Keynesian government spending multipliers and spillovers in the euro area*

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Abstract

The global financial crisis has lead to a renewed interest in discretionary fiscal stimulus. Advocates of discretionary measures emphasize that government spending can stimulate additional private spending — the so-called Keynesian multiplier effect. Thus, we investigate whether the discretionary spending announced by Euro area governments for 2009 and 2010 is likely to boost euro area GDP by more than one for one. Because of modeling uncertainty, it is essential that such policy evaluations be robust to alternative modeling assumptions and different parameterizations. Therefore, we use five different empirical macroeconomic models with Keynesian features such as price and wage rigidities to evaluate the impact of fiscal stimulus. Four of them suggest that the planned increase in government spending will reduce private spending for consumption and investment purposes significantly. If announced government expenditures are implemented with delay the initial effect on euro area GDP, when stimulus is most needed, may even be negative. Traditional Keynesian multiplier effects only arise in a model that ignores the forward-looking behavioral response of consumers and firms. 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 euro appreciation.

Keywords: fiscal policy, fiscal stimulus, government spending multipliers, model uncertainty, crowding-out, New-Keynesian models.

JEL-Codes: E62, E63, H31

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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. U.S. Congress, for example, approved 787 billion dollars of additional spending, transfers and tax reductions with the 2009 *American Recovery and Reinvestment Act*. The European Union initiated the *European Economic Recovery Plan* while national European governments announced their own fiscal stimuli. The German government, which was initially criticized 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 text-book 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 a recent paper Christina Romer, Chair of the U.S. 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. They estimate that an increase in government purchases of 1 percent of GDP would induce an increase in real GDP of 1.6 percent compared to what it otherwise would be.[3] Given this multiplier

[1] A prominent critic was Paul Krugman, who accused the German government of "boneheadedness" in an article in the New York Times of Dec 12, 2008, titled "The economic consequences of Mr. Steinbrück". 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, page 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.

effect they project that a package similar in size to the ARRA legislation would boost U.S. GDP by 3.6 percent. Cogan, Cwik, Taylor, and Wieland (2009), however, show that this conclusion is not robust. 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 programs announced by Euro area governments in 2008 and 2009 and quantify their effect on economic activity. A macroeconomic model is needed to distinguish the impact of government actions on the economy from other factors. Because of modeling 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 focus is on model simulations of the planned increase in government spending rather than increases in transfers and tax rebates, because spending is supposed to exhibit the largest Keynesian multiplier effect.

The models considered in this comparison are due to Smets and Wouters (2003), Laxton and Pesenti (2003), Ratto, Roeger, and in't Veld (2009), Taylor (1993) and Fagan, Henry, and Mestre (2005).[4] 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 and used at policy institutions such as the European Central Bank, the European Commission, or the International Monetary Fund. The first four model 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 from real-business-cycle models and combine them with Keynesian-style rigidities.

We find that New-Keynesian models provide no support for a traditional Keynesian multiplier effect. The European 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. Implementation lags of government spending worsen the impact on GDP. Even if monetary policy is assumed to counteract the upward pressure on the nominal interest rate in 2009, the negative effect of fiscal stimulus on private spending remains. By contrast,

[4]The models are available in a new macroeconomic model archive for comparative analysis described in more detail in Wieland, Cwik, Mueller, Schmidt, and Wolters (2009). For analysis of monetary policy see Taylor and Wieland (2009). Earlier euro area model comparisons have been conducted by Hughes-Hallett and Wallis (2004) and Kuester and Wieland (2009).

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 Keynesian multiplier effect, but the boom is followed by a bust. Thus, the cumulative effect of government on private spending eventually turns negative. More importantly, models with backward-looking dynamics are not as well-suited for the analysis of major policy changes as the New-Keynesian models. Instead, they are used primarily for short-term forecasting.

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 euro appreciation.

2 Euro area fiscal stimulus packages for 2009 and 2010

Table 1 provides an overview of discretionary fiscal policy measures announced by the 11 largest euro area economies. In terms of GDP, these economies account for 99 percent of the euro area. We have collected information from the publicly available stability programs that national finance ministries prepared for the European Commission and compared these numbers to estimates obtained by Saha and von Weizsäcker (2009).

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

	Total fiscal package (bln Euro)		Expenditures (bln Euro)		Total fiscal package (percent of GDP)		Expenditures (percent 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	0.36
Belgium	1.3	1.2	0.9	0.8	0.36	0.33	0.27	0.24
Germany	35.9	48.4	18	13.6	1.44	1.93	0.72	0.54
Greece	0	0	0	0	0.00	0.00	0.00	0.00
Spain	26.8	14.7	12.1	0	2.44	1.34	1.10	0.00
Finland	2.4	2.4	0.4	0.4	1.25	1.25	0.23	0.23
France	17	4	16.3	4	0.87	0.2	0.83	0.2
Ireland	0	0	0	0	0.00	0.00	0.00	0.00
Italy	-0.3	-0.8	3.1	0.2	-0.02	-0.05	0.19	0.01
Netherlands	3.1	2.9	0.2	0	0.53	0.49	0.03	0.00
Portugal	1	0.3	0.9	0.3	0.6	0.18	0.54	0.18
EU-11	92	77.6	53.2	20.4	1.01	0.85	0.58	0.22

Source: Saha and von Weizsäcker (2009) "Estimating the size of the European stimulus packages for 2009 An Update" and the stability programs provided by the finance ministries for the European Commission.

Detailed information on the construction of our estimates is given in **Appendix A**. 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 expenditures separately. The total also includes temporary tax deductions, rebates and transfers. The amounts are reported in billions of Euro and in relative shares in percent 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: 84.3 billion Euro spread over 2009 and 2010. In relative terms these measures amount to 3.37 percent 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 U.S. measures are spread over four years. The German stimulus corresponds to 49.7 percent 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 42.9 percent.

The second largest package was announced by the Spanish government, roughly 41.5 billion Euro, and the third largest is the French stimulus of about 21 billion Euro. Other countries launched smaller fiscal measures and some none at all. In total, the euro area stimulus measures of the eleven largest economies sum to 1.01 percent of euro area GDP in 2009 and 0.85 per cent in 2010, much less than the U.S. stimulus. Of these measures government purchases amount to 0.58 percent of GDP in 2009 and 0.22 percent in 2010.

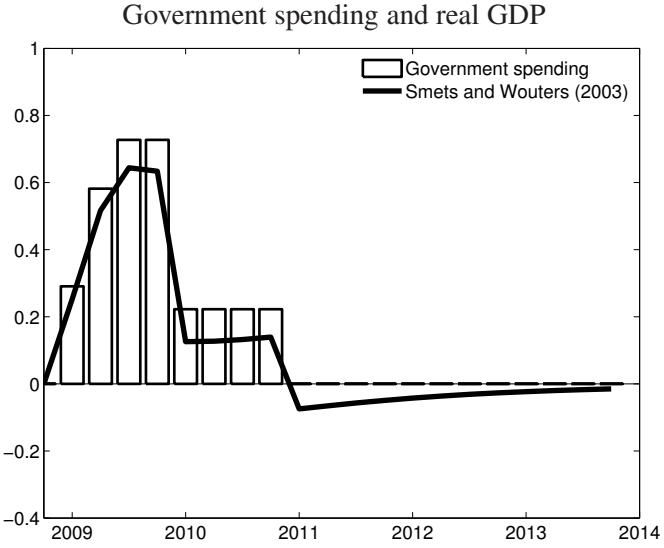
3 The estimated impact of announced government expenditures on euro area GDP

Cogan et al. (2009) consider two empirically estimated macroeconomic models of the U.S. economy, one developed by Taylor (1993) and the other one by Smets and Wouters (2007). Their analysis of the consequences of the ARRA legislation focuses primarily on the Smets and Wouters model, which 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, Eichenbaum, and Evans (2005). In earlier work, Smets and Wouters (2003) estimated a version of this model with data from the euro area. Thus, we start by assessing the effect of the additional expenditures announced by national governments on euro area economic activity in that model. We focus attention on government expenditures such as direct purchases and similar measures, because traditional Keynesian analysis suggests that government expenditures have a greater multiplier effect than tax reductions or additional transfers. The purpose of the model simulation is to evaluate the effect of the fiscal measures in isolation from other disturbances that may currently influence actual economic outcomes.

Figure 1 reports the increase in government expenditures (bar chart) together with the resulting

effect on euro area real GDP (solid black line). 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 0.58 percent of GDP for 2009 and increases above the average level in the second part of the year. Possible implementation lags and their consequences will be discussed later on.

Figure 1: The impact on euro area GDP in the Smets & Wouters (2003) model



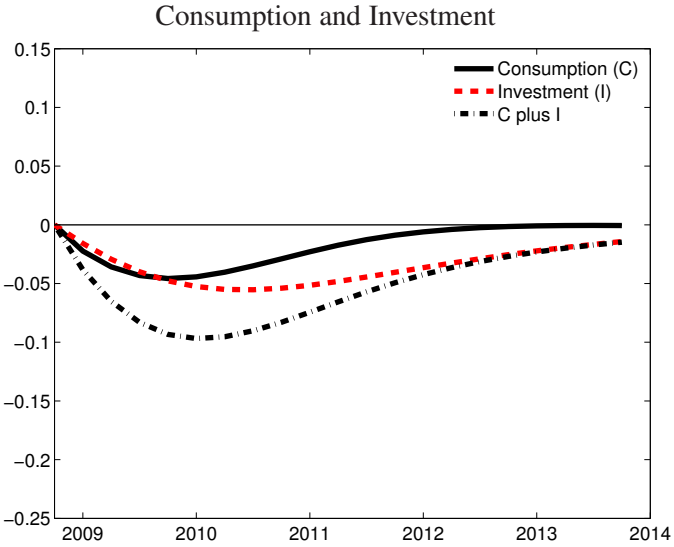
Notes: Quarterly annualized government spending is depicted by the bars in percent of GDP: 0.29085 in 2009Q1, 0.5817 in 2009Q2, 0.727125 in 2009Q3 and 2009Q4 and 0.2225 in 2010.

Euro area GDP increases as a result of additional government spending. However, the simulation does not exhibit a traditional Keynesian multiplier effect that would imply a greater than one-for-one increase in GDP relative to government spending. Instead, the increase in GDP is significantly smaller than the associated boost to government expenditures. Once government spending returns to baseline at the end of 2010, GDP even declines. 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. 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 using the euro area model of Smets and Wouters (2003) are similar to the results for the U.S. economy reported by Cogan et al. (2009). 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. In addition, there is also a strong crowding out of investment. This crowding-out effect is reinforced by an increase in real interest rates.

Figure 2: Private spending in the Smets & Wouters (2003) model



Modeling uncertainty and robustness

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 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. Thus, modeling uncertainty is particularly pronounced and comparative analysis is crucial to obtain robust conclusions as shown in Kuester and Wieland (2009). To this end we make use of a new database of macroeconomic models designed explicitly with the purpose of doing such policy evaluations and robustness studies.[5]

First, we consider two other New-Keynesian DSGE models of the euro area for comparison. We use the term "New-Keynesian" to indicate that the models assume forward-looking (rational) expectations by individuals and firms, and some form of price rigidity, usually staggered price or wage setting. The term "DSGE", which stands for "dynamic stochastic general equilibrium", indicates that these models fully incorporate microeconomic foundations consistent with the optimizing decision-making of representative households and firms, similar to earlier real-business cycle models that

[5]A detailed description of this database and the comparative approach to modeling and policy analysis is provided by Wieland et al. (2009).

assumed fully flexible prices. The model of IMF researchers Laxton and Pesenti (2003) was developed at the same time as the Smets and Wouters model, but its parameters were calibrated rather than estimated with artificial pre-EMU data. It includes two countries, the euro area and the Czech republic. It is referred to as the "Small IMF model" in the model comparison because IMF staff have also developed several larger macroeconomic models of the world economy.[6]

The other model was developed by researchers at the European Commission. Ratto et al. (2009) named the model "QUEST III" and we refer to it as the "EU-Quest" model. This model is estimated with quarterly euro area data from 1981Q1 to 2006Q1 thereby including a large part of EMU history. Another important departure from the assumptions made by Smets and Wouters (2003) and Laxton and Pesenti (2003) concerns the treatment of households. These models have been criticized for assuming that all households are forward-looking and optimize their spending decisions. Instead, it has been proposed that one allows 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, López-Salido, and Vallés (2007)). Ratto et al. (2009) estimate that 35 % of households in the euro area are liquidity-constrained in this manner.[7]

Figure 3: Models of IMF and EU-Commission researchers

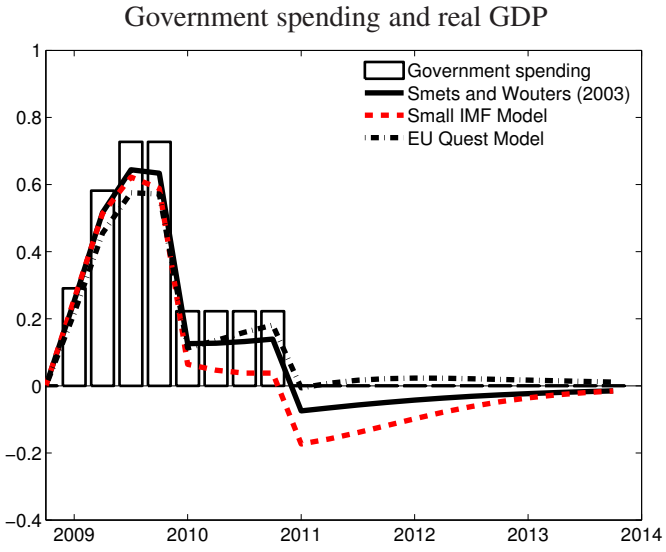


Figure 3 reports the effect of planned spending by euro area governments on real GDP in the

[6]One such model is MULTIMOD, a dynamic multi-country macro model of the world economy (see Laxton, Isard, Faruqee, Prasad, and Turtelboom (1998) for an introduction). Its companion model with microeconomic foundations is called Global Economy Model (GEM) and described in Pesenti (2008). IMF staff also developed another structural model for the analysis of fiscal and monetary policy called GIMF, which is described in Kumhof and Laxton (2007).

[7]This finding is similar to estimates reported by Coenen and Straub (2005) and Forni, Monteforte, and Sessa (2009). The latter authors obtain estimates between 30 and 40% for the euro area.

Small IMF and EU-Quest models. Output follows a path that is similar to the simulation of the Smets and Wouters model. Neither the updated empirical estimates nor the extensions accounting for the openness of the euro area economy or the presence of liquidity-constrained consumers fundamentally alter the effect of the Euro area government spending measures. In both models consumption and investment decline from the start rather than being multiplied in traditional Keynesian fashion. The negative effect is even slightly more pronounced than in the Smets and Wouters model in 2009.

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, Lopez-Salido, Valles (2007)). However, Coenen and Straub (2005), show that it is empirically unlikely that an increase in government spending crowds in consumption even with such assumptions. They find that the estimated share of constrained households is not sufficient to overturn the negative wealth effects that are internalized by the forward-looking households. The Quest model further corroborates their finding.

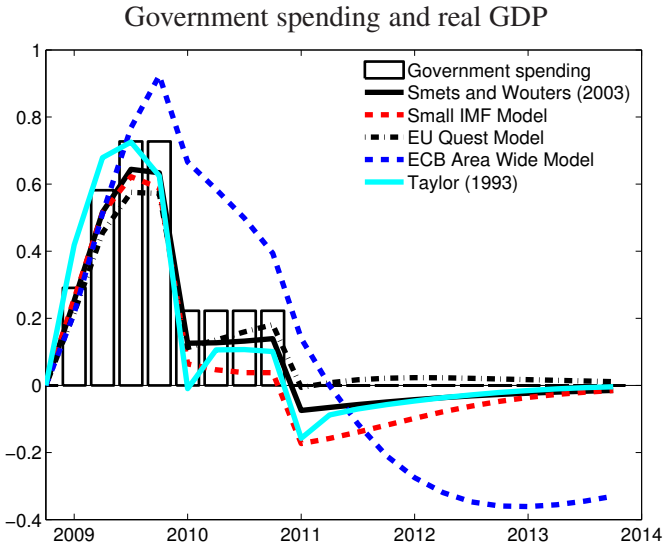
Some have criticized New-Keynesian DSGE models for being too similar to real business cycle models and incorporating too little of the lessons derived from earlier New Keynesian models with rational expectations or more traditional Keynesian models with backward-looking dynamics. Thus, we introduce two 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).[8]

The Taylor model is interesting because it is a multi-country model. It allows us to look at euro area member economies such as France, Germany and Italy, separately. Furthermore, this model offers a different perspective on households and firms. They are assumed to be forward-looking and forming rational expectations, but Ricardian equivalence is not enforced as in the Smets and Wouters model. 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.[9] As shown in **Figure 4** the initial boost to GDP in the first three quarters of 2009 is slightly greater than in the Smets an Wouters (2003) model. The effect on GDP is smaller, however, in 2010 and slightly more negative in 2011. A small crowding-in effect is observed in the first two quarters, but it is quickly overwhelmed and followed by a decline in consumption and investment.

[8] We use the linearized version of Dieppe, Kuester, and McAdam (2005).

[9] 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.

Figure 4: The Taylor (1993) G-7 model and the ECB's area-wide model



The ECB's area-wide model provides a more traditional Keynesian outlook on fiscal stimulus. It exhibits significant crowding-in effects of consumption and investment that raise output in 2010 twice as high as the remaining increase in government spending. This result is obtained, because the model assumes backward-looking behavior. Expectations are represented by lagged values of the variables to be forecasted. Furthermore, private consumption is modeled as a function of disposable income and wealth, with the latter defined as cumulative savings. Thus, households are not modeled 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. It is neglected by the simple static text-book 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 allowed for in the analysis. It is noteworthy that models such as the ECB area-wide model have been criticized for assuming backward-looking, adaptive behavior. 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, de Cos, and Momigliano (2004) show that the introduction of more forward-looking elements in the ECB area-wide model substantially reduce the government spending multiplier.[10]

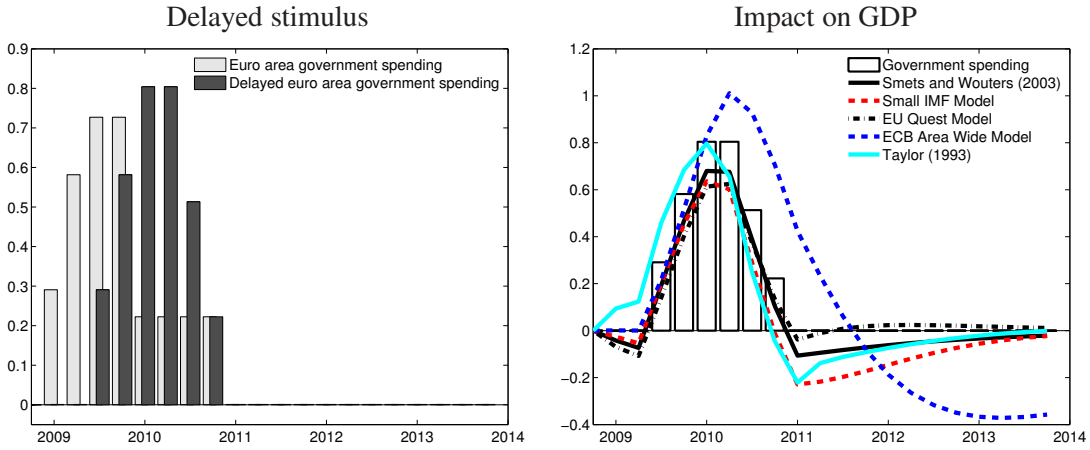
[10]Interestingly, the comparison of euro area macroeconomic models in Kuester and Wieland (2009) suggests that models which allow for an important influence of forward-looking decision-making by households and firms have fared better in terms of fitting euro area inflation and output dynamics since the start of monetary union.

Recently, ECB staff have introduced a New-Area-Wide model, which is more similar to the Smets and Wouters and EU-Quest models (see Christoffel, Coenen, and Warne (2008)).

Implementation lags and negative stimulus

So far, we assumed that governments start spending immediately following the announcement of their fiscal packages. Realistically, many spending measures take more time to be implemented. Even if the packages have passed parliament rather quickly, the planning of specific expenditures by the authorities who are expected to execute them still takes additional time. Once government authorities have decided and planned specific budgets, the particular work projects still need to be selected. The offers of companies applying for tenders need to be prepared and then compared by the authorities. Delays of several months should be expected as long as the selection process is sufficiently rigorous to avoid wastage of government funds. We recognize such limitations by shifting expenditures planned for the first half of 2009 to 2010 in the model simulations. This shift is shown graphically in the left panel of **Figure 5**.

Figure 5: Implementation lags and anticipation effects

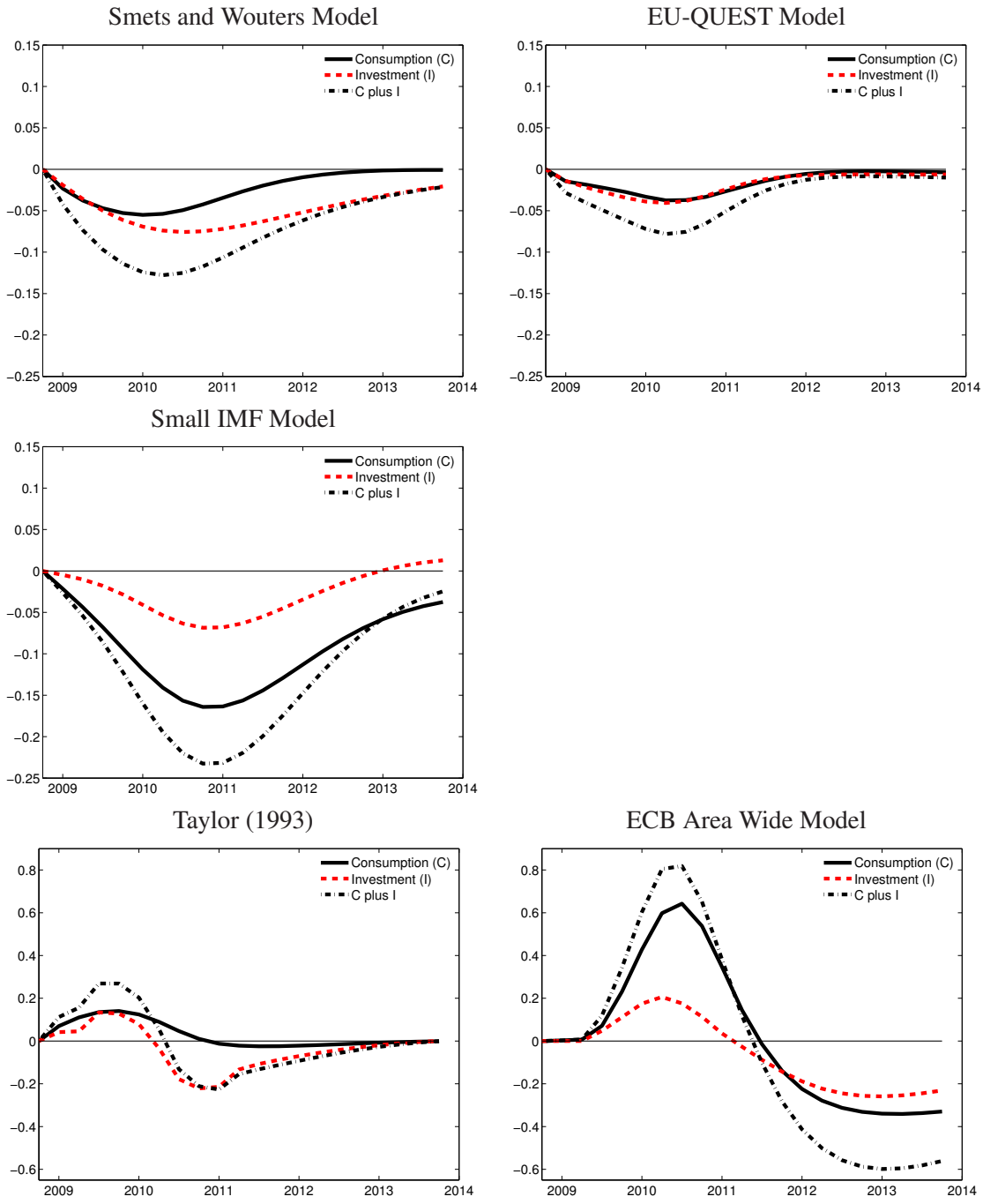


The three-New Keynesian DSGE models (Smets and Wouters, Small IMF, EU-Quest) project that GDP will decline in the first half of 2009 due to the implementation lag. Thus, negative stimulus would occur just at the time when positive stimulus is most needed. This finding is particularly disconcerting for proponents of fiscal stimulus, because this class of models is judged by many to be the best currently available framework for policy evaluation.[11] By contrast, the 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, the stimulative effects are realized once government spending

[11] See for example the survey of Woodford (2008).

is implemented successfully from summer 2009 onwards. Interestingly, the model of Taylor (1993) indicates the possibility of a slight boost ahead of the delayed stimulus.

Figure 6: Consumption and investment with delayed stimulus



Further insight regarding these differential results may be obtained from the comparison of consumption and investment dynamics in **Figure 6**. In the Smets and Wouters model and the Small IMF

model the negative impact of the delayed government spending and the negative wealth effect on private consumption of 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.

The earlier-generation New-Keynesian model of Taylor (1993) does not generate the same strong Ricardian effects as the current vintage of New-Keynesian DSGE models. Households and firms make forward-looking decisions. However, their expectations are 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.[12] Finally, the ECB's area-wide model essentially 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.

Interest rates and accommodative monetary policy

It is well-known that fiscal policy may suffer implementation lags and that it puts upward pressure on real interest rates that reinforces crowding-out of private consumption and investment. By contrast, the central bank is able to implement monetary policy changes immediately. Thus, proponents of fiscal stimulus have emphasized that the central bank could accommodate fiscal policy for some time in order to strengthen the overall stimulus. Romer and Bernstein (2009), for example, assumed that monetary policy keeps the nominal interest rate constant. Cogan et al. (2009) point out that a permanent peg would lead to instability and non-uniqueness in New-Keynesian models. They consider instead that the Fed would act to prevent any increase in the interest rate due to fiscal stimulus for one or two years. Afterwards, central bank policy is assumed to return to a policy rule that ensures a greater than one-for-one response to rising inflation. Such a rule avoids explosive and self-fulfilling increases in inflation.

The euro area model simulations presented so far have been conducted under the assumption that ECB monetary policy follows an interest rate rule that stabilizes output and inflation. The particular policy rule implemented in all the models considered in this paper is taken from Gerdesmeier and Roffia (2004). The rule is estimated with euro area data. It was also used by Kuester and Wieland (2009) in a comparative study of the first generation of euro area models developed at the ECB. It is a rule for setting the short-time nominal interest rate, r_t as a function of inflation, output and the lagged

[12] Perhaps, current research on credit-constrained but still forward-looking households as in Roeger and in't Veld (2009) may come closer to this effect.

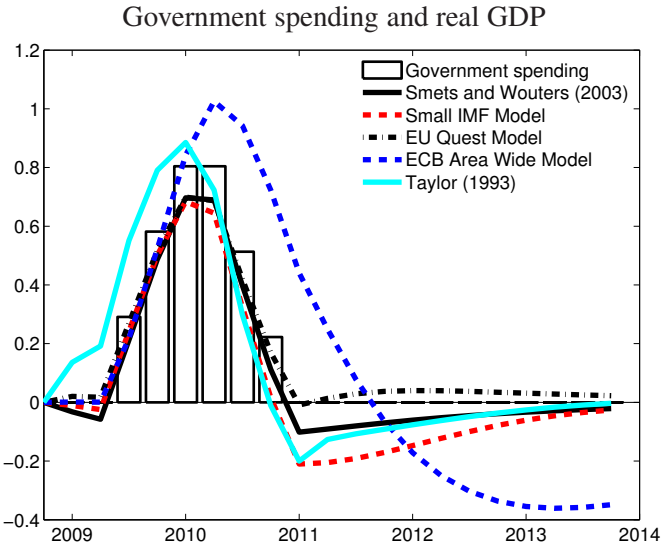
interest rate:

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

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.

Instead, we now introduce the possibility that the ECB deviates from the rule in order to accommodate the fiscal stimulus. Specifically, the ECB is assumed to promise keeping the nominal interest rate constant throughout 2009. This assumption introduces an additional nonlinearity into the analysis. The monetary accommodation is anticipated by forward-looking households and firms. Thus, crowding-out effects, to the extent that they arise due to an increase in interest rates following the announcement of fiscal stimulus, are eliminated. In 2010 policy is assumed to return to the 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 **Figure 7**. The year of monetary accommodation implies little change from our earlier findings. The initial negative stimulus in the New-Keynesian DSGE models of Smets and Wouters (2003) and Laxton and Pesenti (2003) is muted but not reversed. In the EU Quest model output the initial negative effect on output is eliminated. All three DSGE models still exhibit crowding-out effects over the 8 quarters of fiscal stimulus. The reason is that the original 2009 increase in interest rates in response to fiscal stimulus was not that large in the first place. The small initial crowding-in effect in the Taylor model and the larger crowding-in effect in the ECB's area-wide model are reinforced somewhat.

Figure 7: Impact on euro area GDP: constant interest rates in 2009



What should one 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 measures the cumulative private spending multiplication or displacement over a given horizon. It is reported in **Table 2** for the simulations with delayed stimulus and constant interest rates in 2009. The first column shows the cumulative effect over two years, that is from the first quarter of 2009 to the first quarter of 2011. Over this period, the three New-Keynesian DSGE models indicate significant private spending displacement. The Taylor model indicates a value near zero, while the ECB's area-wide model suggests a small net increase. However, 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 middle column.

Table 2: Cumulative GDP net off government spending

Percentage increase in real GDP			
	EU fiscal package (2011Q1)	EU fiscal package (2013Q4)	US fiscal package (2013Q4)
Smets and Wouters (2003)	-0.20	-0.34	-1.32
ECB Area Wide Model	0.37	-0.18	-0.01
Taylor (1993)	0.04	-0.11	-0.55
Small IMF Model	-0.26	-0.56	-1.68
EU Quest Model	-0.11	-0.02	-1

Notes: Delayed euro area fiscal stimulus package as in figure 7 assumed for the results in column 2 and 3. The interest rate is assumed constant in 2009. The cumulated euro area stimulus amounts to 0.80 percent of euro area GDP (see table 1) and the cumulated US government purchases to 2.21 percent of US GDP.

Would the results be better if only the euro area governments would have enacted a greater stimulus? So far, only Germany has announced measures that come close to the spending program initiated in the United States under the ARRA legislation (in terms relative to GDP). As a counterfactual we consider the possibility that other euro area governments follow suit and a package similar in magnitude to the ARRA is implemented symmetrically across Europe. To this end, we study the impact of the package simulated by Cogan et al. (2009) 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 discretionary fiscal stimulus will substantially reduce private spending and investment. In the ECB's area-wide model the negative effect is delayed.

4 Fiscal stimulus and 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 behavior referred to 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.[13] As indicated by our review of announced fiscal packages in the euro area, the German government eventually announced by far the largest fiscal stimulus measures accounting for almost 50 % 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. Analyzing 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 Germany, France and Italy.

Table 3: Impact of German government expenditures

Percentage increase in real GDP					
	2009Q1	2009Q4	2010Q4	2011Q4	2012Q4
Monetary union					
France	0.040	0.038	0.012	-0.01	0.002
Germany	0.746	0.696	0.429	-0.087	-0.153
Italy	0.015	-0.011	-0.050	-0.059	-0.02
Flexible exchange rates					
France	0.058	0.065	0.023	-0.021	-0.014
Germany	0.675	0.527	0.267	-0.127	-0.072
Italy	0.047	0.057	0.027	-0.016	-0.017

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.

Table 3 reports the effects on German, French and Italian GDP from the first quarter of 2009 to the fourth quarter of 2012. The first three row indicate the outcome when these countries 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,

[13] An example, is the contribution of Paul Krugman cited in the first footnote in the introduction.

United Kingdom and Japan). As a result, France and Italy loose competitiveness and exports to countries outside the euro area decline.

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-a-vis others. The spill-over effects to France and Italy, however, would be positive. As emphasized by Wieland (2006) it is important to account for this regime change in assessing the extent of likely spill-overs between euro area member economies. While empirical VAR studies that use data from before and after monetary union will confound the differential spill-over effects from these two periods, they may be distinguished by using a structural model. The findings with the Taylor (1993) model underscore the drawbacks of discretionary fiscal stimulus in the euro area. It would be of interest to estimate a New-Keynesian DSGE model of the G-7 economies with more recent data and conduct a robustness analysis.

5 Conclusions

In this paper we have constructed an estimate of the additional government expenditures in the euro area in conjunction with the measures announced in national fiscal stimulus packages for 2009 and 2010. According to our calculations the euro area stimulus is primarily driven by measures taken by the German government and to a smaller part by the Spanish and French governments. We have then used a comparative, model-based approach to assess the likely impact of these measures on euro area GDP. Proponents of discretionary fiscal stimulus emphasize the Keynesian multiplier effect that implies that additional government spending would induce an increase in private spending and therefore a greater than one-for-one effect on aggregate GDP. We investigate this proposition by using empirical macroeconomic models with Keynesian features such as price and wage rigidities. Four of the models we use have been developed and estimated at central banks and international institutions. Three of these models are New-Keynesian DSGE models that represent the current state of the art of policy analysis.

Our findings provide no support for a Keynesian multiplier. Instead they suggest that additional government spending will reduce private spending for consumption and investment purposes. The reason is the forward-looking behavior of households and firms. They anticipate higher tax burdens and higher interest rates in the future and therefore reduce consumption and investment. Thus, the initial effect on GDP may even be negative if government spending faces an implementation lag. Monetary accommodation in terms of a constant level of the nominal interest rate for all of 2009 helps but is not sufficient to offset the crowding-out of private spending.

Only the ECB's area-wide model, which largely ignores forward-looking behavior, is found to

generate government spending multipliers that are significantly above one. Although such models are useful for short-term forecasting in the absence of major policy changes they are not well-suited for analyzing the effect of such changes. The New-Keynesian models instead account for the likely response of forward-looking optimizing households and firms.

We have also analyzed the possibility of spillover effects within the euro area using the Taylor (1993) model. This model, which assumes forward-looking, rational expectations and price and wage rigidities, accounts for the French, German and Italian economies separately. The spillover effects of the German stimulus measures with regard to France are very small. They even turn slightly negative in the case of Italy at the end of 2009. Direct demand effects are overwhelmed by the indirect effect of euro appreciation. For further research on euro area spillovers it would be of interest to estimate a multi-country New-Keynesian DSGE model with more recent data and conduct a robustness analysis.

In this paper, we have investigated the possibility of Keynesian multiplier effects using empirical macroeconomic models with Keynesian features. In contrast with real business cycle models, the estimated New-Keynesian models assume "sticky prices" by introducing staggered price and wage setting. But as Chari, Kehoe, and McGrattan (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. For example, Uhlig (2009) considers a neoclassical growth model with endogenous labor and various fiscal instruments and concludes that massive expansions in government spending such as the ARRA package in the United States come at substantial costs in terms of total output over the longer run.

References

R. J. Barro. Voodoo multipliers. *Economist's Voice*, February 2009.

V. V. Chari, P. J. Kehoe, and E. R. McGrattan. New keynesian models: Not yet useful for policy analysis. *American Economic Journal Macroeconomics*, 1 (1):242–266, 2009.

L. J. Christiano, M. Eichenbaum, and C. L. Evans. Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of Political Economy*, 113 (1):1–45, 2005.

K. Christoffel, G. Coenen, and A. Warne. The new area-wide model of the euro area: a micro-founded open-economy model for forecasting and policy analysis. ECB Working Paper 944, 2008.

G. Coenen and R. Straub. Does government spending crowd in private consumption? theory and empirical evidence for the euro area. *International Finance*, 8(3):435–470, 2005.

J. F. Cogan, T. Cwik, J. B. Taylor, and V. Wieland. New keynesian versus old keynesian government spending multipliers. NBER Working Paper Series No. 14782, 2009.

A. Dieppe, K. Kuester, and P. McAdam. Optimal monetary policy rules for the euro area: An analysis using the area wide model. *Journal of Common Market Studies*, 43(3):507–537, 2005.

G. Fagan, J. Henry, and R. Mestre. An area-wide model for the euro area. *Economic Modelling*, 22: 39–59, 2005.

L. Forni, L. Monteforte, and L. Sessa. The general equilibrium effects of fiscal policy: Estimates for the euro area. *Journal of Public Economics*, 93:559–585, 2009.

J. Gali, J. D. López-Salido, and J. Vallés. Understanding the effects of government spending on consumption. *Journal of the European Economic Association*, 5 (1):227–270, 2007.

D. Gerdesmeier and B. Roffia. Empirical estimates of reaction functions for the euro area. *Swiss Journal of Economics and Statistics*, 140:37–66, 2004.

J. Henry, P. H. de Cos, and S. Momigliano. The short-term impact of government budgets on prices: Evidence from macroeconometric models. Banca d'Italia Working Paper, 2004.

A. Hughes-Hallett and K. F. Wallis, editors. *EMU Macroeconomic Model Comparison excercise for the Euroconference 7-8 June 2002*, 2004. Economic Modelling 21(5).

K. Kuester and V. Wieland. Insurance policies for monetary policy in the euro area. forthcoming: *Journal of the European Economic Association*, 2009.

M. Kumhof and D. Laxton. A party without a hangover? on the effects of u.s. government deficits.

IMF Working Paper 07/202, 2007.

D. Laxton and P. Pesenti. Monetary rules for small, open emerging economies. *Journal of Monetary Economics*, 50:1109–1146, 2003.

D. Laxton, P. Isard, H. Faruqee, E. Prasad, and B. Turtelboom. Multimod mark iii the core dynamic and steady-state models. IMF Occasional Paper No. 164, 1998.

P. Pesenti. The global economy model: Theoretical framework. IMF Staff Papers 55, 2008.

M. Ratto, W. Roeger, and J. in't Veld. Quest iii: An estimated open-economy dsge model of the euro area with fiscal and monetary policy. *Economic Modelling*, 26(1):222–233, 2009.

W. Roeger and J. in't Veld. Fiscal policy with credit constrained households. Working Paper, 2009.

C. Romer and J. Bernstein. The job impact of the american recovery and reinvestment plan. 2009.

D. Saha and J. von Weizsäcker. Estimating the size of the european stimulus packages for 2009 an update. Briefing Paper for the Annual Meeting of the Committee on Economic and Monetary Affairs with the National Parliaments on 11-12 February 2009 at the European Parliament in Brussels, 2009.

F. Smets and R. Wouters. An estimated stochastic dynamic general equilibrium model of the euro area. *Journal of the European Economic Association*, 1:1123–1175, 2003.

F. Smets and R. Wouters. Shocks and frictions in u.s. business cycles: A bayesian dsge approach. *American Economic Review*, 97:506–606, 2007.

J. B. Taylor. *Macroeconomic Policy in a World Economy: From Econometric Design to Practical Operation*. WW Norton, New York, 1993.

J. B. Taylor and V. Wieland. Surprising comparative properties of monetary models: Results from a new data base. NBER Working Paper 14849, 2009.

H. Uhlig. Some fiscal calculus. draft, May 2009.

V. Wieland. Monetary policy targets and the stabilization objective: a source of tension in the ems. *Journal of International Money and Finance*, 15:95–116, 1996.

V. Wieland. "comment on 'trade spill-overs of fiscal policy in the european union: A panel analysis'. *Economic Policy*, 48:680–684, 2006.

V. Wieland, T. Cwik, G. Mueller, S. Schmidt, and M. Wolters. A new comparative approach to macroeconomic modelling and policy analysis. Manuscript, Center for Financial Studies, Frank-

furt, 2009.

M. Woodford. Convergence in macroeconomics: Elements of the new synthesis. AEA meeting, January 2008, 2008.

A Country details on the fiscal packages in the euro area

A.1 Austria

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Early implementation of income tax reform	2.30	2.30
	Degressive depreciation deduction	0.23	0.34
	Reduced VAT rate on medication	0.28	0.28
	Tax exemptions	0.16	0.16
	Burden reduction for families with children	0.51	0.51
		3.48	**3.59**
Extra spending	Regional employment initiatives	0.08	0.08
	Spending package, September 2008	0.40	0.00
	Additional research expenditure	0.05	0.05
	Mandatory kindergarten year for all	0.07	0.07
	Energy saving cheques	0.10	0.00
	Investment in public facilities	0.36	0.52
	Advancing of railroad investments	0.24	0.24
	Subsidies to house saving scheme	0.02	0.02
	Investments into broad-band internet infrastructure	0.01	0.00
	"Mittelstandsfonds"- venture capital fund for SMEs	0.04	0.04
		1.37	**1.02**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Österreichisches Finanzministerium.

A.2 Belgium

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Measures for construction sector	0.30	0.30
	No tax on credit insurance	0.02	0.02
		0.32	**0.32**
Extra spending	Higher unemployment pay	0.10	0.00
	Energy subsidy to households	0.14	0.14
	Higher social security allocations	0.51	0.51
	Investments into green technology	0.02	0.02
	Larger fund for energy cost reduction	0.01	0.01
	Accelerated public investments	0.12	0.12
	Lower cost of using food safety agency	0.03	0.03
		0.93	**0.83**

Source: Estimating the size of the European stimulus packages for 2009 An Update

A.3 Germany

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Degressive depreciation deduction	1.94	4.33
	Higher tax-free allowances for companies	0.24	0.37
	Suspension of car tax on on new vehicles	0.44	0.13
	Tax deductibility of professionel commute	4.00	4.00
	Package for tax burden reduction, stabilisation of Social security contributions and investment in families	4.22	12.04
	Income tax cut	2.90	6.04
	Reduction in health insurance contributions	3.00	6.50
	State payment of 50 percent social insurance for short-time workers	1.15	1.15
	Reform of car tax	0.09	0.17
		17.98	**34.73**
Extra spending	Investments into transport infrastructure	1.00	1.00
	Longer eligibility for short-time compensation	0.00	0.00
	Improvement of regional economic structure	0.30	0.00
	Infrastructure investment programme	8.65	8.68
	Innovation support programme	0.45	0.45
	Retraining and stronger job service	1.59	1.59
	Increased child benefits	4.42	2.84
	Premium for new car purchases	1.50	0.00
	Increased housing benefits	0.06	0.06
		17.97	**13.62**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Brot und Butter Brief " Der Wirtschaftskrise entgegensteuern", GDP: OECD Economic Outlook, Gross domestic product, value, market prices.

A.4 Greece

Category	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	0	0
	0	**0**
Extra spending	0	0
	0	**0**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Addendum to the 2008 update of the Hellenic Stability and Growth Programme 2008 - 2011, February 2009.

A.5 Spain

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Longer tax-exemption of saving accounts for housing purchases even if no house is bought	0.03	0.03
	Extended eligibility for tax deductions when selling houses	0.11	0.11
	Reduction in employer social contributions for hiring previously unemployed workers	0.08	0.08
	permanent tax measures (major reform of direct taxation 2007 + additional tax measures)	14.5	14.5
		14.72	**14.72**
Extra spending	Employment Plan	1.1	0.00
	Public Investment Fund	8.00	0.00
	Sector specific support	3.00	0.00
		12.1	**0.00**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Stability Programme update Spain 2008-2011.

A.6 Finland

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	New building and renovation (increase in household tax deduction)	0.10	0.10
	Tax cuts and improvements in benefits (Tax cuts on labour and pension income, lower VAT)	1.83	1.83
		1.93	**1.93**
Extra spending	Transport routes, infrastructure and energy projects	0.08	0.08
	Business subsidies, R and D	0.36	0.36
		0.44	**0.44**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Stability Programme update for Finland 2008, information on the fiscal measures (12.2008).

A.7 France

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Reduced obligation to contribute to social insurance conditional on new hiring, for very small firms	0.70	0.00
		0.70	**0.00**
Extra spending	Direct public investment (government and local government)	6.50	4.00
	Sectoral subsidies: housing industry, subsidies to building, renovation, buyers and renters	1.20	0.00
	Sectoral subsidies: car industry	0.60	0.00
	Increased payment to the endowment for the basic income provision	0.80	0.00
	Employment policies	0.50	0.00
	State-owned enterprises investment	4.05	0.00
	Social package (announced on 18.02.2009)	2.60	0.00
		16.25	**4.00**

Source: Estimating the size of the European stimulus packages for 2009 An Update, French Stability Programme 2009-2012.

A.8 Ireland

Category	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	0	0
	0	**0**
Extra spending	0	0
	0	**0**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Addendum to the Irish Stability Programme Update January 2009.

A.9 Italy

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	No increase of highway toll	0.09	0.00
	Tax cut for productivity bonuses	0.46	0.15
	Deductibility of corporate tax from regional corporate tax	1.19	1.19
	Deferred VAT payments	0.19	0.19
	Municipal infrastructure investment	0.00	0.00
	Voluntary revision of company book values	-2.76	0.00
	More tax inspections	-1.88	-1.88
	Tax inspections of private associations	-0.15	-0.15
	Increased taxation of TV services	-0.47	-0.47
		-3.33	**-0.97**
Extra spending	Spending on low income families	2.40	0.00
	Aid to house mortgages	0.35	0.00
	Unemployment benefits	0.10	0.10
	Financing of strategic infrastructure	0.06	0.00
	Increased tax revenue costs	0.05	0.05
	Renewal of school cleaning contracts	0.11	0.00
		3.07	**0.15**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Italys stability programme 2008 update, Decree-Law no. 185/2008.

A.10 Netherlands

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Accelerated depreciation of investments	0.90	0.90
	Tax cuts for SMEs	2.00	2.00
		2.90	**2.90**
Extra spending	Unemployment benefits (working hours reduction)	0.20	0.00
		0.20	**0.00**

Source: Estimating the size of the European stimulus packages for 2009 An Update, Netherlands stability programme December 2008 Addendum.

A.11 Portugal

Category	Measure	2009 (bln Euro)	2010 (bln Euro)
Tax cuts	Special support to economic activity, exports and SME	0.10	0.00
		0.10	**0.00**
Extra spending	Modernisation of schools	0.30	0.30
	Fostering Renewable Energies, Energy Efficiency and Energy Transmission Infrastructure	0.25	0.00
	Modernisation of technological infrastructure, new generation broadband networks	0.05	0.05
	Protecting employment and strengthening social protection	0.30	0.00
		0.90	**0.30**

Source: Portuguese Republic Stability and Growth Programme 2008 - 2011, January 2009 Update, "Investment and Employment Initiative (IEI)" Programme.