HOW DIFFERENT ARE THE FISCAL POLICY EFFECTS?
ASSESSING THE IMPORTANCE OF CYCLICAL SITUATION, POLICY COORDINATION, COMPOSITION OF POLICY MEASURES AND COUNTRY-SPECIFIC FEATURES

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It is well-known that estimates of fiscal policy effects differ a lot. In this paper we try get some idea of the magnitude of these differences and the underlying reasons for these differences. In the European Monetary Union we face wide cross-country differences in fiscal institutions and key fiscal parameters, some of which may also vary over time (business cycle). Moreover, these effects may also depend on trade spillover effects and thus on the extent of policy coordination. Our empirical analyses make use of data for 15 EU countries, mainly for the period 1970-2011. The results clearly indicate that fiscal multipliers are much larger during economic recessions. By contrast, the policy coordination-effects appear to be more homogenous, although it turns out that small countries may benefit more from coordination. Still, cross-country differences seem to dominate these average features of the results.

Keywords: fiscal policy, policy coordination, government deficit, EMU

Fiscal policy in the EU faces a number of challenges. In the first place there are longer run pressures due to ageing and to the competition from countries such as China with low wage rates and

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seemingly abundant labor reserves. Second, several structural problems in terms of the function of the labor markets, production of public services and changing the industrial structure of the economy have hindered economic growth. Finally, the recent financial crisis has shown the vulnerability of the fiscal position of several EU countries due to problems of banking crisis, loss of competitiveness in the foreign trade, and an inability to control public expenditures and revenues.

We often pretend that we know pretty well how fiscal policies affect the economy, but if we spend some time in figuring out what are really the right values we easily find some problems. Although a simple Keynesian textbook model seems to give an unambiguous answer we have keep in mind that even that model provides different set of results depending on openness of the country, exchange rate arrangements and monetary policy not to speak about possible capacity constraints in terms of labor and capital. Government budget constraint makes also a lot of difference even in the case where we do not literally demand a balanced budget. The case becomes much more complicated if we consider intertemporal extension of the model and deal with expectations and beliefs. Another sort of complications is caused by possible time-invariances of basic relationships. The effect of policies can be very different in the case of normal times and great depressions when consumers and firms face more stringent budget and liquidity constrains due to rationing e.g. in the labor market. So even without the possibility of things like debt neutrality we would end up with a large menu of possible values for fiscal parameters (see e.g. Bénassy-Quéré *et al.* (2010) as a useful summary of the basic models and their properties).

It is not only the economic environment which makes the difference. Also the way of modeling the fiscal policy transmission mechanism shows up in the results. The most striking example is a prototype DSGE model into which the debt neutrality property is typically imposed. Even though we may soften the impact of debt neutrality in the short run this property dominates in the long-run. Thus it is really no point of using a DSGE model to evaluate the size of the fiscal multiplier unless one wants just to demonstrate the properties of some specific model. Other models are not, of course, free of this kind of *a priori* constraints. Already the way in

which long-run growth is modeled is important. In other words the question is, do we only model deviations from equilibrium growth path or actual growth.

Clearly, we need up-to-date estimates of the effectiveness of fiscal policy in different countries and different times. As for the size of the multipliers, we have several estimates which at least point roughly to the same direction; see Giavazzi and Pagano (1990), Blanchard and Perotti (2002), Romer and Romer (2010), Coenen *et al.* (2010), Barro and Redlick (2011). Of these, Romer and Romer (2010) and Giavazzi and Pagano (1990) represent the two extremes whereas the others come close to one in the short run and converge to zero in the long run. Because the underlying models are so different, this comparison is not fair but even so the truth is that the differences are strikingly large. This is also confirmed by a recent meta data study by Gechert and Will (2012).

It is more difficult to say whether the multipliers are time-invariant. Then at least from a single country perspective the most compelling question is, whether the fiscal multipliers are the same in booms and recessions. We already have quite fair amount of evidence that the multipliers are not constant; see Auerbach and Gorodnichenko (2012) for striking differences between boom and bust values. Ilzetzki *et al.* (2011) and Corsetti *et al.* (2012) provide ample evidence of violations of invariance, especially in terms of exchange rate arrangements, level of debt and financial crises. It is also evident that the composition of taxes and spending can make a big difference Alesina and Perotti (1997) as can the manner in which the fiscal actions are carried out (gradual or one-for-all changes in relevant policy parameters; see IMF, 2010; Broadbent and Daly, 2010).

Another issue that remains largely unexplored concerns policy coordination: how much of a difference does it make if certain types of policies are pursued in several countries instead in a single country? Of course we know something of the consequences of policy coordination (see e.g. Branson *et al.*, 1990; Canzoneri and Minford, 1988; Kehoe, 1987-1988; Oudiz and Sachs, 1984; Rogoff, 1985) for some key references and Bénassy-Quéré *et al.* (2010) for a nice summary of basic results), but we know little of the empirical facts. This is mainly due to the difficulty of evaluating the benefits from coordination. We would really need a multi-country model

to obtain the relevant estimates. Unfortunately, we have relatively few models that can be used for this purpose. In this study we tackle this problem by using (in addition to a multi-country structural model) a set of reduced form models that include cross-country dependencies.

Thus far, the EU has not attempted fiscal coordination in the strict sense – there are no directives telling the member states how fiscal policy is to be set as part of some annual "plan" – albeit we do have what the European Commission (2002) describes as "weak co-ordination" *via* the Broad Economic Policy Guidelines (BEPG). There are also rules on budgetary balances laid out in the SGP (described by the European Commission (2002) as "strong co-ordi-nation"). The BEPG has no legal force and relies on peer pressure for the achievement of budgetary balance. In contrast, the SGP has in principle some coercive powers but in fact no penalties have been imposed despite a deluge of breaches, and the whole pact has become a dead letter. The new 2011 Treaty (European Union, 2011) on stability, coordination and governance promulgates a definite change in the degree of coordination (even though it cannot be characterized as coordination but rather an attempt to speed up convergence) and creates the potential for a full convergence of fiscal policies. This treaty may also signal a convergence to a fiscal union in which government debt would be common to the union and some taxes could be federalized.

Here, we do not consider these presumably remote possibilities but concentrate instead on more technical findings on effects of coordinated fiscal policy effects. When we do this, we have to use historical data to estimate the relevant parameters. And then we have a problem which sounds like the Lucas critique. It boils down to questions such as: can we assume that the historical data just reflect purely non-coordinated fiscal policies in different countries and can we assume that the structure and parameters of the models is invariant in terms of the degree of policy co-ordination. These are tough questions and it is not at all obvious that the answer is yes.

All in all, the contribution of the paper is in the joint analysis of asymmetries in fiscal multipliers and policy coordination. Thus, we want to extend the single-country analysis towards an open-economy setting. In addition to these issues, also the nature of

cross-country differences (e.g., small vs. large countries) is scrutinized in the paper. Several different models are used to ensure that the results are not just model-specific. Model comparisons may also tell something about the level of uncertainty that is caused by the choice of the particular model. We try to get a reasonably good idea of the range of values of the relevant fiscal policy effects. If nothing else, this range may be used in assessing the nature of optimal policies in the Brainard uncertainty framework (Brainard, 1967). In the empirical analysis, we use data even up to 2012 and thus we can control the effects of the recent financial and debt crisis.

The structure of paper is straightforward. In section 1, we scrutinize the simple VAR model estimation results, mainly to quantify the cross-country differences and possible cyclical asymmetries (1.1), then make use of the multi-country model of the NIESR called NiGEM to examine the dependence of multipliers on country size and coordination (1.2), after which we use the IMF (2010) model to compare different consolidation strategies and also to scrutinize the asymmetry and coordination effects within this model (1.3). Finally we use the simple structural equations (reaction functions) for different fiscal variables to test for the asymmetry (invariance) property. Some concluding remarks follow in section 2.

1. Empirical analyses

1.1. Time-series analysis

In analyzing the nature of asymmetry and coordination effects we used a set of slightly differing models to ensure that the results are reasonably robust in terms of model specification. As pointed out above, first we use relatively simple three-variable VAR models. Then we turn to the NiGEM multi-country model, to estimate the multipliers and scrutinize the effects of policy coordination. As an alternative to NiGEM we employ the recent IMF model (IMF, 2010) which is also used in Stehn *et al.* (2011) with the data from Devries *et al.* (2011). To examine the asymmetry issue, we also estimate a set of simple nonlinear (threshold) models for main fiscal variables from the data set of EU countries (using the same approach as in Mayes and Viren, 2011).

As a start, we specify and estimate a simple VAR model that has been used e.g. in Viren (2000). Our aim is not so much to get new multiplier estimates but rather to get an idea of the nature and magnitude of cross-country differences in fiscal policy transmission mechanisms. For this purpose, we estimated a three-variable VAR with output growth (DY), the real interest rate (RR) and the deficit-GDP ratio (DEF). Impulse responses were computed by the Cholesky decomposition (using variables the above ordering). The panel-data-based IRF values for 10 periods are presented in Figure 1 (estimates are based on annual data from EU15 countries for the period 1971-2011). We also estimated the models for each single country and computed average values for the impulse response functions. In the latter case, the results were virtually identical to the results illustrated in Figure 1; to save space we do not show them here.

Figure 1. Selected impulse responses from panel data

Response to Cholesky One SD Innovations ± 2 SE
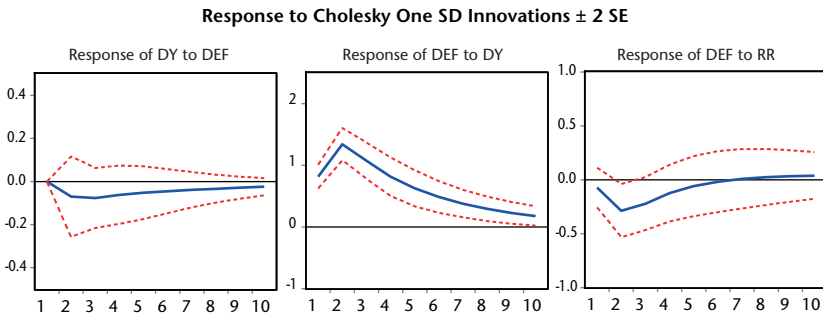
These are derived from a three-variable VAR that is estimated from cross-country panel data. The data consist of 15 EU countries and cover years 1971-2011.

By and large, the IRFs make sense in indicating that fiscal contraction does indeed reduce output substantially, though the multiplier appears to be less than one. On the other hand, a one percentage point (positive) shock to GDP growth increases the surplus to GDP ratio by more than a half percentage point in the short run. It is interesting to compare the IRFs over countries, especially because they appear to differ hugely for certain variables. This is especially true for the effect of government surplus/deficit on GDP growth. The average value of the correlation coefficients is practically nil (0.011). Slightly higher values are obtained for the correlations for real interest rate effects on output growth (0.145)

and real interest rate effects on government deficit (0.269) but only for the impulse responses of government deficit to output growth do we see reasonable similarity (the average value of IRF correlations is 0.779).

Clearly, the results tell us that fiscal policy transmission mechanisms do indeed differ widely as they reflect deeper differences in fiscal institutions, fiscal rules and structure of the economy. Again this fact emerges in the end of section 1.4 (Figure 8).

As for the sizes of the fiscal multipliers, they appear to be relatively small and time-variant. In this respect they are quite similar to those in Corsetti *et al.* (2012) who in summarizing their evidence point out "Output multipliers are virtually zero in our baseline" (p. 533). Indeed, when we estimate the value from the panel data representation for $\Delta y > 0$, the maximum value of the cumulative response multiplier is only 0.11. But when we scrutinize the negative values of output growth, $\Delta y < 0$, the corresponding maximum value of the multiplier is actually 1.18, which is obviously close to the "standard" value.[2,3]

1.2. Multi-country model simulations

To assess the importance of policy coordination for policy effectiveness we used the NiGEM multi-country model to compare the effects of different fiscal policy actions in the single country setting and in the case of collective policy action.[4] In the simulations public consumption was first increased in all EU countries in an un-coordinated way (country-by-country).

In all cases the coordinated fiscal expansion produces an almost twice as large increase in output as does an uncoordinated fiscal expansion in the form of an increased volume of government consumption (Figure 2). As expected we find that, with uncoordi-

2. See Bénassy-Quéré *et al.* (2010) for more extensive comparison.

3. In comparing fiscal multipliers, we have to be somewhat cautious because some of them are based on the level of income, some on the growth rate of income and some on output gap which itself can computed in several different ways.

4. NiGEM is an estimated quarterly New-Keynesian macro model for almost all OECD countries and country blocks outside OECD (NIESR (1999). In evaluating the effects of fiscal policy, an obvious analytical framework is provided by (structural) VAR models (see Blanchard and Perotti,2002; Dalsgaard and De Serres,1999; Viren, 2000 and Ilzetzki *et al.*, 2011). But because we concentrate here on the policy coordination problem, structural multi-country models are more convenient.

nated policy actions, small countries are not able to achieve much (mainly because of import leakage).

Figure 2. Maximum effects of a one per cent increase in public consumption on GDP with and without policy coordination
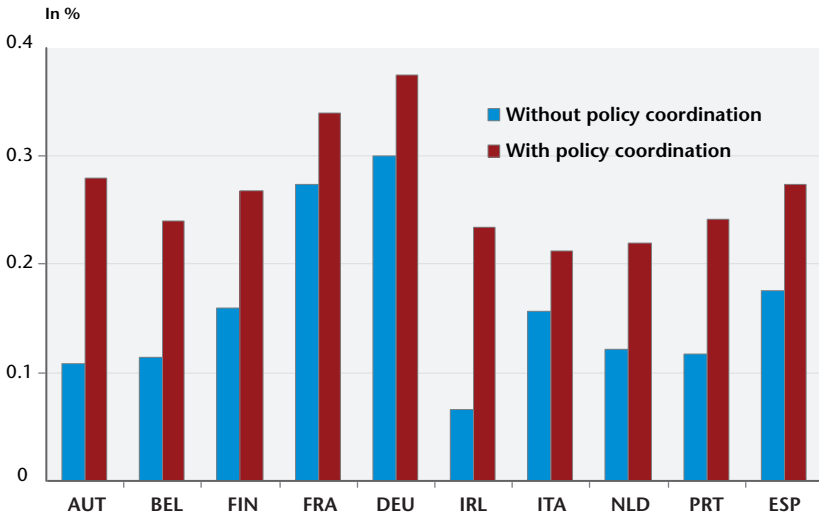
Source: NiGEM model simulations.

   The multiplier values for uncoordinated fiscal policy effects in small countries are generally only about 0.5. For large countries, the values exceed unity but only slightly. The average value for all countries is 0.72 (with four lags) and 0.63 (with eight lags), and the average maximum value is 0.85. With coordinated policies, there is not much difference between small and large countries; the average multiplier value is 1.25 (with four lags) and 1.17 (with eight lags), and the average maximum value is 1.46. This represents an improvement for all countries, but especially for the smaller ones. The multiplier values (in the coordination case) are in fact quite close to the values obtained by Cohen and Follette (1999) with the US FRB/US macroeconomic model.[5] By and large

5.   The Cohen and Follette (1999) value for US data (with four lags) was 1.23 which may be compared with our average EMU10 value of 1.25. When the tax rates were set to zero in the FRB/US model the multiplier increased to 1.35, which indicates how much (or how little) automatic stabilisers will affect the multiplier. Interestingly the multiplier value of 1.25 implies a relatively small marginal propensity to consume. Assuming the average tax rate is 0.4 we come to a marginal propensity to consume of about 0.3 only (or 0.4 if we account for imports).

they agree with the more recent DSGE model predictions (see Coenen *et al.*, 2010 and Freeman *et al.*, 2009). The Coenen *et al.* (2010) paper compares the results for different models while the Freeman *et al.* (2009) paper mainly compares the results for different countries using the IMF multi-country model.

The values are a bit higher than the original SVAR values obtained by Blanchard and Perotti (1999), which are close to one. More recent analyses by Ilzetzki *et al.* (2011) with data from 45 countries find values which clearly encompass our predictions (their multiplier values are very different for closed and open economies as well as for fixed and flexible exchange rate countries). The multiplier values in the uncoordinated case are, of course very low (suggesting that the marginal propensity to spend out of income is very low and the income elasticity of imports is very high), but even for coordinated fiscal policies the multipliers are not particularly high, although they clearly indicate fiscal policies effectiveness. Note also that for coordinated policies the output effect diminishes more rapidly than for coordinated policies.

The effect of an increase in public consumption on government deficits is almost equally clear. Deficits increase, but because output also increases the effect on the deficit-GDP ratio differs from the pure deficit effect. The values for various countries are surprisingly different, reflecting the differences in output effects. In other respects, it is difficult to know why the country results differ so much (the country size and the public sector size do not seem to explain the magnitudes of the output and deficit effects).

As noted earlier, gains from coordination seem to be much larger for small countries (Figure 4) whereas large countries may manage well without coordination because of their higher multiplier values (Figure 3). This accords of course well with the textbook analysis of fiscal policy (the same result is obtained by Ilzetzki *et al.*, 2011). This country-size relationship obviously creates different incentives for small and large countries vis-à-vis policy cooperation and has interesting political economy implications for fiscal policy.

So far, we have considered only public consumption but the picture for direct taxes is very similar. Coordination makes great difference in output effects but the results are less clear for the

Figure 3. Country-size and effectiveness of fiscal policy
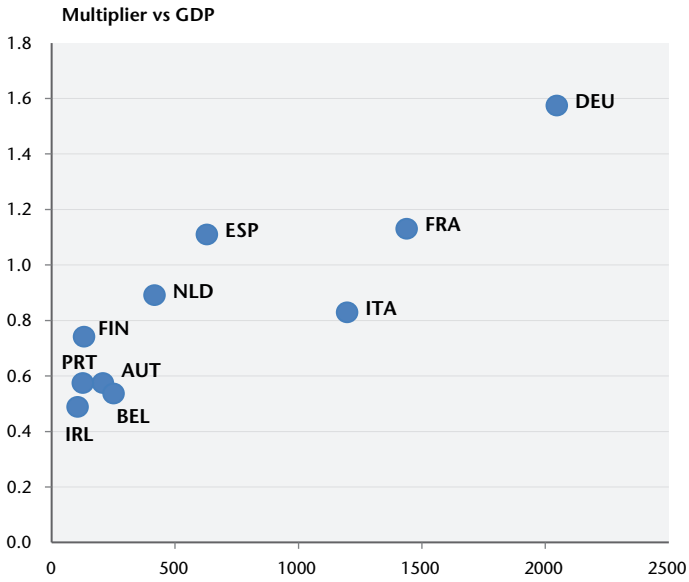
Multiplier vs GDP

Values on the y-axis represent short-run (4-quarter) multipliers. GDP values (x-axis) are for year 2000.

Figure 4. Country-size and benefits of coordination

Coordination vs GDP
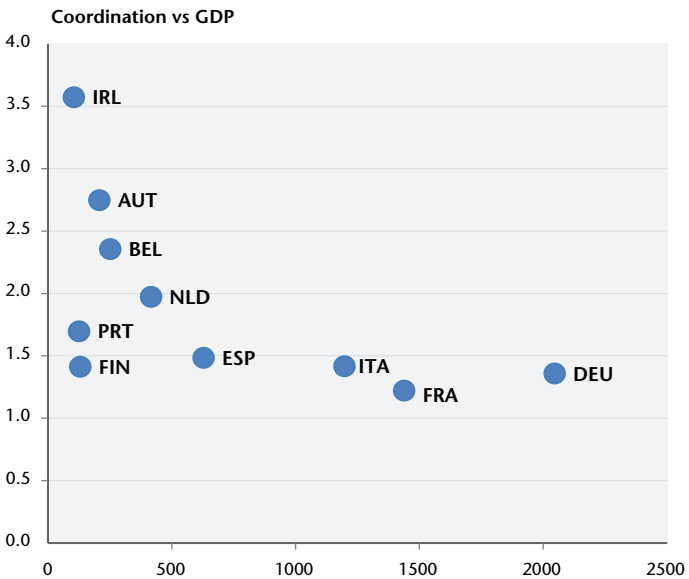
The y-axis indicates the ratio between the multipliers with coordinated and uncoordinated fiscal policies.

deficit-GDP ratio. The problem is with the output effects. When taxes are increased, output and income decrease, which eliminates part of tax revenues and – *ceteris paribus* – increases the deficit-GDP ratio because of lower output.

When dealing with fiscal policy simulation, an obvious question is what happens to interest rates. The answer provided by the NiGEM model is "not very much'. Thus, imposing the inflation targeting assumption for monetary policy produces only a five basis-point increase in long rates, with coordinated policies. In the case of uncoordinated policies, the result is virtually nil. This latter result obviously contrasts sharply with all the theory on credibility and peso effects (but not necessarily with empirical evidence; see *e.g.* Alesina *et al.*, 1992). The problem is that (with all models) it is difficult to account for direct expectations and portfolio effects. This weakness may also be crucial with regard to the assessment of policy coordination effects within the EU.

The implication of these results is interesting. On the one hand they show that it is the small countries that have most to gain from policy coordination. However, one can reverse the argument and say that the other countries have the least to lose if it is small countries which do not achieve a high level of coordination. Historically, coordination among the EU countries has been fairly weak except for the countries that track the Deutschemark. There will therefore have to be a considerable change in behavior if this is to occur in future. The (old and new) SGP may have only a limited effect here since limiting the size of deficits is only part of the problem. Indeed it is only when fiscal policy is not coordinated that this is likely to be a problem, as such anomalies occur mainly when small countries experience asymmetric shocks. Of course, small countries may have comparative advantage with other policies, take for instance wage policy.

1.3. The composition of fiscal policy measures

Now, we turn to the IMF (2010) model, which is basically a simple reduced form equation where the dependent variable is output growth and the right-hand-side variables consist of fixed country and time effects as well lagged output growth and fiscal consolidation indicators constructed separately for tax-based consolidation programs, spending-cuts-based programs and

combined consolidation programs. All of these are expressed in terms of GDP. One might argue that these data are more reliable than the conventional measures, based on the cyclically-adjusted primary balance.[6] This model has been estimated by several authors and institutes (e.g. Stehn *et al.*, 2011, and Alesina and Ardagna, 2012) using OECD data for 1979-2009. Using the original model as a point of reference, we write the estimating equation as:

$$\Delta y_t = a_0 + a_1 \Delta y_{t-1} + a_2 \Delta y_{t-2} + a_3 Fiscal_t + a_4 Fiscal_{t-1} + a_5 Fiscal_{t-2}$$
$$+ \textit{fixed time and cross-section effects} + u_t, \tag{1}$$

where y denotes log GDP, and Fiscal the size of fiscal consolidation – either in the form of taxes, spending cuts, or in total – all in terms of GDP. The set of equations is estimated in a panel data setting with a fixed effects specification. In the reported versions all country coefficients are set equal.

This set of equations was also re-estimated in our study with the most recent data set, 1970-2011, and the corresponding impulse responses are illustrated in Figure 5. As pointed out in the introduction, the most controversial result clearly comes from this set of impulse response functions: taxes hurt much more than spending cuts. Obviously, there are several reasons for this striking result, ranging from monetary policy effects to labor markets, importance of foreign trade and so on (see Alesina *et al.*, 2012). Here we are not, however, interested in challenging the basic results but in extending the testing equation to the open-economy setting in which several countries pursue (in a coordinated manner) similar fiscal policies and, further on, where the cyclical asymmetries are allowed to affect the estimates.

Equation (1) as such does not allow us to analyze the effects of policy coordination because the use of fixed effects makes foreign output exogenous. The nature of this effect comes clear when we compare the estimated fixed time effects with World GDP represented by the combined sum of sample country GDP's. Correlation between these two time series is as high as 0.94! Quite clearly, the fixed time effects correspond to the (omitted) World GDP! Of

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6. These two alternative measures are compared by Guajardo *et al.* (2011). They find several weaknesses in the conventional measure and also that the measure may have a biased tendency to produce expansionary output effects for fiscal consolidation.

course, World GDP is not exogenous but equals the sample countries' GDP, so that we can respecify the basic model (1) as equation (2):

$$\Delta y_t = a_0 + a_1 y_{t-1} + a_2 \Delta y_{t-2} + a_3 \Delta y_{W,t-1} + a_4 Fiscal_t + a_5\ Fiscal_{t-1}$$
$$+\ fixed\ effects + u_t$$
$$with\ y_{W,t-1} = \Sigma b_i y_{it-1,} \tag{2}$$

where the b_i's are country weights. The estimation results for equations (1) and (2) are reported in Table 1. A comparison of tax and spending simulations (impulse response functions) is shown in Figure 6.

**Table 1. Estimation results with cross-country data 1970-2009**

	1	2	3	4	5	6	7
Δy_{-1}	0.509	0.479	0.487	0.558	0.498	0.482	0.490
	(7.83)	(7.57)	(7.81)	(7.53)	(7.81)	(7.62)	(7.77)
Δy_{-2}	-0.122	-0.073	-0.086	-0.238	-0.099	-0.089	-0.108
	(1.46)	(1.30)	(1.50)	(3.94)	(1.70)	(1.59)	(1.87)
Fiscal	-0.337	-0.632	-0.298	-0.557	-0.245	-0.618	-0.277
	(1.86)	(3.18)	(2.86)	(2.25)	(1.55)	(3.11)	(2.45)
Fiscal$_{-1}$	-0.016	-0.456	-0.166	-0.062	0.082	-0.419	-0.057
	(0.54)	(2.00)	(1.24)	(0.24)	(0.58)	(1.87)	(0.48)
Fiscal$_{-2}$	0.223	0.130	0.235				
	(2.04)	(0.69)	(2.05)				
Δyw_{-1}				0.378	0.403	0.402	0.402
				(3.51)	(1.62)	(1.62)	(1.61)
R^2	0.706	0.689	0.686	0.370	0.352	0.346	0.351
SEE	1.332	1.363	1.372	1.883	1.393	1.365	1.381
DW	1.95	1.96	1.95	1.76	1.93	1.58	1.93
Fiscal	spend	tax	total	tax	spend	tax	total
Fixed effects	cf+tf	cf+tf	cf+tf	cf	cf+tr	cf+tr	cf+tr

Cf. Indicates fixed cross-section effect, tf fixed time effect, and tr in turn indicates random time effect. ΔyW is the growth rate of World GDP. Numbers inside parentheses are t-ratios. The dependent variable is the growth rate of GDP. In constructing the World variable, we used GDP weights although equal weights did make a dramatic difference. D|Δy<0 equals 1 if output growth is negative. All estimates are (nonlinear) Least Squares estimates.

The qualitative nature of results in terms of different consolidation strategies remains the same as with the simple fixed effects model, although the numerical values are somewhat different. But the interesting feature in these results is the outcome for policy coordination. As can be seen from Figure 5, policy coordination pays off; the long-run impact of consolidation is slightly more

than two times bigger for coordinated policies – both with tax or spending-cut policies. In this respect, the results are quite similar to the NiGEM model results.

Figure 5. Effect of fiscal policy coordination on GDP

In %

Spending, no coordination

Spending, coordination

Taxes, no coordination

Taxes, coordination
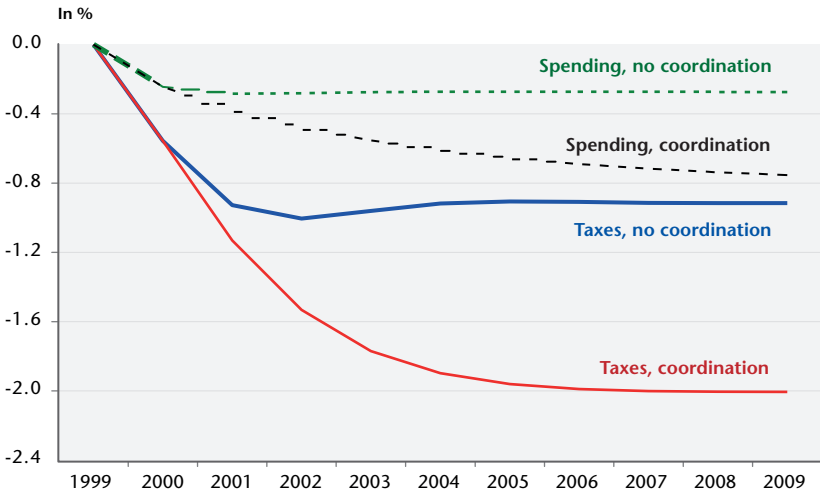
Values are based on equation (2).
Source: Author's estimates

Figure 6. Effect of spending cuts and taxes on GDP

In %

■ Spending cuts
■ Taxes increases
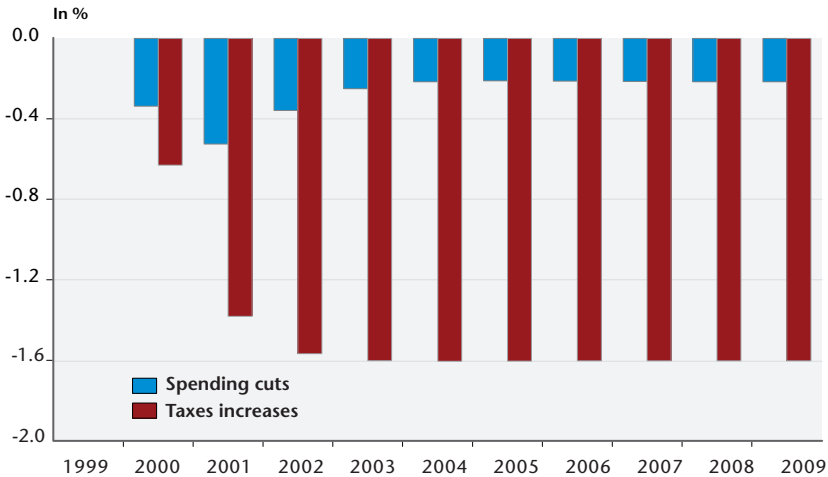
Source: Author's estimates

1.4. Analysis of cyclical sensitivity

What about asymmetry with the IMF model? We tried to get an answer by using a simple threshold model structure that entitled two regimes for the fiscal consolidation effort, depending on whether GDP is increasing or decreasing. That is illustrated with simple threshold-type model estimates that are reported in Table 2. We use both a very simple single threshold for zero output growth rate, a multiple threshold with "corridor" between zero and 2 per cent output growth rates and, finally, a smooth transition threshold model (3) where the smoothing is done by a simple logistic function.[7] The parameters are selected so that they minimize the sum of squared residuals.

$$\Delta y_t = a_0 + a_1 \Delta y_{t-1} + a_2 \Delta y_{t-2} + a_3 Fiscal_t + a_4 Fiscal * (1/(1+e^{(-a5\Delta yt - a6)}))$$
$$+ \textit{fixed time and cross-section effects} + u_t, \tag{3}$$

The result of these tests is strikingly clear. In "normal times" consolidation hurts very little whereas in economic depression the costs are very high irrespectively of the way consolidation is carried out. In fact, the coefficients of the linear "Fiscal" terms are not even statistically significant in the simple threshold specification, which also reflects the fact that in "good times" fiscal consolidation may not become overwhelmingly costly (in very good times (column 4), the cost is practically nil). Although the empirical evidence on asymmetry is not very compelling, here it nevertheless points in the same direction as the results of previous analyses and other analyses in this paper.

In our final attempt to measure the cyclical sensitiveness of fiscal policy parameters we estimate fairly simple deficit reaction equations from cross-country data. Here we deal with the following common specification for a set of fiscal variables (deficits, expenditures and revenues):

$$def/y = b_0 + b_1 def_{-1}/y_{-1} + b_2 \Delta y^- + b_3 \Delta y^+ + b_4 r + b_5 D_{-1}/y_{-1} + u \tag{4}$$

where *def* refers to the general government balance metric (positive values for surpluses and negative for deficits), D refers to ratio of general government debt to real GDP, y, and r the real interest rate (government bond yield minus inflation); u is an error term.

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7. Those values (0, 2.0) minimize the sum of squares.

Equation (1) provides a characterization of fiscal behavior so that it reflects both automatic stabilizers and possible fiscal authorities' reactions. This kind of equation is often used in cross-country comparisons (see e.g. Mélitz, 1997; Buti and Sapir, 1998) because the main differences can be expressed by some key parameters that can be easily estimated. (4) is a straightforward example of a threshold model, where, in this case, the threshold is applied to the growth rate of GDP Δy. Thus, we have two regimes according to Δy (for positive (and negative) values of output growth denoted by Δy^+ (and Δy^-)); here it is assumed that only the coefficient of the output growth variable changes with a regime shift.

Table 2. Analysis of cyclical sensitivity of parameters

	1	2	3	4	5	6
Δy_{-1}	0.475 (7.50)	0.465 (7.48)	0.459 (9.31)	0.449 (9.82)	0.442 (7.02)	0.475 (7.04)
Δy_{-2}	-0.085 (1.46)	-0.065 (1.16)	-0.084 (1.83)	0.045 (1.61)	-0.071 (1.20)	-0.186 (3.13)
Fiscal	-0.064 (0.52)	-0.256 (1.36)	-0.116 (1.04)	-0.358 (2.05)	-1.180 (3.27)	-1.783 (6.98)
Δyw_{-1}						0.386 (3.72)
Fiscal* D|Δy<0*	-0.647 (1.81)	-1.428 (3.04)	-0.641 (3.36)	-0.471 (2.11)		
Fiscal* D|Δy>2				0.455 (2.22)		
Fiscal*ST					1.353 (2.98)	2.523 (7.88)
R^2	0.680	0.695	0.690	0.697	0.695	0.416
SEE	1.382	1.348	1.161	1.347	1.349	1.814
DW	1.95	1.97	1.95	1.95	1.95	1.68
Fiscal	spend	tax	total	total	total	total
Fixed effects	cf+tf	cf+tf	cf+tf	cf+tf	cf+tf	cf

The data and the notation is the same as in Table 1. D\|Δy<0 equals 1 if output growth is negative. ST denotes the-smooth transition threshold that here takes the form: (1/(1+exp(-66Δy -0.005))). In equation (4), the two multiplicative terms are clearly different from zero (x^2 = 24.18 (0.000)).

This set of equations is estimated from data for EU15 countries for the period 1971-2011(2012). The basic features of the data are illustrated in Figure 7.[8] The results for different definitions of defi-

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8. As expected, we see a positive relationship between government balance (surplus) and output growth and, similarly between indebtedness and real interest rates. The data also shows a negative relationship between indebtedness and GDP growth (possibly even a nonlinear relationship between these variables).

cits as well as of expenditures and revenues are reported in Table 3, which presents a comparison of linear and nonlinear models both terms of deficits and other fiscal variables (revenues and expenditures). The equations are estimated by OLS or GLS (Generalized Least squares to account for cross-country differences in error variances), with Nonlinear Least Squares (to account for the threshold in terms of output growth) and GMM (Generalized Method Moment to account for the dynamic panel effects).

Table 3. Evidence of Changing Fiscal Behavior

	Δy		Lagged def/y	debt$_{-1}$	r	R^2/ SEE	DW F(Wald)	Estimator J-stat
	0.466 (11.02)		0.821 (28.82)	0.022 (5.52)	-0.064 (2.18)	0.785 2.006	2.10	GLS
def/y	0.464 (8.22)		0.744 (7.48)	0.028 (5.10)	-0.106 (2.52)	0.789 2.032	2.00	OLS
def/y *)	0.396 (6.69)		0.797 (16.61)	0.029 (4.62)	-0.142 (3.06)	0.851 1.661	2.03	OLS
def/y **)	0.643 (9.56)		0.578 (3.36)	0.006 (0.38)	0.115 (0.75)	0.741 2.340	2.29	OLS
exp/y	-0.579 (12.06)		0.815 (13.55)	-0.017 (2.13)	0.121 (3.22)	0.932 1.850	2.11	OLS
rev/y	-0.091 (3.02)		0.867 (38.11)	-0.003 (0.80)	0.050 (2.18)	0.976 1.111	1.64	OLS
	$\Delta y\|\Delta y<0$	*$\Delta y\|\Delta y>0$*						
def/y	0.741 (5.34)	0.327 (2.90)	0.750 (7.98)	0.025 (4.21)	-0.104 (2.52)	0.792 2.017	2.06 0.073	OLS
def/y *)	0.983 (4.76)	0.265 (3.74)	0.795 (16.94)	0.028 (4.42)	-0.141 (3.11)	0.856 1.636	2.09 0.009	OLS
def/y	0.776 (11.21)	0.405 (8.03)	0.536 (4.22)	0.060 (3.40)	-0.257 (2.12)	.. 2.683		GMM 30.9
Cyclically adjusted data								
defa/$\hat{y}$	0.282 (2.89)	0.027 (0.60)	0.826 (24.74)	0.018 (4.78)	-0.062 (1.79)	0.778 1.845	2.11 0.033	GLS
defa/$\hat{y}$	0.182 (1.51)	0.108 (1.42)	0.767 (9.05)	0.026 (5.19)	-0.057 (1.09)	0.782 1.780	2.02 0.654	OLS
defpa/$\hat{y}$	0.308 (2.08)	0.127 (1.40)	0.750 (8.24)	0.027 (4.90)	0.092 (1.73)	0.741 1.929	1.97 0.393	OLS
expa/$\hat{y}$	-0.081 (0.75)	-0.136 (1.65)	0.906 (13.93)	-0.029 (3.58)	0.047 (1.07)	0.917 1.725	2.12 0.880	OLS
reva/$\hat{y}$	0.117 (1.84)	-0.130 (3.78)	0.840 (34.41)	0.008 (2.25)	0.033 (1.45)	0.970 1.137	1.87 0.006	OLS

def denotes government balance in the sense of net lending (thus positive values represent surpluses), Δy the growth rate of GDP, $\hat{y}$ trend GDP, *exp* government expenditures, *rev* government revenues, and *debt* general government debt (all three in relation to GDP). r is the real interest rate in terms of government bond yields. "a" denotes cyclically adjusted data in def, rev and exp (for details of the adjustment procedure, see AMECO data base). defpa denotes cyclically adjusted primary deficit. OLS (GLS) denotes panel least squares (generalized least squares) estimator with fixed cross-section effects, and GMM the Arellano-Bond GMM estimator with first differences.
The sample period is1971-2011 expect for *) when the sample period is 1971-1998 and **) when the sample period is 1999-2011. Data source: AMECO data base. The cyclically adjusted data cover 1971-2012. F (Wald) gives marginal significance values for an F test of the parameter restriction $b_2 = b_3$.

Figure 7. Relationship between key variables in the panel data
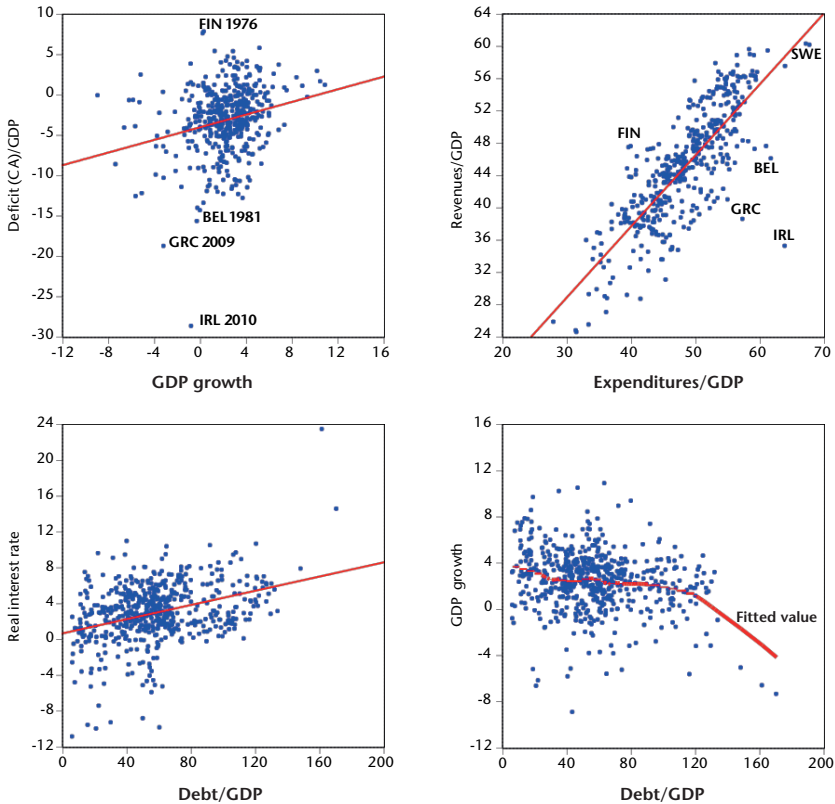
The data cover the period 1971-2012.

We use both the conventional deficit-GDP ratio and the ratio of cyclically adjusted deficit (and other fiscal variables) to trend GDP, $\hat{y}$. The cyclically adjusted deficit gives an idea of the overall stance of fiscal policy, although it is difficult to specify the appropriate cyclical adjustment. It can be computed after the event but the policy stance is a forward looking concept that depends on a forecast of what the trend is likely to be over the medium term – something that often turn out to be wide of the mark. Even so, we use a well-established definition rather than entering the debate, especially since it is this definition that is used in the official EU discussions about the stance of policy (more precisely, the change in cyclically adjusted primary deficit relative to trend (or potential) GDP, which is used as an indicator of fiscal consolidation). Simi-

larly, while interest payments are a function of the overall stance, they too vary over the course of the cycle, with the fluctuations in interest rates and outstanding debt.

The main implications of the results can be summarized as follows. Fiscal policy seems to respond strongly to business cycles. Thus, the deficit elasticities with respect to output growth appear to be around 0.3-0.6 for a one-year horizon (more than that obtained by e.g. Melitz, 1997). But what is perhaps more important, there appears to be strong evidence of asymmetric cyclical behavior in government deficits. The effects of output on deficits seem to differ depending on the business cycle phase: they appear to be much stronger in contractions (falling output) than in expansions. The hypothesis of equal coefficients over the business cycle phases can be rejected.[9] The rejection is also clearly revealed in Figure 8, which illustrates the country-specific nonlinear coefficients of the output variable for deficit, expenditures and revenues (the figure is based on single-country estimates of equations (3)). The cross-country differences are indeed large which may also explain why some of the key parameters in (3) cannot be estimated with high precision.

This combination of asymmetry and large cross-country differences pose serious challenges for common policy, as well as for policy coordination. Policy cannot be based solely on mean values of the cross-country data; and the whole distribution of country values must to be taken into account. Needless to say, this makes all coordination efforts very difficult because simple rules are no longer very useful (for more details, see Mayes and Viren, 2011).

The different cyclical effects show up in both revenues and expenditures. Revenues seem to behave quite asymmetrically in contractions and expansions. Thus, when output increases, revenues increase less than trend output, whereas in recessions revenues decrease markedly more than does trend output. This may partly reflect pro-cyclical tax policy – taxes are lowered in good times in response to higher tax incomes. With expenditures, there is no clear pattern of cyclical behavior except that the changes seem to be smaller than the changes in GDP. The direct

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9. The (possibly nonzero) threshold estimated by the maximum likelihood procedure was close to zero, so those results are not reported.

Figure 8. Country-specific nonlinear coefficients of output growth in the deficit equation
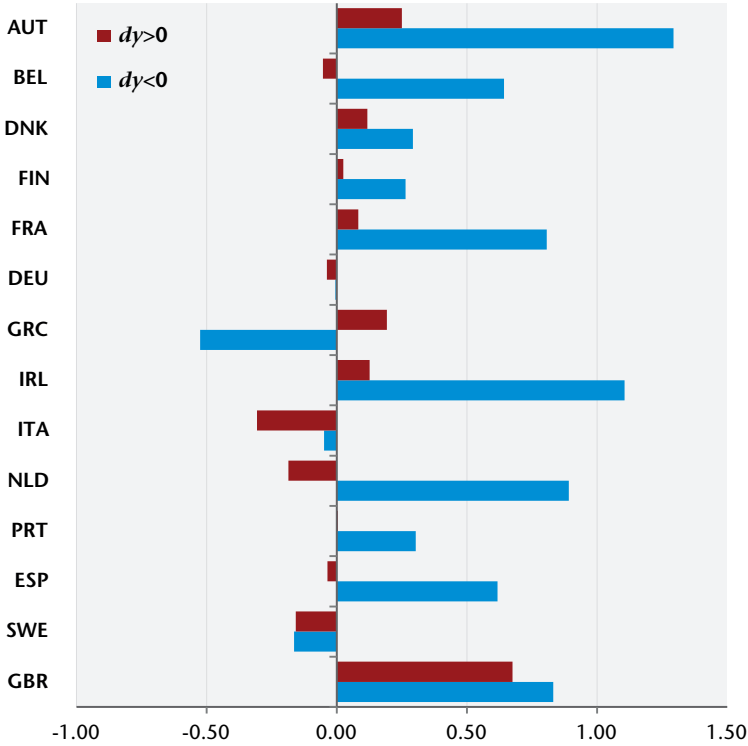
Values are GLS estimates from equation (3) for individual countries with cyclically adjusted AMECO data for 1971-2012.

effect of interest rates on deficits can be clearly discerned. The effect is particularly strong for net lending, but it also shows up in the primary deficits. The net lending effect obviously follows from the direct interest expense effect, whereas the primary deficit effect presumably reflects the need for an offsetting increase in revenues. More interestingly, the effect of government debt also turns out to be both significant and "correct" in sign and magnitude. Larger debt leads to some correction in the form of lower deficits.

We do however have to be cautious in interpreting these results, as the reverse impact of the fiscal balance on output has not been taken into account in the estimation on the grounds that it occurs with a lag (while the effect of growth on the deficit is contemporaneous). Omission of expectations effects raises another caveat.

2. Concluding remarks

Country differences, asymmetry of key policy parameters and size of possible policy coordination effects pose some clear challenges for fiscal policy. The problems may be particularly important in the presence of downward pressures of the economy. Policy needs to be asymmetric itself in order to counteract the slide. Put simply, downside threats require much stronger policy reactions.

Policy coordination may pose smaller problems, but still small and large countries are clearly in different positions in terms of common policies. Regarding fiscal policies, large countries have always an advantage because of larger multipliers while small countries may achieve such values only with coordinated policies. This does not of course mean that policy coordination would simply be a matter of country size: clearly other country characteristics and political economy issues also matter.

It is very hard to characterize the effects of fiscal policy with a single value of fiscal multiplier, and the difference between some polar values is very large so that policy uncertainty in Brainard sense may question attempts to pursue ambitious policies. Policy coordination surely affects the values of fiscal multiplier, at the same time increases overall uncertainty of the true parameter values and increases pressures to much more ambitious policies. There would even be temptation to use fiscal policies in an excessive amount.

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