likely effect of announced government spending in the context of the EERP and national fiscal stimulus packages, it is worth taking stock of what has happened following these announcements. One question of great interest would be whether these plans were carried out and whether there were any delays. For the United States, the Bureau of Economic Analysis has published information on the stimulus money spent and its impact on the government sector in the quarterly national accounts. This information indicates that federal spending largely increased as planned, though it involved substantial transfers to US states rather than direct federal purchases. Considering the BEA data as well as developments at the federal and the state and local level, Cogan and Taylor (2010) find that the increase in government purchases through the 2nd quarter of 2010 has been only 2% of the total spending announced by the ARRA. This increase in purchases has occurred mainly at the federal level, while state and local governments apparently used the substantial grants they received under the ARRA to reduce borrowing and increase transfer payments rather than implement purchases. This finding helps explain why the contribution of government purchases to GDP growth in the national accounts has remained rather flat.

It would be very useful if the European Commission and national euro area governments would similarly publish information on the actual spending that is the

additional transfers and government purchases relative to their earlier announcements. This information is crucial for appropriate *ex-post* evaluations of their effectiveness. We have contacted experts at the European Commission and at the German finance ministry in this regard. However, we have not received such information nor an indication whether authorities are planning to publish such an *ex-post* assessment.

A narrative that we have heard repeatedly being told in policy circles or the media is that fiscal stimulus played a crucial role in the recovery that started in the second quarter of 2009, and that its removal at the end of 2010 may cause economies to fall back into recession. In the absence of any information on actual stimulus spending carried out, we review the available aggregate national accounts data on government spending in Figure 8.

The top left panel in Figure 8 reports the real GDP growth contribution of government spending (solid line) in the euro area from the first quarter of 2007 up to and including the second quarter of 2010. It is rather flat and declines slightly towards the second half of 2009. By contrast, real GDP growth (dashed line) collapsed from the first quarter of 2008 to the second quarter of 2009 and then started to recover in the second half of 2009 and accelerated at the beginning of 2010. Certainly, this data makes it more difficult to argue for a crucial role of government purchases in stimulating economic growth during the recession and recovery.

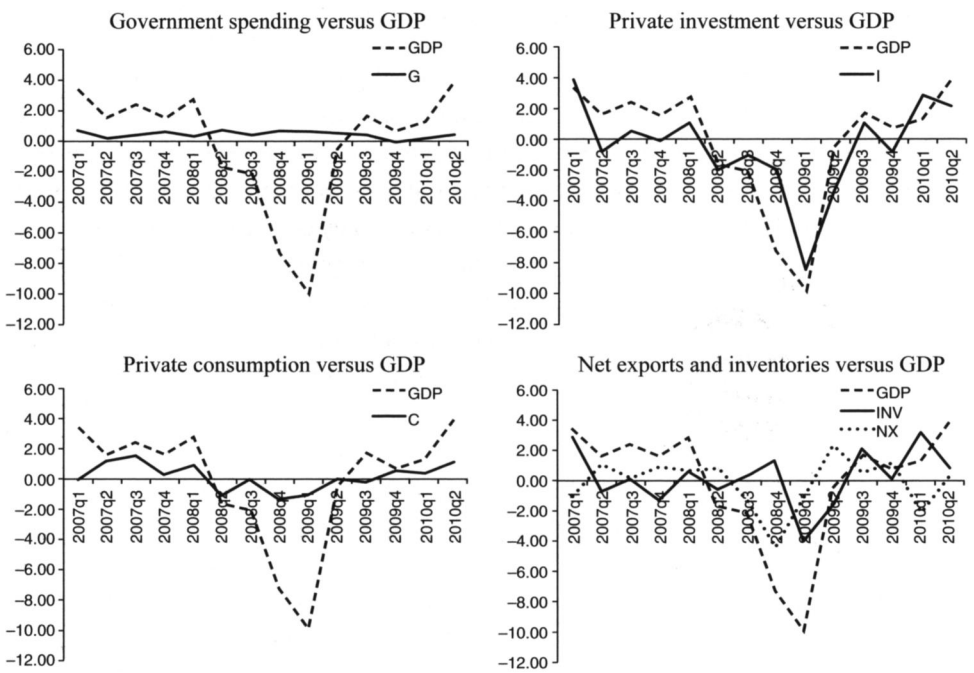

Figure 8. GDP growth contributions throughout the 2008–2010 recession

Notes: Real GDP growth and contributions of GDP components.

The lower-left panel plots the GDP growth contribution of private consumption. Consumption declines somewhat during the recession and picks up again in the second half of 2009. Consumption growth variation, however, is rather small relative to variation in GDP growth. This observation is consistent with the hypothesis of consumption-smoothing by forward-looking households. As shown in the top right panel, the real GDP growth contribution of investment explains much of the variation in GDP growth together with a significant contribution coming from net exports as shown in the lower right panel (dotted line). Investment dynamics partly reflect inventory adjustments (solid line in lower right panel).

These observations suggest that factors that influence investment and net exports such as real interest rates, risk premia and credit availability should receive a crucial role in any explanation of the recession and recovery. Regarding policy actions, possible candidates that may have influenced the cost and availability of credit include central bank interest rate cuts, credit and quantitative easing measures, as well as guarantees and capital injections for financial institutions.

10. CONSOLIDATION-CUM-STIMULUS: ESTIMATED EFFECTS OF SPENDING CUTS

In the course of the global recession government indebtedness increased rapidly raising the question when and how to start consolidating government finances. Many of the commentators who supported fiscal stimulus packages in the recession worry about negative fall-out for the economic recovery from the impending fiscal consolidation. We aim to address this concern by simulating the consequences of government spending cuts in the five models used for evaluating the impact of the stimulus packages. Not surprisingly, the ECB's area-wide model supports such concerns. It exhibits symmetric GDP impacts from government spending and savings packages independent of their timing. The reason lies in the absence of forward-looking behaviour.

The policy message from state-of-the-art New-Keynesian DSGE models, however, depends on the timing of spending cuts. Of course, the mirror image of the stimulus package in the baseline scenario in the form of spending cuts would result in a negative impact on GDP in the SW, Small IMF and EU-Quest models that is symmetric to the increase previously shown in Figure 1. Private consumption and investment would increase symmetrically to the decline reported in Figure 2, because reduced government spending would allow for future tax cuts.

While implementation lags reduced the GDP impact of government spending increases, such delays would improve the GDP impact of spending cuts. To illustrate we consider the following counterfactual scenario: at the beginning of 2009 euro area governments forego any stimulus packages and instead announce a government savings package consisting of future spending cuts that would be slowly phased in from the first quarter of 2011 onwards and spread over six years. The

reduction in government spending would be equivalent (in un-discounted terms) to the increase in government spending implied by the fiscal stimulus packages in Table 1.

The path of announced spending cuts is displayed by the bars in the top left panel of Figure 9. Households and firms will anticipate the future spending cuts as early as the first quarter of 2009. The flip side of spending cuts is a reduction in current or future taxes, or the avoidance of tax increases as part of a consolidation. Either way, the spending cuts result in higher household lifetime income than it otherwise would be. As a result, forward-looking households will consume more as of the start of 2009. This positive wealth effect also boosts investment. Expected real interest rates decline, the price of capital rises and private investment goes up.

As shown in the top-left panel, GDP increases throughout 2008 and 2009 in all three New-Keynesian DSGE models as a consequence of the anticipation of future spending cuts (solid, dashed and dotted lines). Interestingly, the crowding-in effect is largest in the EU-Quest model (dash-dotted line). While crowding-in of consump-

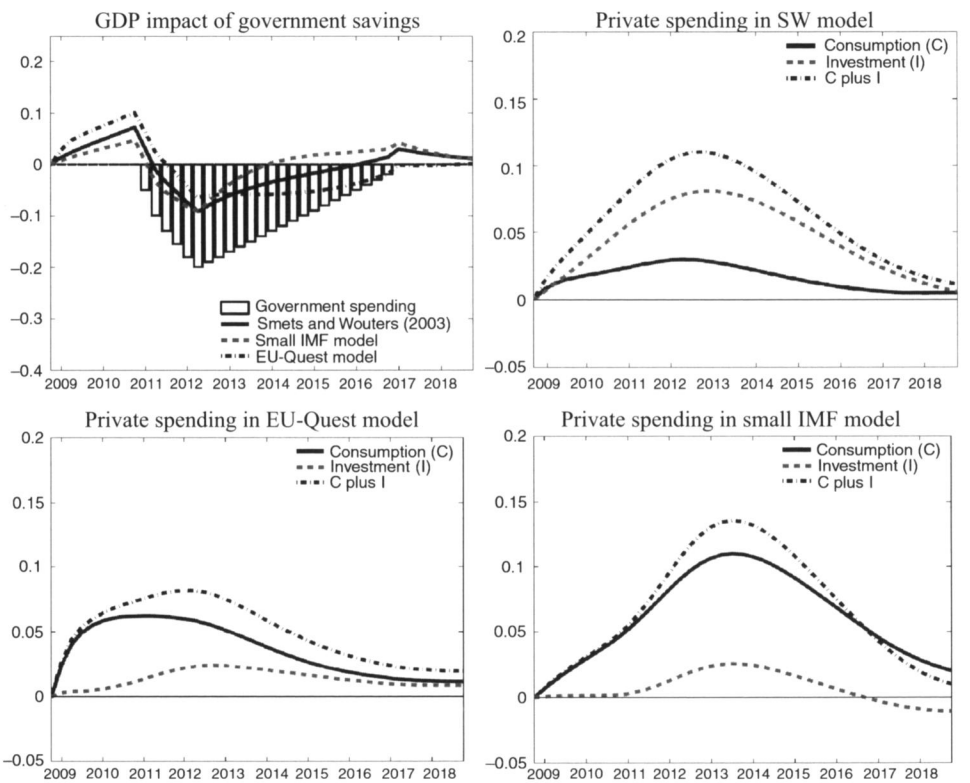

Figure 9. The impact of government spending cuts on GDP and private spending

Notes: Savings plan in the size of the euro area fiscal stimulus package from 2011Q1 on. No monetary accommodation.

tion due to future government spending cuts only occurs in the presence of forward-looking, optimizing households, the magnitude of the crowding-in effect is greater if there are also some rule-of-thumb consumers as in the EU-Quest model (35%). Note, the government spending multiplier in 2009 and 2010 is infinite because no government spending occurs. From 2011 onwards GDP declines as government spending cuts are phased in. The trough is reached in 2012. It is of similar absolute magnitude as the peak effect in 2010. However, private consumption and investment spending remain above baseline throughout the full 6-year period of spending cuts (see top right and bottom panels of Figure 9). Note also, that the models we use tend to understate the long-run effect of spending cuts, because taxation occurs either exclusively (SW and Small IMF models) or to some extent (EU-Quest model) in a lump-sum fashion. In practice, income taxes are proportional and introduce inefficient distortions in the economy. Thus, spending cuts would allow a reduction in distortionary taxation or would avoid increasing distortionary taxes in the context of a consolidation package that aims to reduce government indebtedness. As a consequence, output growth would be greater in the long run than it would have been in the absence of spending cuts.

Our idea of government savings packages is related to the analysis of government spending shocks with reversals by Corsetti *et al.* (2009, 2010). Based on a VAR study with US data they argue that surprise increases in government spending are typically followed by a decline in government spending that turns into spending cuts about 9 quarters after the initial shock. They conduct such impulse response simulations in a calibrated New-Keynesian DSGE model and show that the anticipation of future spending cuts induces a greater short-run spending multiplier with crowding-in of consumption. Wieland (2010) finds that the ratio of anticipated spending cuts to spending increases in their simulation is 1.1 in absolute value. Thus, future spending cuts exceed the initial spending increase. Neither the ARRA nor the EERP stimulus packages included announcements of such substantial future spending cuts. Furthermore, there is no indication that market participants in the United States or Europe formed an expectation of spending cuts of equal or greater size than these stimulus packages in the first quarter of 2009. Wieland (2010) therefore concludes that the empirical case for expecting such cuts upon announcement of the stimulus packages is rather weak.

New-Keynesian DSGE models, however, generate a strong normative prescription. Properly designed government savings packages announced with sufficient lead time can provide significant short-run stimulus. If such a plan had been announced in the beginning of 2009 it could have boosted private spending in 2009 and 2010. This boost would have been reinforced further in case of monetary accommodation due to zero-bound effects. Figure 10 illustrates the additional boost to private spending and GDP if nominal interest rates are anticipated to remain constant in 2009 and 2010. Again, the initial increase in GDP is largest in the EU-Quest model which includes 35 percent of rule-of-thumb households.

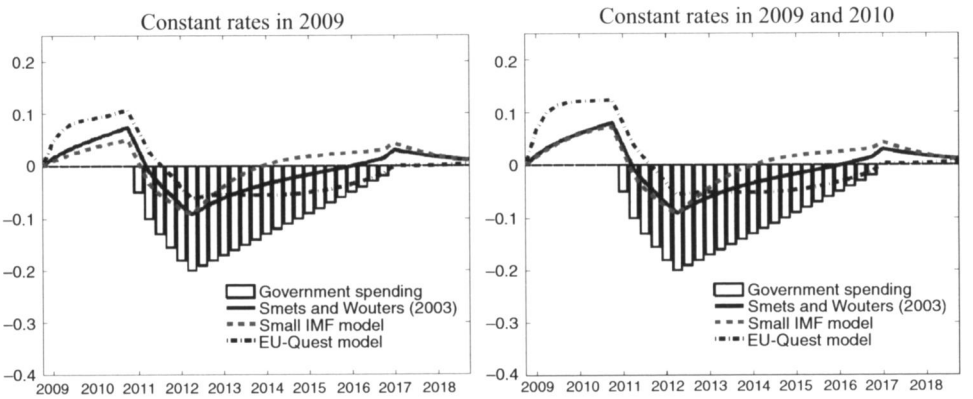

Figure 10. The GDP impact of government spending cuts when nominal interest rates remain constant

11. CONCLUSIONS

Quantitative, model-based estimates of government spending multipliers have previously been used to make the case for fiscal stimulus packages to policymakers. A recent example is a paper prepared by the economic advisers of US President Obama in January 2009 to promote the passage of the ARRA in US Congress (Romer and Bernstein, 2009). Romer and Bernstein as well as other advocates of discretionary fiscal stimulus emphasize the Keynesian multiplier effect. Additional government spending is believed to induce additional private spending and therefore an effect on aggregate GDP that is greater than one-for-one – hence the reference to multiplication. In this paper, we have provided estimates of the impact of government spending increases announced by European governments on euro area GDP. Our particular objective is to compute estimates from a range of different macroeconomic models in order to develop policy recommendations that are robust to modelling uncertainty. Some of our calculations circulated in an earlier working paper version have been used in policy circles, specifically by the German Council of Economic Experts in a critical review of the discretionary fiscal measures taken by the German and other euro area governments (see Sachverständigenrat, 2009).[18] Contrary to Romer and Bernstein, we conclude from our analysis that policymakers should not follow the traditional Keynesian stimulus advice, because the increase in government spending is more likely to reduce private sector spending on consumption and investment. This recommendation is derived from the following considerations.

First, the impact of fiscal stimulus, of course, depends importantly on the timing and magnitude of additional government spending. Thus, we started by construct-

[18] Unlike the US Council of Economic Advisers to the President the German Council of Economic Experts is an independent advisory committee that frequently expresses critical views on government policies in its annual report prepared for the German government.

ing an estimate of the planned spending increase based on the information published by national finance ministries. Our findings indicate that the euro area stimulus is primarily driven by measures to be taken by the German government and to a smaller extent by the Spanish and French governments in 2009 and 2010. On the basis of these calculations, we were able to use macroeconomic models to simulate the actual spending plans announced by fiscal authorities rather than standardized government spending shocks.

Second, we have investigated the robustness of our findings by considering five different models of the euro area economy that span a relevant range of modelling uncertainty. One of them is a traditional Keynesian-style model with backward-looking dynamics such as those employed by some of the consulting firms involved in the Romer–Bernstein study for the United States. Another model is of the first generation of New-Keynesian models with forward-looking behaviour by market participants. The remaining three models are state-of-the-art New-Keynesian DSGE models with explicit foundations in optimizing decision making of households and firms. They exhibit important differences due to estimation techniques, sample periods, country coverage, household heterogeneity and the modelling details of the government sector of the economy. Four of the models have been developed at central banks or international institutions. All of them have been built by their authors to be able to evaluate the consequences of short-run variations in government purchases and their interaction with monetary policy decisions. Several of them were also intended to study longer-run and permanent changes in government spending and variations of other fiscal policy instruments.

Third, the cumulative impact of the planned additional government purchases on euro area private sector spending over four years is negative in all five models. Thus, instead of a textbook-style multiplicative effect of government purchases, the euro area would experience a crowding-out of private sector demand over the horizon most relevant to newly elected governments. In the four New-Keynesian models, crowding-out occurs from the start. The reason is the forward-looking behaviour of households and firms. They anticipate higher tax burdens and higher interest rates in the future and therefore reduce consumption and investment. Only the ECB's area-wide model, which largely ignores forward-looking behaviour, is found to generate a positive effect of government purchases on private consumption and investment in 2009 and 2010. The short-run stimulus is overwhelmed in the third and fourth year by a negative oscillatory effect on GDP that arises from accelerator-type dynamics. All five models have Keynesian features such as wage and price rigidities. But as Chari *et al.* (2009) have emphasized, the models go further in the Keynesian direction by assuming 'the backward indexation of prices' in 'a mechanical way' which amplifies Keynesian aggregate demand effects of policy. Addressing this criticism by eliminating these features from the New Keynesian models would tend to further strengthen the case against discretionary fiscal stimulus (see, for example, Uhlig, 2010).

Proponents of fiscal stimulus might argue instead that some of our models indicate a positive effect over a shorter horizon, that a larger fiscal package such as the US ARRA would deliver better results, and that the multiplier effect would be bigger in certain scenarios, which are particularly relevant to the 2009 recession. We have addressed these arguments in the following manner.

In addition to modelling uncertainty, we have considered alternative scenarios that may capture special aspects of the 2008–2009 recession. The timing of fiscal stimulus may be delayed, because the recession is not recognized in time, and because of the steps needed to move from an announcement to actual implementation of government spending. Such implementation lags lead to more crowding out and may even cause an initial contraction. In a deep recession, the zero-bound on nominal interest rates may cause the central bank to abstain to raise interest rates in response to fiscal stimulus as in normal times, because its notional interest target is below zero. Such implicit monetary accommodation increases the GDP impact of government spending. Crowding-in, however, requires an immediate anticipation of at least two years at the zero bound.

To the extent that the five models do not agree about the sign of the short-run multiplier effect, it would be natural to consider the average effect over models and scenarios. The weights assigned to different models or scenarios in averaging need not be equal. For example, models that ignore forward-looking behaviour may receive a smaller weight, because they are not well-suited to analysing market participants' response to major policy changes. Furthermore, Bayesian decision making would imply attaching probability weights to models or scenarios. Thus, a scenario for which there is little evidence such as an anticipation of two years of constant euro area interest rates as of the first quarter of 2009, would receive a smaller weight in the policy recommendation. An alternative approach to decision making under uncertainty that does not rely on probability weights is worst-case analysis. It is often called robust control or Minimax analysis and aims to guard against worst-case outcomes (cf. Kuester and Wieland, 2010). Thus, it would assign a greater weight to the models or scenarios that imply smaller fiscal multipliers.

Given these considerations regarding different models and scenarios, we would like to warn policymakers that discretionary fiscal stimulus is likely to crowd out private sector demand, and that additional government purchases will raise GDP by less than one for one. Policymakers should not conclude from this warning that even larger stimulus is needed. In our view, it would be rather unwise to pile further government debt on top of the debt needed to finance the huge deficit arising from automatic stabilizers at a time when governments' creditworthiness is needed to back up the private financial sector.

Looking forward, it is more appropriate to think of the consolidation of euro area government finances. In this context, we highlight an interesting finding from the three New-Keynesian DSGE models. These models suggest that cuts in government spending that are announced two years ahead of implementation will induce signifi-

cant short-run stimulus to GDP and sustained crowding-in of private spending. Of course, forward-looking households and firms will only change their behaviour in response to such an announcement if it is credible. Credibility could be improved by introducing constitutional amendments such as the German 'Schuldenbremse' or 'debt brake'. Crowding-in of private consumption and investment would arise to the extent the debt brake induces spending cuts and thereby lower future taxation. While further research on the impact of particular fiscal rules is clearly called for, our results already provide some support for consolidation strategies involving government spending cut announced of time.

Discussion

Refet S. Gürkaynak

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This paper makes a welcome contribution to the very important debate on the effectiveness of government spending as a countercyclical policy tool. Until the Great Recession both cyclical policy and research on the topic were concentrated on monetary policy, but with the zero nominal bound binding or looming in many countries stabilization via fiscal policy came to the forefront of the policy debate again.

The authors first show the composition of the euro area fiscal stimulus across spending categories and time. The actual immediate increase in government spending was fairly low, which is surprising given the public debate on the topic. Only about a third of the total fiscal package is increased spending (as opposed to transfers and tax cuts) and the total size of the fiscal package is less than half a percent of GDP. Showing this is in itself very valuable, but this is not the main focus of the paper.

The major part of the paper is an exercise in simulating a set of macroeconomic models to see what these imply for fiscal multipliers. The finding is that the multipliers are usually positive but below one while the spending increase is going on, and turn negative when the stimulus ends and taxes increase to keep the intertemporal government budget in balance. The normative policy advice is to announce fiscal retrenchment in the future and not to do any expansionary fiscal policy today.

Not doing anything and promising future fiscal retrenchment during a downturn of the magnitude observed in 2008–2009 is not feasible policy. But would government spending increases necessarily be bad policy in a welfare sense?

To the extent that the aim of government spending increases is to increase output and employment today, any positive multiplier suggests that the policy will work. However, the smaller the multiplier, the larger the increase in government spending needed to achieve any given increase in output. In general we think of this as a low bang-for-buck and therefore would turn to monetary policy for stabilization, rather than fiscal policy. But if monetary policy is ineffective due to the

zero nominal bound and stabilization policy has to be carried out by fiscal policy, then a small but positive multiplier implies that the extent of the spending increase must be large, not that fiscal policy should not be used either.

Increased government spending is not only useful for increasing output, government spending also provides utility to the recipients of government services. This is missing from most models of fiscal policy and hampers their ability to answer welfare questions. Equally importantly, even in the absence of utility from government services, the welfare effect of fiscal policy depends on marginal utility at the time of output increase due to policy. Even if the fiscal policy multiplier is less than one while spending is increasing and is negative at some horizon (or in total), if marginal utility is high in the positive multiplier periods and low in the negative multiplier periods, government spending increases may well be welfare improving. Of course, properly countercyclical policy, such as spending increases during the Great Recession, fits this description of higher government spending and output during high marginal utility periods.

Thus, it is possible that using government spending as a policy tool may be welfare improving even when the multiplier is small and perhaps negative for a period. Therefore taking it as given that the model implied multipliers are the 'true' multipliers, expansionary government spending may still be good policy when monetary policy loses its effectiveness due to the zero nominal bound.

What is the government spending multiplier for the euro area? This paper was written because we do not know that answer. Using a set of models to extract information about the size of fiscal policy multipliers in the euro area is a good idea. But that exercise may either be telling us something about the true multipliers or about the collective shortcomings of the models in the fiscal policy dimension.

The analogue with monetary policy is useful here. Almost all modern monetary macroeconomic models generate hump-shaped responses to monetary policy, and we indeed think that the 'true' response of output to monetary policy shocks is hump-shaped. But this is not because the models tell us so; econometric research over and over uncovered the hump-shaped responses and models were built to replicate the empirical finding. And because they could replicate the stylized facts we took those models seriously in carrying out monetary policy experiments. This is most strikingly shown in Taylor and Wieland (2009), who show that a variety of monetary models have almost identical impulse responses to monetary policy shocks because they all were trying to match the same observed facts, even though they differ in other dimensions.

While there is more or less a consensus over what monetary policy does to output, the jury is still out on fiscal policy. Fiscal policy modelling lagged behind that of monetary policy both because there is yet no consensus on what is to be modeled – the stylized facts – and because in the past 30 years cyclical economic policy was carried out predominantly by monetary policy until the Great Recession. The celebrated Smets and Wouters (2003) model, which is one of the models con-

sidered in this study, has a simple statistical rule for fiscal policy rather than optimizing behaviour of any kind. Other models have more sophisticated fiscal sectors but we do not know whether they are sophisticated enough because we do not know what to compare them to.

The key question here is the extent to which Ricardian equivalence operates. Models with strong Ricardian features have low multipliers and models where the Ricardian equivalence does not hold have high ones. We learn from this paper that in the models considered here it operates rather strongly. But in models with forward looking, optimizing agents that is to be expected unless other mechanisms dampening it are present. One model that builds in such mechanisms is the IMF's GIMF, which finds a larger government spending multiplier (Freedman *et al.*, 2010). Thus, it is likely that Ricardian equivalence holding or not, or equivalently the size of government spending multipliers, depend on modelling choices rather than on what the data tells us.

In sum, then, this valuable paper tells us more about the current state of fiscal policy modelling than about the size of the government spending multiplier in the euro area. Hopefully it will be a call for action for more detailed empirical and modelling work on the subject.

Pietro Cova

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Cwik and Wieland (CW) perform a robust evaluation of the effectiveness of the euro area's (EA) crisis-related government expenditures during 2009 and 2010. In a nutshell the two authors find that standard New-Keynesian models, widely used by academics and central banks, provide no support for Keynesian multiplier effects.

In particular, CW show that this stark result on the ineffectiveness of discretionary fiscal expenditures is mainly related to three facts: First, as most of the models used by the authors are forward-looking, they exhibit strong anticipation effects due to announcement and implementation lags of fiscal policy interventions. This channel considerably weakens the effectiveness of government expenditures in New-Keynesian models, due to anticipated crowding-out effects on private consumption and investment. Second, while monetary accommodation (i.e. constant rates, likely to be constrained by the zero lower bound (ZLB)) can magnify the multiplier effects of fiscal policy, as stressed among others by Christiano *et al.* (2009) and Woodford (2010), CW downplay this result by stressing the importance of the duration of monetary accommodation: at least 2 years of anticipated monetary accommodation are needed in order to have discernible incremental fiscal multiplier effects. Third, a point more specific to the EA, spillover effects due to fiscal expenditure expansions within the EA are more than offset by negative effects on extra-EA trade.

The main corollary of the CW results, emphasized towards the end of the paper, is that modern dynamic New-Keynesian models offer a compelling case for well-

communicated fiscal consolidation plans and not for fiscal expansions. Building on this stark result, at the extreme, one could conclude that the most effective crisis-related fiscal package should have been a credible fiscal consolidation plan (based on cuts to government expenditures), announced some years in advance, and possibly coordinated with the monetary authority's planned exit from ZLB.

Is this a fair evaluation of the EA's crisis-related government expenditures' effectiveness enacted in 2009 and 2010? Yes and no.

Strictly speaking the CW results are rigorous as the EA multipliers are derived from multiple structural models commonly used by researchers at central banks and other policy institutions. Yet to some extents, as I will try to argue, CW do not give a fair treatment to the EA fiscal stimulus measures. In particular, as I intend to show during most of the rest of my discussion, reconsidering the EA fiscal stimulus measures after accounting for some of the salient features of the Great Recession (mainly the global dimension of both the crisis and policy responses) shows that these can be very effective, even when evaluated within the benchmark New-Keynesian modelling framework.

To be sure the EA crisis-related fiscal measures did not meet many of the main core principles underlying an optimal fiscal package, identified early on during the crisis by the IMF (see Spilimbergo *et al.*, 2008), as they were probably neither too *timely*, nor too *large* (at least when evaluated at the EA level). Yet they were implemented in an environment in which (1) the decrease in private demand was exceptionally large (Table 5), and (2) each individual country that had fiscal and monetary space contributed sizeably (Tables 6 and 7), that is, from a global point they were large and *collective*. Note further from Table 6 that, if anything, monetary policy rates across developed and emerging economies, at least during the first part of 2009 (Table 6

Table 5. Quarterly global real GDP developments during the Great Recession

	Real GDP						Real GDP	
	% over previous period, saar						% over year ago	
	2008 Q3	2008 Q4	2009 Q1	2009 Q2	2009 Q3	2009 Q4	2008	2009
United States[a]	−4.0	−6.8	−4.9	−0.7	1.6	5.0	0.0	−2.6
Euro area[a]	−2.1	−7.1	−9.6	−0.6	1.7	0.8	0.4	−4.1
Japan[a]	−5.4	−10.0	−16.6	10.4	−1.0	4.1	−1.2	−5.2
Asia ex Japan[b]	3.4	−5.2	2.5	12.9	10.9	8.7	5.8	5.6
Latina America[b]	3.8	−8.9	−10.0	0.8	6.6	7.4	3.8	−2.4
World[b]	0.0	−7.0	−7.5	1.4	2.8	4.3	1.3	−2.2
Developed[b]	−0.9	−7.2	−8.3	−0.3	1.3	3.5	0.3	−3.5
Emerging[b]	3.4	−6.6	−3.9	7.6	8.5	7.1	5.0	1.3
World PPP[c]							2.8	−0.6

[a] National sources.

[b] JP Morgan Global Data Watch

[c] IMF.

Table 6. Central Bank policy rates and market expectations

Central Bank policy rates, 15 October 2010[a]							
			Forecasts				
	Latest	Chg from Aug. 2007 (bp)	Dec-10	Mar-10	Jun-11	Sep-11	Dec-11
Global	1.76	−319	1.8	1.85	1.93	1.97	2.04
Developed	0.6	−358	0.62	0.63	0.65	0.68	0.72
Emerging	5	−210	5.12	5.27	5.49	5.57	5.73
Central Bank policy rates, 3 April 2009[a]							
			Forecasts				
	Latest	Chg from Aug. 2007 (bp)	Jun-09	Sep-09	Dec-09	Mar-10	Jun-10
Global	1.6	−311	1.33	1.23	1.23	1.22	1.24
Developed	0.58	−355	0.41	0.33	0.33	0.33	0.33
Emerging	5.64	−136	5	4.8	4.8	4.78	4.88

[a] JP Morgan Global Data Watch, GDP-weighted averages.

Table 7. Crisis-related discretionary fiscal stimulus in G-20 economies (in percentage of GDP)[a]

	2009	2010
United States	1.8	2.9
Japan	2.8	2.2
Euro area[b]	0.9	1.1
China	3.1	2.7
G-20 average	2	1.9
Advanced	1.8	2
Emerging	2.3	1.8

[a]IMF, Fiscal Monitor May 2010.

[b]GDP-weighted average of France, Germany, and Italy.

lower panel), that is, at the beginning of the simulation period, were expected to be constant at exceptionally low levels or even falling throughout 2009 and 2010.

Considering the above facts, how important is this particular environment for assessing the 'fair' size of EA fiscal multipliers?[19] One would like to answer this question by taking into account, as much as possible, this particular setup as the baseline scenario of the simulation exercise. In particular, consistently with the above facts, one would ideally like to (1) take into account the particular macroeconomic environment (both in terms of output gaps and monetary policy stances) as the baseline scenario of the simulation exercise, and (2) perform a model-based measurement of fiscal (government spending) multipliers using a multi-country model, so as to properly account for global fiscal spillovers.

[19] In a stimulating and thought-provoking empirical work, Almunia *et al.* (2009) provide a positive answer to this question.

In the spirit of the CW philosophy I therefore present some simulation exercises using two New-Keynesian multi-country models[20]: a GEM-type multi-country model developed at the Bank of Italy (Pesenti, 2008, develops an exhaustive theoretical discussion of the IMF GEM model; details of the Bank of Italy GEM-type model can be found in Cova *et al.*, 2008 and in the working paper version of that paper), and the NiGEM model developed by the National Institute of Economic and Social Research (see, for example, Barrell *et al.*, 2004).[21]

For both models we assume a baseline scenario with constant policy rates during the first two years of the simulation period (from the third year onwards monetary policy follows a standard Taylor-type rule in each country), and that tax instruments adjust to stabilize public debt through a fiscal rule, only starting from the third year after the beginning of the stimulus.[22] We then compare the effects of a 1% of GDP increase in government expenditures in both 2009 and 2010, respectively the first and second year of the simulation period: we distinguish between the case when each country/block in the models enacts its fiscal stimulus in isolation versus the polar case of a contemporaneous fiscal expansion.[23]

The results, reported in Table 8, speak in favour of the crisis-related fiscal expansions: both the NiGEM and the GEM-type model simulations show that EA fiscal multipliers rise significantly – on average by 20% in NiGEM, and by 35% in the GEM-type model – when moving from an isolated to a global fiscal expansion, given constant policy rates during the first two years.

How do these positive and significant differentials in fiscal multipliers come about? Through global demand-driven decreases in real interest rates which crowd-in (Table 9) consumption and investment expenditures (during both years in NiGEM, only in the first year in the GEM-type model). The forward-looking nature of both models underpins this front-loading effect.

Thus, consistent with work on fiscal multipliers done by the IMF using its multi-country Global Integrated Monetary and Fiscal Model (see IMF, WEO, October 2010, Chapter 3; Freedman *et al.*, 2009), the results above confirm that global spillovers matter for assessing the size of country-specific fiscal multipliers in the *short term*, particularly in an environment *temporarily* characterized by global monetary accommodation. Over the long term, rising government debt will reduce output, as

[20] The simulation exercises presented below are excerpts from a Bank of Italy research note (*An evaluation of simultaneous expansionary fiscal measures based on two models for the world economy*, May 2009, Bank of Italy, *mimeo*) prepared jointly with two colleagues, Francesco Paternò and Massimiliano Pisani, to whom I am kindly indebted. All statements regarding the simulation results reflect my own opinion. Any eventual responsibilities for errors in discussing and presenting these simulations are solely mine.

[21] The former is calibrated to match salient features, mainly national accounts ratios and trade flows, of the five economies it comprises (United States, euro area, Japan, Asia, rest of the world); NiGEM, which partly relies on estimation and calibration, includes many more countries and regions.

[22] The latter is to avoid that automatic stabilizers offset part of the fiscal stimulus when it is implemented in the first two years.

[23] Admittedly a more realistic, but hard to pin down, scenario would account for global fiscal expansions enacted at (slightly) different points in time.

Table 8. Scenario: public government expenditure rises by 1% of GDP in 2009 and 2010 (deviations from baseline)

Geographic areas applying fiscal stimulus	All economies (advanced and emerging)		All advanced economies		Unites States		Euro area	
	2009	2010	2009	2010	2009	2010	2009	2010
Constant policy rates over 2009 and 2010	col.1	col.2	col.3	col.4	col.5	col.6	col.7	col.8
Model: NiGEM								
United States								
GDP[a]	1.4	1.3	1.3	1.2	1.0	1.0	0.1	0.1
Inflation[b]	1.0	2.6	0.9	2.4	0.7	1.6	0.1	0.3
Short-term nominal interest rate[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term real interest rate[b]	−1.0	−2.6	−0.9	−2.4	−0.7	−1.6	−0.3	−0.2
Real effective exchange rate[a]	−2.2	−1.3	−1.8	−1.0	−1.3	−0.3	−0.2	−0.2
Euro area								
GDP[a]	1.0	1.0	0.9	0.9	0.0	−0.1	0.8	0.9
Inflation[b]	0.1	0.9	0.1	0.8	−0.2	0.1	0.2	0.6
Short-term nominal interest rate[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term real interest rate[b]	−0.1	−0.9	−0.1	−0.8	0.3	0.1	−0.2	−0.6
Real effective exchange rate[a]	0.8	−0.1	0.8	0.0	0.9	0.2	−0.1	−0.1
Model: GEM-type DSGE								
United States								
GDP[a]	2.7	1.6	2.2	1.3	2.1	1.3	0.0	0.0
Inflation[b]	1.6	3.8	1.3	3.0	1.3	2.8	0.0	0.0
Short-term nominal interest rate[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term real interest rate[b]	−3.6	−2.7	−2.9	−2.1	−2.7	−2.0	0.0	0.0
Real effective exchange rate[a]	2.4	1.1	−0.2	0.8	−1.6	0.8	0.0	−0.1
Euro area								
GDP[a]	2.3	1.4	1.6	1.0	0.0	0.0	1.6	1.1
Inflation[b]	1.3	3.1	1.0	2.1	0.0	0.0	1.0	2.3
Short-term nominal interest rate[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Short-term real interest rate[b]	−2.8	−2.3	−2.0	−1.4	0.0	0.0	−2.2	−1.6
Real effective exchange rate[a,c]	2.6	0.5	−0.6	0.1	1.0	0.2	−2.2	−0.1

[a]Percentage deviations; for the real effective exchange rate, a positive deviation corresponds to an appreciation with respect to the baseline.

[b]Absolute deviations.

[c]Computed using export weights.

real interest rates rise and higher interest payments on the debt imply an increase in distortionary taxes. Given the forward-looking nature of both models the long run kicks in pretty soon. No doubt there is a trade-off here for policymakers, but not as strong and as soon as found by CW.

Also note, that the above should be considered conservative fiscal multipliers as the baseline does not account for (1) reduced and then constant rates at very low levels (or at the ZLB), (2) in response to large negative output gaps. Both (1) and (2), as shown in Christiano *et al.* (2009), would further enhance the reduction in

Table 9. Scenario: public government expenditure rises by 1% of GDP in 2009 and 2010 (deviations from baseline)

Geographic areas applying fiscal stimulus	All economies (advanced and emerging)		All advanced economies		Unites States		Euro area	
	2009	2010	2009	2010	2009	2010	2009	2010
Constant policy rates over 2009 and 2010 Model: NiGEM	col.1	col.2	col.3	col.4	col.5	col.6	col.7	col.8
United States								
Consumption[a]	0.2	0.0	0.2	0.0	0.2	0.1	0.0	0.0
Investment[a]	1.6	0.8	1.5	0.7	1.2	0.6	0.1	0.0
Next exports (contribution to growth)[b]	0.0	0.2	−0.1	0.2	−0.2	0.1	0.1	0.0
Euro area								
Consumption[a]	0.2	0.2	0.2	0.2	0.0	−0.1	0.1	0.2
Investment[a]	1.6	1.0	1.5	1.0	0.0	−0.2	1.3	1.0
Nex exports (contribution to growth)[b]	−0.4	0.1	−0.4	0.1	0.0	0.0	−0.5	0.1
Model: GEM-type DSGE								
United States								
Consumption[a]	1.7	1.3	1.4	1.1	1.3	1.0	0.0	0.0
Investment[a]	3.3	−1.1	2.7	−0.7	2.6	−0.6	−0.1	−0.1
Nex exports (contribution to growth)[b]	0.0	−0.2	−0.2	−0.3	−0.3	−0.3	0.0	0.0
Euro area								
Consumption[a]	1.4	1.1	1.0	0.7	0.0	0.1	1.0	0.7
Investment[a]	2.7	−0.9	2.0	−0.3	0.1	0.4	2.1	−0.5
Nex exports (contribution to growth)[b]	0.1	−0.1	−0.3	−0.4	0.0	−0.1	−0.3	−0.3

[a]Percentage deviations.

[b]Absolute deviations.

global real interest rates which matter so much for the size of fiscal multipliers in the New-Keynesian models.[24]

While the above is my main concern with regard to the CW results, I also have some other unrelated but possibly important comments for the subject at hand on which I can only formulate some educated guesses. First, it is not clear whether uncertainty with respect to the global economic environment – a salient feature of any systemic crisis as the 'recent' one – may affect the impulse response simulations. In particular, is the size of the fiscal multiplier affected by the degree of

[24] To be more specific, Christiano *et al.* stress that 'the multiplier is very large in economies where the output cost of being in the zero bound state is also large'.

economic uncertainty? It could well be that by dampening uncertainty fiscal policy interventions may positively affect agents' consumption and saving decisions, but I have to admit that I do not know of any such simulation exercise. Second, a point closely related to the previous comment, all of the structural models typically utilized – irrespective of their New-Keynesian nature – neglect the interactions between fiscal measures and financial variables. It could well be, as documented among others by Ardagna (2004), that a fiscal policy induced change in risk premia may have first order effects on the size of the fiscal multiplier. Again, it would be nice to start investigating this issue using structural models that can account for time-varying risk premia. Third, as highlighted in Decressin and Laxton (2009) the interactions between fiscal measures and monetary policy in times of distress can have non-trivial consequences for the size of fiscal expansions if they successfully manage to bring about a reduction in the risk of deflation, a risk which is no stranger to the recent crisis. Finally, I think it would be worthwhile to have a firmer knowledge on the sensitivity of fiscal multipliers with respect to different fiscal rules for stabilizing the public debt in the long run. Most of the modern structural macro models, also the ones employed by CW, adopt slightly different fiscal rules (both in terms of the instruments used to stabilize the debt-to-GDP ratio and of the calibration of the parameters governing the speed of convergence to the long-run target ratio). Given the forward-looking nature of modern quantitative macroeconometric models, adopting different fiscal rules should feed back on current expenditure decisions. This is another channel that should affect the size of the multiplier.

Let me conclude by stressing that this is an enriching paper, as euro area multipliers are derived from *multiple* models used by researchers at central banks and other policy institutions.[25] The results tend to downplay the size of the fiscal multiplier, and hence, the role of (the EA's) fiscal expansion during 2009 and 2010. Reconsidering the fiscal stimulus after accounting for some of the salient features of the Great Recession (global dimension of the crisis and policy responses) shows that it can be very effective.

Panel discussion

Morten Ravn was surprised by the finding of the small size of the fiscal stimulus required in the paper and asked for further discussion on how the fiscal stimulus was calculated. Focusing on the anticipation effect of government spending, he argued that the potential sign could be positive or negative depending on the model

[25] The new database of macroeconomic models designed explicitly with the purpose of doing such policy evaluations and robustness studies is a great contribution for the profession at large.

used and agreed with Refet Gürkaynak that the models estimated in the paper do not correctly identify the fiscal parameters. He noted that an important transmission mechanism which needed to be considered was government debt which he believed to have a non-linear effect on fiscal multipliers. In normal times the feedback between government debt and fiscal instruments might not be large but when the government debt becomes quite large in a short period of time a government might want to quickly adjust its fiscal deficit.

Fabrizio Perri remarked that much of the current debate is focused on identifying the New Keynesian multipliers at the zero bound which can give very different results to the standard models. He suggested that as a robustness check the authors should use models at the zero bound. Harald Gruber pointed out that the rescue measures taken to save banking systems overshadowed the fiscal action taken by governments and wondered how the authors would account for the banking rescue measures in their analysis.

Michael Kiley highlighted the importance of fiscal and monetary policy coordination. The identification of the fiscal multipliers at the zero bound was relevant but he believed it was important to ask what the fiscal multipliers are when both monetary and fiscal authorities make a coordinated effort to stimulate the economy. He commented that policymakers do not follow a simple rule but try to achieve certain objectives and that fiscal policy multipliers differ when accompanied by interest rate changes. Further, he considered how both authorities could support each other at present. He suggested one possible way fiscal authorities, aside from fiscal stimulus, could support monetary authorities' action was to try and change the maturity structure of the debt held by the public in order to affect term premia.

Marco Pagano reflected on the perception of government consumption and how it is often considered to be unproductive spending. He noted it was important to distinguish between the components that make up government spending as many parts should be viewed as 'genuine' investment such as expenditure on education and human capital which can improve long-term growth prospects.

In response to Morten Ravn's comment, Tobias Cwik noted that the findings on the size of a fiscal stimulus package were driven by the fact that the larger US stimulus package spread over a longer time frame compared to the EU stimulus led to a greater crowding-out due to households' anticipation effect. In reply to the discussant's comment on the need to include a banking sector in the models, Tobias Cwik noted that fiscal policy works through demand and productive government spending and therefore a banking sector in the model would not affect the transmission of fiscal policy. In reply to comments on the appropriateness of the models for assessing the importance of fiscal policy which are used in the paper, he noted that the EU-Quest model contains a very detailed fiscal sector and results from this model are very similar to those of the other models.

Web Appendix

Available at http://www.economic-policy.org.

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