ASSESSING THE ECONOMIC IMPACT OF THE FISCAL STIMULUS PLANS WITH THE NiGEM MODEL*

*Cristina Manteu***

*Carlos Martins***

1. INTRODUCTION

In the last year, almost all advanced economies have launched and/or announced discretionary fiscal packages, to help mitigate the impact of the global financial and economic crisis.[1] The objective of this work is to assess the impact of these packages in the 2009-2010 period using the NiGEM model. The group of selected advanced economies includes the US, Japan, the UK and the euro area.[2] NiGEM is a multi-country macro-econometric model whose features make it particularly suitable for simulating the effects of discretionary and synchronized fiscal plans, of which the following should be highlighted: detailed structure (in particular of the government sector), options in simulation design (regarding for instance the specification of monetary policy and fiscal rules or type of forward looking behaviour) and modelling of commercial and financial linkages between countries.[3]

The article is organized as follows. In section two, we present the fiscal multipliers resulting from simulations in the NiGEM, showing that countercyclical effects depend on the type of fiscal instrument used and differ across economies. We also show that fiscal multipliers increase with international coordination of policy stimulus, because of positive spillovers from national packages. In section three, after briefly assessing and comparing the size and composition of the different fiscal packages, we present the results of two simulation scenarios. The first scenario considers the simultaneous implementation of these packages assuming unaltered interest rate risk premia. The results show that the announced fiscal stimulus plans have a transitory positive impact on GDP growth rates. Relative to the baseline scenario, world GDP growth rate is estimated to increase in 2009 by 0.6 percentage points (p.p.), to be unaltered in 2010 and to decrease in 2011. The reduction in 2011 reflects mainly the disappearance of the fiscal stimulus. The fiscal packages, combined with the effect of the automatic stabilizers, imply a large increase in fiscal deficits and a build-up of public debt. In the current environment, these trends in fiscal ratios may raise concerns over sustainability and trigger an adverse market reaction in the form of a rise in risk premia. Accordingly, in the second scenario, we combined the implementation of the fiscal stimulus plans with a risk premium shock. Results show that increases in interest rate risk premium

* We would like to thank Nuno Alves, Mário Centeno, Ana Cristina Leal and João Sousa for very helpful comments. The opinions expressed in this article are of the author and do not necessarily coincide with those of Banco de Portugal or the Eurosystem.

** Banco de Portugal, Economic and Research Department.

(1) Several emerging market economies have also announced fiscal stimulus packages aimed at offsetting the slowdown in domestic private demand (e.g. Saudi Arabia, China, Korea and Russia). See IMF (2009c).

(2) In our analysis, the euro area excludes Luxembourg, Slovenia, Slovakia, Cyprus and Malta.

(3) See Gomes *et al.* (2007) for a more detailed description of the NiGEM model.

as a result of debt concerns imply a slight reduction of the impact of the fiscal packages on GDP growth (by 0.1 and 0.2 p.p. in 2009 and 2010, respectively). Section four concludes.

2. FISCAL MULTIPLIERS

We define fiscal multipliers as the per cent change in GDP in the first year resulting from a one per cent of GDP change in the fiscal instrument in that year. These multipliers provide a quantitative summary of the impact of fiscal measures on aggregate activity in the short term.

Table 1 presents the main characteristics of the simulations performed in the NiGEM model to estimate the fiscal multipliers. The fiscal shock is temporary, assumed to last only for a year (just one quarter in the case of the increase in transfers).The NiGEM model incorporates an automatic fiscal solvency rule, which was disabled during the first two years of the shock.[4] Only after these two years taxes are assumed to rise to ensure the payment of the debt created by the current fiscal expansion. Regarding monetary policy, we have computed the fiscal multipliers assuming no monetary policy reaction for two years.[5] In the simulations, financial markets, including the foreign exchange market, are assumed to be forward looking while consumers are backward-looking (e.g. they do not react to expected future increases in taxes).[6]

Table 2 shows the fiscal multipliers by economy and by fiscal instrument resulting from the NiGEM simulations in the first year.[7] Chart 1 presents the impact on real GDP at longer horizons (up to year 12),

Table 1

SIMULATION OF FISCAL MULTIPLIERS

		Scenarios					
		Increase in transfers to households	**Government consumption increase**	**Government investment increase**	**Indirect tax cut**	**Personal income tax cut**	**Corporate tax cut**
Dimension of the shock	Size	1% of GDP					
	Duration	1 quarter	4 quarters				
Policy options	Fiscal policy solvency rule	non-active in the first 2 years					
	Monetary policy rule	non-active in the first 2 years					
Agents	Financial markets	Forward looking					
	Consumers	Backward looking					

(4) This automatic solvency rule works as follows: if after a shock the government budget deficit is greater than the deficit target defined by authorities, then the tax revenue has to increase gradually, which is implemented by a gradual increase in direct tax rates. When we temporarily turn off this solvency rule, we delay the adjustment, which implies larger fiscal multipliers.

(5) We have also computed the fiscal multipliers assuming the regular functioning of monetary policy (see results in the Annex 1, Table 1). As expected, under the assumption of endogenous monetary policy, the fiscal multipliers are smaller than when assuming an accommodative monetary policy. However, the difference between the two sets of multipliers is quite small (Annex 1, Table 2).

(6) If consumers would be set in forward-looking mode, the impact on GDP of a fiscal expansion would be subdued. However, it may be noticed that in our simulations, with private consumption set in the backward-looking mode, consumers still look towards the future via financial markets that are set to be forward looking and affect financial and housing wealth and hence consumption behaviour now.

(7) Barrel *et al.* (2009) present results for a set of similar simulations.

Table 2

FISCAL MULTIPLIERS

Per cent change in GDP in year 1 resulting from a 1 per cent of GDP fiscal expansion in year 1

	Increase in transfers to households	Government consumption increase	Government investment increase	Indirect tax cut	Personal income tax cut	Corporate tax cut
US	0.3	1.0	1.0	0.4	0.3	0.4
Japan	0.5	1.1	1.1	0.3	0.5	0.3
UK	0.2	0.7	0.7	0.2	0.2	-
Euro area [(a)]	0.2	0.8	0.8	0.3	0.3	-

Source: Authors' simulations based on NiGEM model.
Note: (a) Impact of implementation of measure in all euro area countries simultaneously (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta).

measured as percentage deviations from the baseline level (that is, without the implementation of fiscal packages).

The main conclusions regarding short term multipliers from Table 2 are the following:

- Fiscal multipliers in year 1 are positive but show some variation across fiscal instruments and economies;
- Government spending on consumption or investment has the biggest effect in year 1;
- Multipliers for transfers and both indirect and direct taxes cuts are usually smaller in year 1.

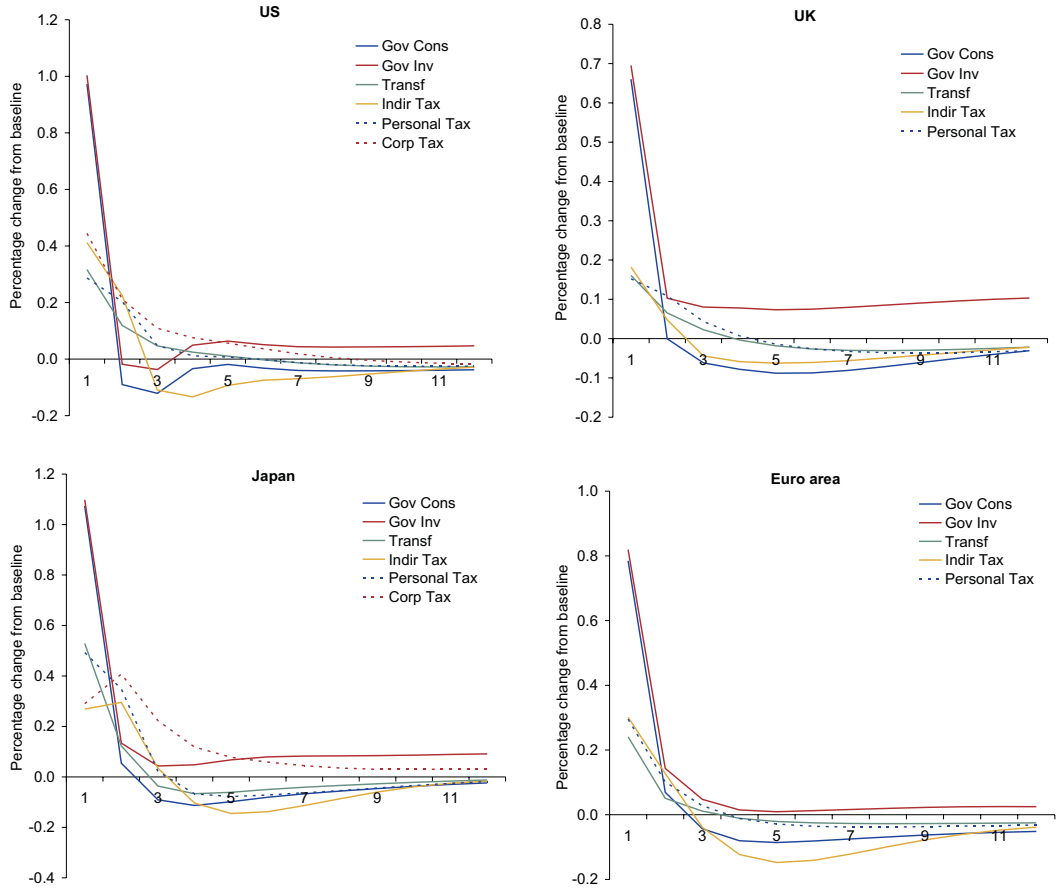
Regarding the impact at longer horizons, NiGEM simulations point to a relatively rapid return of the level of real GDP to the baseline after a temporary fiscal expansion in year 1 (Chart 1). For example, for the US, an increase in government consumption and investment in year 1 implies a negative to null deviation of the level of real GDP relative to the baseline already in year 2. The impact of indirect and personal taxes cuts as well of transfers also fades away by year 3 (deviations of real GDP from baseline become less than 0.05 p.p. or negative). The impact of the corporate tax cut seems to last longer, but is less than 0.1 p.p. after year 4.[8] Results for Japan, the UK, and the euro area show a similar trend of relatively quick convergence of the level of real GDP to the baseline after year 1.

However, in year 1, there is considerable heterogeneity in results across economies regarding the GDP impact. Short-term fiscal multipliers in the US and Japan are higher than the ones in the UK and in the euro area, independently of the instrument considered. Differences are more noticeable in the case of public consumption and investment multipliers. These differences can be related to a certain extent to differences in the degree of openness of the economies (defined as the ratio of the average level of exports and imports in volume in percentage of GDP). The reaction of GDP to a fiscal expansion tends to be smaller the more open the economy is, as it is more likely that some of the impact of the domestic fiscal expansion will leak abroad through imports. Chart 2 illustrates this relation for the

(8) Notice that, given its structure, the NiGEM model does not take into account eventual effects of tax reductions or increases in public investment on the supply side of the economy.

Chart 1

IMPACT ON REAL GDP OF A 1 PERCENT OF GDP FISCAL EXPANSION IN YEAR 1 AT LONGER HORIZONS



Source: Authors' simulations based on NiGEM model.

case of public consumption multipliers.[9]

The fiscal multipliers obtained with the NiGEM model can be seen as broadly consistent with the results from other macro-models (See Annex 2).

The effectiveness of the fiscal expansion may increase if implementation is coordinated, because in this case each country benefits from the others´ fiscal stimulus through trade linkages. The gains from coordination can be measured by comparing fiscal multipliers assessed when each country acts alone with those resulting from a coordinated move.[10] Table 3 shows the NiGEM results of this exercise for government consumption multipliers, illustrating that the gains from a generalized fiscal expansion can be quite significant in some cases.[11] These gains tend to be smaller for more closed economies (Chart 3).

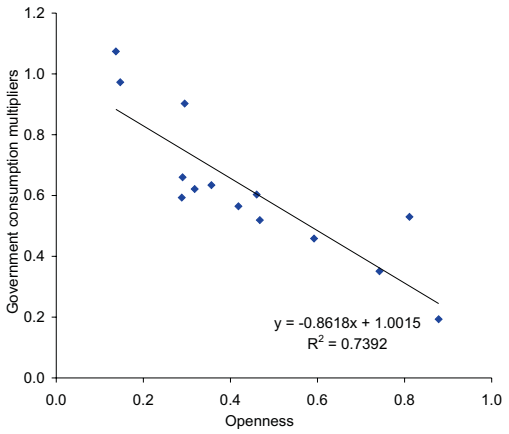
(9) There is also an inverse relation between the degree of openness and the other fiscal instruments multipliers. However, this relation is stronger in the case of the expenditure side multipliers than in the case of revenue side multipliers.

(10) See similar comparisons in Barrel *et al.* (2009), OECD (2009a) and Freedman *et al.* (2009).

(11) Table 3 in Annex 1 contains the results for the same exercise when monetary policy is non-accommodative in all countries.

Chart 2

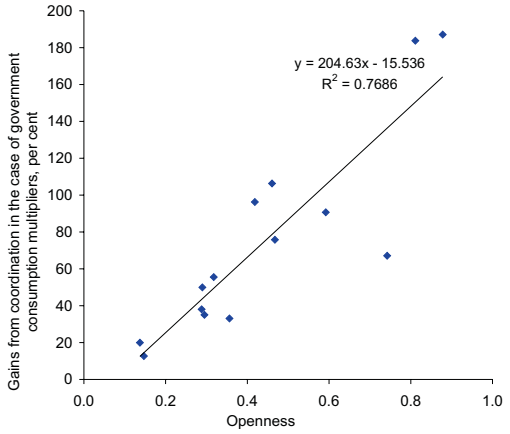
FISCAL MULTIPLIERS AND COUNTRIES' OPENNESS [(a)]



Source: Authors' simulations based on NiGEM model.
Note: (a) The fiscal multipliers considered are the ones of the USA, Japan, UK and euro area countries. The measure of openness is: [imports + exports]/2 in percentage of GDP.

Chart 3

COORDINATION GAINS AND COUNTRIES' OPENNESS [(a)]



Source: Authors' simulations based on NiGEM model.
Note: (a) The fiscal multipliers considered are the ones of the USA, Japan, UK and euro area countries. The measure of openness is: [imports + exports]/2 in percentage of GDP.

Table 3

FISCAL MULTIPLIERS WITH COORDINATION

Per cent change in GDP in year 1 resulting from a 1 per cent of GDP increase in public consumption (no monetary policy reaction)

	Acting alone (1)	Coordinated policy (2)	Gains from coordination (2)/(1) in %
US	1.0	1.1	12.7
Japan	1.1	1.3	20.0
UK	0.7	1.0	49.9
Euro area [(a)]	0.8	0.9	19.2

Source: Authors' simulations based on NiGEM model.
Note: (a) The first column presents the impact of the implementation of the measure in all euro area countries simultaneously (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta), while the second presents the impact of the implementation in all listed economies.

3. IMPACT OF FISCAL PACKAGES

The set of multipliers by geographical area and fiscal policy instrument obtained with the NiGEM simulations in the previous section can be used to determine the impact of the fiscal packages on economic activity. However, to control for the spillovers between countries and to obtain the effect on other macroeconomic variables (inflation, public deficit and debt, long run interest rates), the simulation of actual fiscal packages was required. Therefore, in this section, we considered the simulation of two scenarios: the first considering the simultaneous implementation of all countries´ fiscal packages and the second, combining the implementation of the packages with an interest rate risk premia shock. In both scenarios, we continued to assume an accommodative monetary policy during 2009-10 (implying unaltered official interest rates relative to the baseline), as well as the assumption that the fiscal rule is

not active during the implementation of the stimulus.

3.1. Scenario 1: Impact of fiscal packages (with unaltered interest rate risk premia)

The simulation of the fiscal packages implied the need of detailed information on the countries' plans. We used data compiled by OECD (2009b), which contains details of fiscal measures taken by each OECD country in response to the economic crisis, presented using a consistent methodology across countries.[12] The main principles adopted in defining and measuring the size of the fiscal packages were as follows (see OECD (2009b) for a more detailed description):

- Fiscal packages include discretionary measures (both expansionary and restrictive[13]) implemented and/or announced in response to the crisis up to 6 March 2009. Changes in fiscal balances resulting from automatic stabilizers were not included. Discretionary measures which cannot be considered as a response to the crisis, even if they are implemented over the period 2009 to 2010, were also excluded from the definition of fiscal packages.

- The overall size of the fiscal packages was measured as the deviation of fiscal balances compared with a "no-crisis related action scenario" over the period 2009-10.

- Spending and revenue measures have been broken down, to the extent possible, by main categories so as to allow cross-country comparisons.

Table 4A and 4B present a summary description of the fiscal packages used in the simulations. Table 4A includes the size of the packages (measured by its net effect on fiscal balances in percentage of the GDP) and its distribution over the period 2009-10. Table 4B contains the decomposition of the fiscal measures in revenue and spending items. Note that we have classified the measures listed in OECD country tables in a way that allowed them to be used in NiGEM simulations (specifically tax cuts – personal, corporate and indirect – transfers and public consumption and investment expenditures), which required some degree of judgement.

Table 4A reveals that there is considerable variation in the size of the fiscal packages across economies. These differences may be accounted not only by the severity of the economic crisis in each country, but also by the size of automatic stabilizers and the fiscal position prior to the crisis and subsequent room for fiscal expansion. The US package is the largest, amounting to 4.6 per cent of GDP over the period 2009-10. The UK and Japan packages represent 1.0 and 1.7 per cent of GDP, respectively. For the euro area countries aggregate, the announced fiscal stimulus amounts to 1.4 per cent of GDP.

In Japan and the UK, the fiscal stimulus will be concentrated in 2009, while in the US and the euro area the size of fiscal packages in 2009 and 2010 is broadly similar.

Regarding the composition of the fiscal packages, the economies considered in Table 4B have an-

(12) Some cautions are required in comparing the data compiled by OECD and those communicated by national governments or presented by other international organizations (IMF (2009c)). The differences may reflect judgement required in deciding whether a discretionary measure was adopted as a response to the crisis. In addition, there may be differences in the methodology for classifying the fiscal measures. Finally, there may be differences in the cut-off date of the measures.

(13) Restrictive discretionary measures were also announced in response to the crisis. In fact, in Ireland the overall fiscal package is restrictive.

Table 4A

FISCAL PACKAGES - SIZE AND TIMING

	Net effect on fiscal balance (in percentage of GDP)		
	2009	**2010**	**2009-10**
US	2.1	2.5	4.6
Japan	1.3	0.4	1.7
UK	0.9	0.1	1.0
Euro area [(a)]	0.8	0.6	1.4

Sources: OECD (2009b) and authors' calculations.
Note: (a) The values for the euro area exclude the fiscal packages of Luxemburg, Slovenia, Slovakia, Cyprus and Malta.

Table 4B

COMPOSITION OF FISCAL PACKAGES

Total over 2009-10 period as percentage of GDP

	Revenue				Expenditure			
	Personal Taxes	**Corporate Taxes**	**Indirect Taxes**	**Total**	**Public Consumption**	**Public Investment**	**Transfers to Households**	**Total**
US	1.6	0.6	0.0	2.2	1.6	0.3	0.5	2.5
Japan	0.2	0.2	0.1	0.5	0.7	0.1	0.5	1.2
UK	0.0	0.1	0.8	0.8	0.0	0.1	0.1	0.2
Euro area[(a)]	0.5	0.1	0.0	0.6	0.1	0.4	0.2	0.7

Sources: OECD (2009b) and authors' calculations.
Note: (a) The values for the euro area exclude the fiscal packages of Luxemburg, Slovenia, Slovakia, Cyprus and Malta.

nounced both tax reductions and spending increases. However, the fiscal package of the UK privileged tax cuts. On the contrary, Japan has given priority to spending measures. The packages of the US and the euro area are relatively more balanced, with roughly half the stimulus stemming from tax cuts and the other half from increased expenditure. The tax cuts are expected to take place mainly through cuts in personal taxes and, to a lesser extent, in corporate taxes. Significant reductions in indirect taxes were announced only in the United Kingdom. Concerning expenditure measures, public investment seems to feature predominantly in the euro area packages while the US and Japanese packages give more weigh to public consumption and transfers to households.

Table 5 presents the simulation results of our first scenario.[14] The impact of the combined fiscal stimulus packages of the selected countries on real GDP growth is positive in 2009, as expected. The growth rate of world GDP in 2009 is 0.6 p.p. higher in the fiscal packages' scenario than in the baseline scenario. Growth of world GDP is unaltered by the packages in 2010 and it is actually reduced vis-à-vis the baseline in 2011 reflecting the disappearance of the fiscal stimulus. Note that this implies that the level of world GDP in the scenario with the fiscal packages stands above the baseline during the years 2009 and 2010 (by 0.6 p.p. in both years) and equals the baseline in 2011.

(14) Simulation results for scenario 1 with non-accommodative monetary policy can be found in the Annex 1, Table 4.

Table 5

IMPACT OF THE FISCAL PACKAGES

Percentage point deviations from the baseline

	Real GDP growth			Inflation			Fiscal balance (in % GDP)			Government debt [a] (in % GDP)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
US	1.3	0.3	-1.5	0.2	1.3	1.1	-1.5	-1.9	-0.1	-0.1	0.3	1.3
Japan	1.0	-0.4	-0.6	0.0	0.3	0.2	-1.0	-0.2	-0.1	-1.7	-1.1	0.0
UK	0.6	-0.2	-0.3	-0.6	1.2	0.5	-0.4	0.2	0.1	0.4	-0.3	-0.5
Euro area [b]	0.6	0.0	-0.4	0.1	0.4	0.4	-0.6	-0.4	0.0	-0.2	0.0	0.2
World	0.6	0.0	-0.6	0.1	0.8	0.7	-	-	-	-	-	-

Source: Authors' simulations based on NiGEM model.
Notes: (a) Maastricht definition for the euro area. (b) Impact of implementation of the fiscal packages of all euro area countries (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta).

The impact on GDP growth is the highest for the US (1.3 and 0.3 p.p., respectively, in 2009 and 2010). In 2011, US GDP growth is reduced by 1.5 p.p. relative to the baseline, which implies that the level of real GDP will stand above the baseline by 0.1 p.p this year. In the euro area, the fiscal packages raise real GDP growth by 0.6 p.p. in 2009, leave the rate unaltered in 2010 but reduce it in 2011 (by 0.4 p.p., respectively).[15] By 2011, the level of real GDP in the euro area is just 0.1 p.p. above the baseline, illustrating the transitory effect of the fiscal stimulus measures.

The impact on consumer price inflation in 2009 is generally positive but small. World inflation deviates from the baseline by just 0.1 p.p.. Only in the UK, inflation is reduced vis-à-vis the baseline as the UK package incorporates a reduction in VAT rates. In 2010 and 2011, consumer price inflation rises more significantly above the baseline in all economies. World inflation rises by 0.8 and 0.7 p.p., respectively, in 2010 and 2011, relative to the baseline. The impact is more significant in the US.

As would be expected, the packages imply a deterioration of the fiscal balance-to-GDP ratio relative to the baseline in 2009 and 2010. In 2011, reflecting the disappearance of the stimulus measures and the re-activation of the fiscal rule in NiGEM, the fiscal balance returns to levels close to the baseline. In general, the public debt-to-GDP ratio does not change much in the years 2009-11 relative to the baseline. This partly reflects higher GDP growth and inflation in the fiscal stimulus scenario which limit the increase in the debt ratio. Notwithstanding, the generalized fiscal expansion implies a rise in long term interest rates in all economies relative to the baseline (between 0.2 and 0.3 p.p.).

It is worth mentioning that both the fiscal packages scenario and the baseline scenario incorporate a large deterioration of fiscal balances and a considerable build-up of public debt, which mainly reflect

(15) Freedman *et al.* (2009) use the GIMF model to simulate the impact of the fiscal packages of euro area countries in euro area GDP growth, pointing to an estimate of 0.5 p.p. in 2009, which rises to 0.7 p.p. when considering spillover effects from the fiscal stimulus in the US and Japan. For 2010, the impact in the euro area GDP growth is negative (-0.2 p.p.) when taking into account fiscal packages only in euro area countries, but it becomes positive (0.3 p.p.) when spillover effects from other countries packages are considered. According to the authors, the fiscal package in the euro area is assumed to amount to 0.9 and 0.8 per cent of GDP, respectively, in 2009 and 2010.

the operation of the automatic stabilizers in the context of a quite severe downturn (Chart 4).[16] In fact, the deterioration in public finance indicators should be more marked than suggested in these two scenarios. On the one hand, the baseline scenario results from projections made in January 2009 and, since then, the projections for economic activity in 2009 have been revised downwards.[17] A more pronounced economic crisis implies, through the operation of automatic stabilizers, a bigger increase in fiscal deficits and public debt ratios than the one considered in the baseline scenario (and also in the fiscal packages scenario). On the other hand, financial sector support plans which have been announced were not incorporated in any of these scenarios but are also expected to contribute to the rise in public debt ratios, in particular in some economies. These increases in government debt may give rise to an adverse market reaction and trigger a rise in interest rate risk premia. This is the motivation for the scenario considered in the next section.

3.2. Scenario 2: Impact of fiscal packages combined with a risk premium shock

The deterioration of fiscal positions may prompt an increase in interest rate risk premia, reflecting rising risks of default or of inflation. In order to investigate the implications of this event, we augmented the scenario considered in the previous section with a shock on interest rate risk premium on government debt. We imposed an exogenous increase in the risk premium of 100 basis points in 2009-2011 in all economies. The calibration of the shock is in line with the empirical literature pointing to increases in the long run interest rates of 2 to 6 basis points when the government debt-to-GDP ratio rises by one percentage point (Freedman et al. (2009), Kinoshita (2006) and Laubach(2003)).[18]

The macroeconomic effects of the risk premium rise are relatively small when compared with the direct effects of the fiscal packages (Tables 6 and 7). The impact on world real GDP growth is reduced by 0.1 p.p. in 2009 and by 0.2 p.p. in 2010 compared to the scenario considered in the previous subsection, as the increase in risk premia reinforces crowding-out effects. In the euro area, GDP growth deviates from the baseline by +0.4 p.p. in 2009, by -0.4 p.p. in 2010, and -0.5 p.p. in 2011, which compares to deviations of +0.6 p.p., 0.0 p.p. and -0.4 p.p., respectively, in 2009, 2010 and 2011 in the scenario of the previous subsection. Regarding the impact on consumer price, the scenario with risk premia implies a less strong increase in world inflation relative to the baseline in the period 2009-2010. The fiscal balance worsens compared with the scenario of fiscal packages only, reflecting higher interest rate expenditures due to the risk premium and lower economic growth. This implies that all countries accumulate more government debt than in the scenario considering only the fiscal packages.

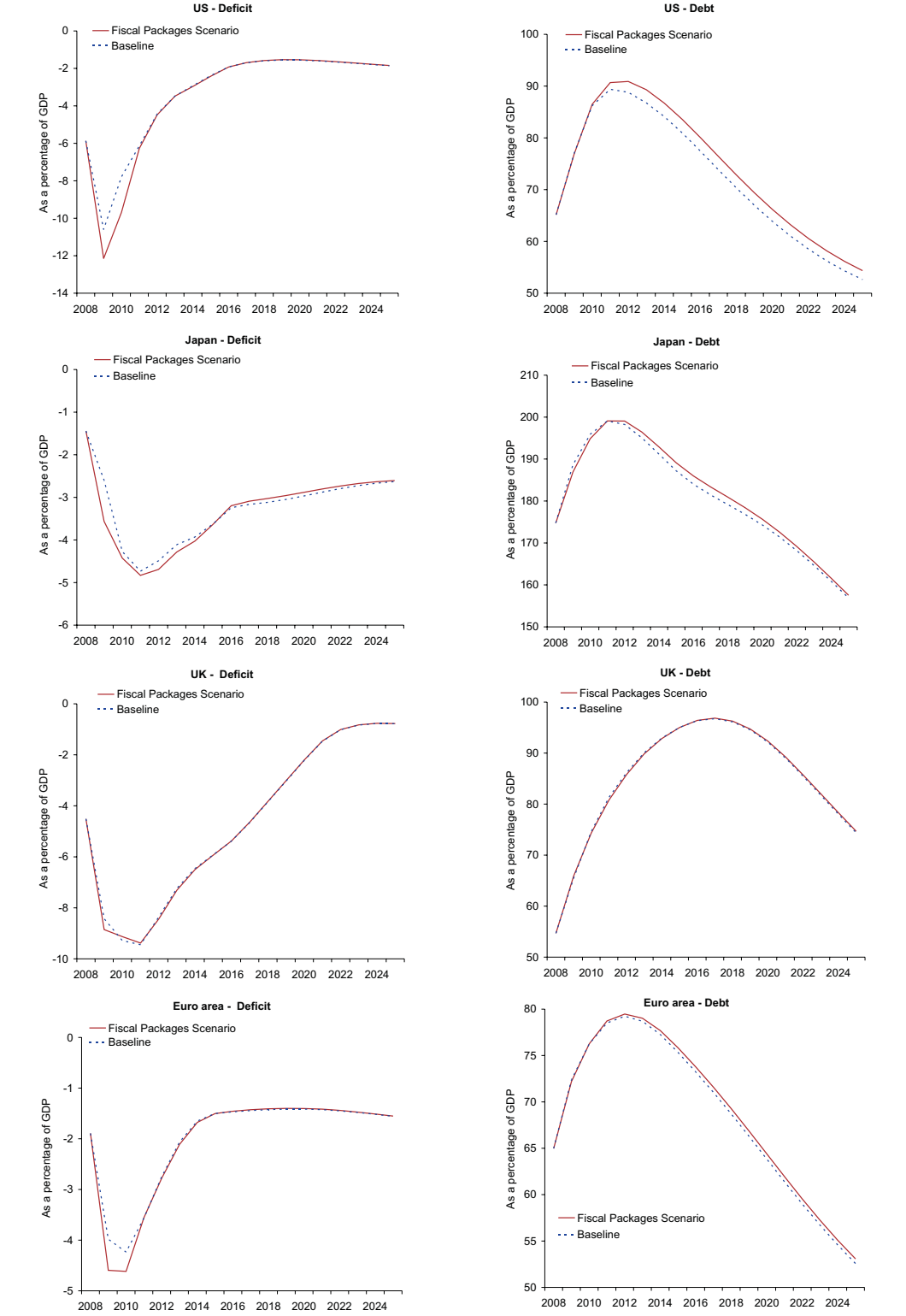
(16) The debt-to-GDP ratios start to moderate only after 2012 (2017 in the case of the UK) due to the operation of the fiscal rule in the model.

(17) In the baseline scenario, world GDP growth is estimate to stand at 0.5 per cent in 2009 and 1.7 per cent in 2010 (Holland *et al.* (2009)). The IMF, in its latest projections released in April 2009, considers that world economy activity will contract by 1.3 per cent in 2009 and recover to a growth rate of 1.9 per cent in 2010 (in January 2009, the IMF had forecasted world GDP growth to stand at 0.5 and 3.0 per cent, respectively, in 2009 e 2010).

(18) In the fiscal packages' scenario, government debt ratios increase between 2008 and 2012 by 15 p.p. in the euro area, by around 25 p.p. in the US and Japan and by roughly 30 p.p. in the UK. These increases would be higher if one took into account the likely downward revision to growth projections as well as the measures to support the financial sector announced in several economies. Public debt evolution in scenario 1 would result, according to the above rule, in a rise in interest rates ranging between 30 and 190 basis points, depending on the economy. We have chosen to consider an equal rise of 100 basis points in all selected economies.

Chart 4

GOVERNMENT DEFICIT AND DEBT-TO-GDP RATIO



Source: Authors' simulations based on NiGEM model.

Table 6

IMPACT OF THE FISCAL PACKAGES AND THE SHOCK TO RISK *PREMIA*

Percentage point deviations from the baseline

	Real GDP growth			Inflation			Fiscal balance (in % GDP)			Government debt [a] (in % GDP)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
US	1.2	0.1	-1.5	0.2	1.1	0.8	-1.7	-2.3	-0.5	0.0	1.1	2.7
Japan	0.9	-0.7	-0.6	0.0	0.2	0.1	-1.3	-0.8	-0.8	-1.2	0.7	2.8
UK	0.4	-0.5	-0.3	-0.6	1.0	0.1	-0.5	-0.1	-0.3	0.5	0.3	0.7
Euro area [b]	0.4	-0.4	-0.5	0.1	0.3	0.4	-0.7	-0.7	-0.3	0.0	0.8	1.4
World	0.5	-0.1	-0.6	0.1	0.6	0.4	-	-	-	-	-	-

Source: Authors' simulations based on NiGEM model.
Notes: (a) Maastricht definition for the euro area. (b) Impact of implementation of the fiscal packages of all euro area countries (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta).

Table 7

COMPARISON OF SCENARIOS

Scenario 2 (Table 6) minus Scenario 1 (Table 5), in p.p.

	Real GDP growth			Inflation			Fiscal balance (in % GDP)			Government debt [a] (in % GDP)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
US	-0.1	-0.2	0.1	0.0	-0.2	-0.3	-0.1	-0.4	-0.3	0.2	0.8	1.4
Japan	-0.2	-0.2	0.0	0.0	-0.1	-0.1	-0.3	-0.7	-0.7	0.6	1.8	2.8
UK	-0.2	-0.3	0.0	-0.1	-0.2	-0.3	0.0	-0.3	-0.3	0.1	0.6	1.2
Euro area [b]	-0.2	-0.3	-0.1	0.0	-0.1	0.0	-0.1	-0.3	-0.3	0.2	0.8	1.2
World	-0.1	-0.2	0.0	0.0	-0.2	-0.3	-	-	-	-	-	-

Source: Authors' calculations.
Notes: (a) Maastricht definition for the euro area. (b) Impact of implementation of the fiscal packages of all euro area countries (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta).

4. CONCLUSIONS

NiGEM simulations of the impact of the fiscal packages suggest that the announced measures can have positive but transitory effects on real GDP growth rates. The results show that the impact on output growth will be concentrated in 2009, implying a 0.6 p.p. increase in world GDP growth in that year. On the contrary, the impact on inflation will be mainly noticeable in 2010, when the rate of change of consumer prices at the world level rises by 0.8 p.p. relative to the baseline. As would be expected, fiscal balances deteriorate relative to the baseline, but the impact on government debt-to-GDP ratio is not significant in most cases. However, in both the baseline and fiscal packages scenarios, there is a strong deterioration in fiscal balances and a marked increase in public debt ratios. The deterioration in public finances ratios would be even more marked if one considered the impact of the downward revi-

sions to growth projections embedded in the baseline scenario (which dates from January 2009), as well as the measures to support the financial sector announced in several economies.

The expected deterioration of fiscal positions may cause a rise in interest rate risk premia, if it is seen as jeopardizing medium-term fiscal sustainability. In the event of a 100 basis points increase in the risk premia, the effectiveness of fiscal packages in raising GDP growth rates is reduced. World GDP growth is reduced by 0.1 and 0.2 p.p. in 2009 and 2010, respectively, compared to the scenario without rises in risk premia. Assuming a larger shock to the risk premium – which could be justified in a scenario of crisis, where macroeconomic uncertainty and non-linearities become more important – would imply a bigger loss in the effectiveness of the fiscal stimulus packages. This should act as a reminder of the importance of a credible commitment to long-run fiscal discipline.

REFERENCES

Barrel, R., T. Fic and I. Liadze (2009), "Fiscal policy effectiveness in the banking crisis ", *National Institute Economic Review* No. 207, January 2009.

Freedman, C., M. Kumhof, D. Laxton and J.Lee (2009), "The case for global fiscal stimulus", *IMF Staff Position Note*, March 2009.

Gomes, S., C. Martins and J. Sousa (2007), "The effects of monetary and technology shocks in three different models of the euro area", Economic Bulletin, Banco de Portugal, Summer 2007.

Holland, D., R. Barrell, T. Fic, I., I. Liadze, A. Orazgani and V. Pillonca (2009), "The world economy", *National Institute Economic Review* No. 207, January 2009.

IMF (2009a), *The State of Public Finances: Outlook and Medium-Term Policies after the 2008 Crisis,* January 26, 2009.

IMF (2009b), *The State of Public Finances-Outlook and Medium-Term Policies after the 2008 Crisis – Update*, February 19, 2009.

IMF (2009c), *Update on fiscal stimulus and financial sector measures*, April 26, 2009.

Laubasch, T. (2003), *New evidence on interest rate effects of budget deficits and debt*, Board of Governors of the Federal Reserve System, March 2003.

Kinoshita, N. (2006), "Government debt and long-term interest rates", IMF *Working Paper* 06/63.

OECD (2009a), "The effectiveness and scope of fiscal stimulus", OECD *Economic Outlook Interim Report*, March 2009.

OECD (2009b), "The effectiveness and scope of fiscal stimulus – Annex 1: Details of country fiscal packages", 17 March 2009, *mimeo*.

Annex 1

Simulation results assuming endogenous monetary policy

Table 1

FISCAL MULTIPLIERS (ASSUMING ENDOGENOUS MONETARY POLICY REACTION)

Per cent change in GDP in year 1 resulting from a 1 per cent of GDP fiscal expansion

	Increase in transfers to households	Government consumption increase	Government investment increase	Indirect tax cut	Personal income tax cut	Corporate tax cut
US	0.3	0.9	1.0	0.4	0.3	0.4
Japan	0.5	1.0	1.0	0.2	0.4	0.3
UK	0.1	0.6	0.7	0.1	0.1	-
Euro area [(a)]	0.2	0.7	0.8	0.2	0.3	-

Source: Authors' simulations based on NiGEM model.
Note: (a) Impact of implementation of measure in all euro area countries simultaneously (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta).

Table 2

DIFFERENCE BETWEEN FISCAL MULTIPLIERS (EXOGENOUS *VS* ENDOGENOUS)

Fiscal multipliers in Table 2 A (Main Text) minus fiscal multipliers in Table 1 (Annex)

	Increase in transfers to households	Government consumption increase	Government investment increase	Indirect tax cut	Personal income tax cut	Corporate tax cut
US	0.0	0.1	0.0	0.0	0.0	0.0
Japan	0.0	0.1	0.1	0.1	0.0	0.0
UK	0.0	0.1	0.0	0.1	0.0	-
Euro area [(a)]	0.0	0.0	0.0	0.1	0.0	-

Source: Authors' calculations.

Table 3

FISCAL MULTIPLIERS WITH COORDINATION (ASSUMING ENDOGENOUS MONETARY POLICY REACTION)

Per cent change in GDP in year 1 resulting from a 1 per cent of GDP increase in public consumption

	Acting alone (1)	Coordinated policy (2)	Gains from coordination (2)/(1) in %
US	0.9	1.1	16.1
Japan	1.0	1.2	22.4
UK	0.6	0.9	53.9
Euro area [a]	0.7	0.9	24.5

Source: Authors' simulations based on NiGEM model.
Note: (a) The first column presents the impact of the implementation of the measure in all euro area countries simultaneously (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta), while the second presents the impact of the implementation in all listed economies.

Table 4

IMPACT OF THE FISCAL PACKAGES (ASSUMING ENDOGENOUS MONETARY POLICY REACTION)

Percentage point deviations from the baseline

	Real GDP growth			Inflation			Fiscal balance (in % GDP)			Government debt [a] (in % GDP)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
US	1.2	0.2	-1.4	-0.1	1.0	1.2	-1.6	-2.0	-0.2	0.1	0.9	2.0
Japan	1.1	-0.4	-0.6	0.1	0.3	0.2	-1.0	-0.2	-0.1	-1.7	-1.2	-0.1
UK	0.5	-0.3	-0.3	-0.5	1.2	0.4	-0.4	0.0	-0.1	0.4	-0.1	0.0
Euro area [b]	0.6	0.0	-0.4	0.2	0.3	0.3	-0.6	-0.4	0.0	-0.2	0.0	0.2
World	0.6	0.0	-0.5	0.1	0.6	0.6	-	-	-	-	-	

Source: Authors' simulations based on NiGEM model.
Notes: (a) Maastricht definition for the euro area. (b) Impact of implementation of the fiscal packages of all euro area countries (except for Luxemburg, Slovenia, Slovakia, Cyprus and Malta).

Table 5

COMPARISON OF FISCAL PACKAGES' SCENARIOS (EXOGENOUS *VS* ENDOGENOUS MONETARY POLICY REACTION)

Impacts in Table 5(Main Text) minus impacts in Table 4 (Annex)

	Real GDP growth			Inflation			Fiscal balance (in % GDP)			Government debt [a] (in % GDP)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
US	0.1	0.1	-0.1	0.2	0.3	0.0	0.1	0.1	0.1	-0.2	-0.6	-0.7
Japan	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
UK	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	-0.2	-0.5
Euro area [b]	0.0	0.0	0.0	-0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
World	0.0	0.0	0.0	0.0	0.2	0.1	-	-	-	-	-	-

Source: Authors' calculations.

Annex 2

Multipliers from other Macro-Models

The Table below presents simulation results from diverse macro-models for the US and the euro area.[19] The structure of the macro-models surveyed can be very different, with considerable variation in underlying assumptions. In some cases the design of the simulations differs across models, which may affect the comparability of results. These caveats may help explaining the large diversity in fiscal multipliers estimates. For the US, simulation results from the macro-models surveyed point to government expenditure multipliers in the range between 0.8 and 1.8. The personal income tax multipliers are lower, standing between 0.2 and 0.4. The results for the euro area are qualitatively similar (between 0.6 and 1.5 and between 0.3 and 0.5, respectively for a public consumption increase and a personal income reduction).

FISCAL MULTIPLIERS FROM OTHER MACRO-MODELS

Per cent change in GDP in year 1

	Model name	Interlink [a]	FRB- US [b]	MULTIMOD [c]	GIMF [d]	*Memorandum item*: NiGEM
US	*Model proprietor*	*OCDE*	*FRB*	*FMI*	*FMI*	*NIESR*
	Gov't expenditure	1.1	1.4	0.8	1.8	1.0
	Personal income tax	0.4	0.4		0.2	0.3

	Model name	AWM [e]	*Interlink* [a]	QUEST [f]	QUEST III [g]	MULTIMOD[h]	*Memorandum item: NiGEM* [i]
Euro area	*Model proprietor*	*ECB*	*OECD*	*EC*	*EC*	*IMF*	*NIESR*
	Gov't expenditure	1.1	1.2	0.9	0.6	1.5	0.8
	Personal income tax	0.3	0.5				0.3

Notes and Sources: (a) INTERLINK The simulations are based on a sustained increase in real government non-wage expenditures worth 1 per cent of baseline GNP an on a personal income tax cut worth 1 per cent of GDP (drop in wage and salary tax rate). Real interest rates are held at their baseline level and nominal exchange rates are fixed. Source: Dalsgaard *et al.* (2001), "Standard Shocks in the OECD Interlink Model," OECD Economics Department Working Papers 306, OECD Economics Department. (b) FRB-US The shocks relate to a permanent increase in federal government purchases of goods and services equal to 1 percent of GDP and a permanent decrease in federal personal income taxes equal to 1 percent of GDP ex ante. Constant interest funds rate was assumed. Source: Reifschneider, D., R. Tetlow, and J. Williams (1999), "Aggregate disturbances,monetary policy, and the macroeconomy: The FRB/US perspective", Federal Reserve Bulletin, 1/1/1999. (c) MULTIMOD The simulation is that of a permanent increase in government consumption expenditure of 1% of baseline GDP. Standardised fiscal and monetary rules. Source: Mitchell *et al.* (1998), "Comparing global economic models", Economic Modelling 15 1998. (d) GIMF The shocks area are temporary fiscal expansions (government productive investment and labour income taxes) calibrated to deliver a primary deficit that is 1% above the baseline in year 1 and 0.5% above baseline in year 2. Interest rates are held constant for the initial two years. Source: IMF (2008), World Economic Outlook, Chapter 5, Fiscal Policy as a Countercyclical Tool, October 2008. (e) AWM The simulations are based on a temporary increase in government purchases of goods and services or a decrease in personal income tax, worth 1 per cent of baseline GNP. Interest rates, exchange rates and fiscal policy variables were left exogenous. Source: Henry et al (2004), "The short-term impact of government budgets on prices: Evidence from macroeconomic models", ECB Working Paper Series, No. 396 / October 2004. (f) QUEST The fiscal shock relates to a 1% of GDP rise in government spending in the first year. During the first year the model's normal policy reaction functions are switched off. The results relate to the aggregation of individual national fiscal shocks in France, Germany and Italy. Source: Wallis, K.F. (2004), "Comparing Empirical Models of the Euro Economy", Economic Modelling, Volume 21, Issue 5, September 2004, Pages 735-758. (g) QUEST III The fiscal shock relates to a 1% of GDP rise in government spending in the first year. Normal monetary policy reaction function. Source: Ratto *et al.* (2008), "QUEST III An Estimated Open-Economy DSGE Model of the Euro Area with Fiscal and Monetary Policy," European Comission Economic Papers 335, July 2008. (h) MULTIMOD The fiscal shock relates to a 1% of GDP rise in government spending in the first year. During the first year the model's normal policy reaction functions are switched off. Source: Hunt and Laxton (2003), "Some Simulation Properties of the Major Euro Area Economies in MULTIMOD", IMF Working Papers 03/31. (i) Authors' simulations based on NiGEM model.

(19) See also OECD (2009a), which contains a box surveying simulation results from various macro-models for OECD countries. Short term fiscal multipliers based on all large-scale models surveyed (and all countries) range from 0.6 to 1.9 for government consumption, from 0.1 to 1.1 for personal income tax cut, from 0.1 and 0.5 for corporate tax cut and from 0.0 to 1.4 for indirect tax cuts.