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230

HOW SENSITIVE IS THE PUBLIC BUDGET BALANCE TO CYCLICAL FLUCTUATIONS IN THE EU?

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Abstract: This paper discusses the fiscal behaviour of EU countries in 1972–1999. It attempts to find out how deficits adjust to changes in interest rates and output growth by examining the hypothesis that the reaction of deficits to output growth is non-linear: relatively small in “good times“ and quite substantial in depressions. This hypothesis is tested using pooled cross-country data for 14 EU countries. All test results give support for the hypothesis, which suggests that nonlinearity is an essential ingredient of the fiscal policy transmission mechanism. The paper also discusses some explanations and policy implications of this finding. It is also found that overall deficits are quite sensitive to output fluctuations. This result appears to be quite robust in terms of different model specifications and estimation methods. The sensitiveness seems to be related to the size of the public sector.

Key words: fiscal policy, automatic stabilisers, non-linear models

JEL Classification E61

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Tiivistelmä: Tutkimuksessa tarkastellaan EU-maiden finanssipolitiikkaa ajanjaksona 1972–1999. Tarkoituksena on selvittää, miten budjettialijäämät reagoivat korkojen ja kokonaistuotannon kasvun muutoksiin. Taustalla on hypoteesi, jonka mukaan alijäämät reagoivat suhdanteisiin epälineaarisesti: verraten heikosti ”hyvinä aikoina” and huomattavan voimakkaasti lamakausina. Tätä hypoteesia testataan käyttämällä 14 EU-maan paneeliaineistoa. Testitulokset tukevat yksiselitteisesti tätä epälineaarisuushypoteesia. Raportissa arvioidaan mahdollisia selityksiä tälle tulokselle. Tutkimuksen toinen tärkeä tulos koskee alijäämien suhdanneherkkyyttä. Empiiriset analyysit viittaavat siihen, että suhdanneherkkyys on huomattavan suurta ja että herkkyys liittyy julkisen sektorin kokoon. Tältäkin osin tulokset ovat hyvin robusteja mallitäsmennysten ja estimointimenetelmien suhteen.

Asiasanat: finanssipolitiikka, automaattiset vakauttajat, epälineaariset mallit

Contents

1. Introduction

With the start of monetary union in Europe, interest in fiscal policy has increased considerably. There are obvious reasons for this renewed interest. Basically, only fiscal policy can minimise the effects of country-specific shocks. On the other hand, monetary union has strongly highlighted the sustainability restrictions for fiscal policy in general. The Maastricht deficit criteria create a new environment for policy. Finally, the question of policy co-ordination has become topical and is giving rise to serious efforts to find out what can be done in the area of fiscal policy in this respect.

In considering these challenges, it is easy to see that the key question with regard to the fiscal policy transmission mechanism in monetary union is the nature and magnitude of automatic stabilisers. If automatic stabilisers are large enough, country-specific shocks can be handled easily in individual countries and there is probably no need for co-operative actions. On the other hand, a very strong stabiliser may create problems as regards the deficit criteria. A mild recession could induce excessively large deficits, and these could create difficult situation for politicians and the ECB.

When examining automatic stabilisers, one soon notices that they involve difficult conceptual and measurement problems.[1] Not surprisingly, there has been a wide range of estimates of the importance of automatic stabilisers. To mention some of the polar cases, one may refer to Melitz (1997), who finds the deficit effects of GDP growth to be quite small, whereas e.g. the European Commission (1998) arrives at just the opposite results.[2]

To be a bit more specific, Melitz (1997) finds that output shocks increase not only revenues but also expenditures. Thus, the overall effect on the government surplus (deficit) remains relatively small, being of the magnitude of ten per cent. There are also some differences as regards short- and long-run effects.[3]

Obviously, there are many explanations for the differences in results. Both the estimating models and the data differ. On the data side, there are, in addition to the usual problems associated with country and time period settings, more serious problems connected with cyclical adjustment. One has to decide whether to use

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[1] See e.g. Virén (1999) for a review of these problems. See also Mäki and Virén (1999) for comparison of different estimates of structural and cyclical deficits and an analysis of stability of these estimates.

[2] See also Buti et al. (1998) and Virén (1998).

[3] In explaining these differences, Melitz cites some bureaucratic behavioural rules: "But a simple account would be that a certain bureaucratic impulse prevails at the start. When tax receipts falter, the government tends to nibble at individual ministerial budgets and transfer programs, and when tax receipts flow in from everywhere, the government becomes lenient in meeting budget requests from the individual ministries and in disbursing transfer payments that are permitted by existing legislation" (p. 8).

the actual deficit or some kind of cyclically adjusted (structural) deficit. This choice would not be unduly difficult if cyclical adjustment were essentially the same regardless of the adjustment procedure applied. Unfortunately, we know that this is not the case (Brandner et al. (1997)).[4] Moreover, one has do decide whether to use only the deficit variables or to analyse the revenue and expenditure sides separately. Finally, one has to consider the proper variable transformations: i.e. whether to use just level form data, first difference or deficit ratios (and in the case of deficit ratios, whether to use actual or trend GDP as the relevant scale variable).

This paper tries to shed new light on this dispute by applying recent data and more general econometric methodology. Thus, in addition to conventional linear specifications, we use non-linear threshold models. As for the data, we use both cyclically adjusted or unadjusted deficit variables, as well as the revenue and expenditure values separately. In addition, we scrutinise the cyclical component of deficits (i.e. the components which have been computed by the European Commission). In addition to the single – equation models we also use a four – variable VAR-model and the NiGEM multi – country structural model to derive the estimates of the cyclical deficit effect. The NiGEM simulations apply to both 10 EMU countries and 14 EU countries while all other analyses apply to 14 EU countries (so that Luxemburg is always excluded).

[4] What can be achieved by cyclical adjustment is already quite a controversial question. In the case of systematic policy rules, the meaning of cyclical adjustment would, of course, be different from the case of discretionary policy approach; see e.g. the classical paper of Blinder and Solow (1973) on this issue. See also Barrell (1994), Blanchanrd (1987) and Alesina and Perotti (1998) for a discussion on the nature of cyclical adjustment.

2. Analysis

2.1 Single-equation models

The analysis is mainly based on a simple reduced-form specification for the deficit/output ratio. This equation could be seen as some sort of data description equation rather than a strict behavioural equation (reaction function of the fiscal authority). Thus, the estimating equation is simply of the form:

$$\frac{def}{y^*} = b_0 + b_1\left(\frac{def}{y^*}\right)_{-1} + b_2\,trend + b_3\Delta y + b_4 r + b_5\left(\frac{debt}{y}\right)_{-1} + u$$

where def denotes the general government deficit (positive values correspond to a surplus), y is output (GDP), y* trend output, trend is the time trend, r is the nominal interest rate, debt is general government debt and u is the error term. To take into account the possibility that cyclical behaviour of deficits (or revenues, or expenditure) is different in booms and recessions, we estimate a non-linear threshold model specification of the following form:

$$\frac{def}{y^*} = b_0 + b_1\left(\frac{def}{y^*}\right)_{-1} + b_2\,trend + b_{31}\Delta y \mid \Delta dy < 0 + b_{32}\Delta y \mid \Delta y > 0 + b_4 r + b_5\left(\frac{debt}{y}\right)_{-1} + u$$

where $\Delta y|\Delta y < 0$ ($\Delta y|\Delta y > 0$) denotes negative (positive) values of GDP growth.[5] The nonlinear structure of the model is very simple, partly because we do not have enough data to estimate a more sophisticated version of the model (like a smooth transition threshold model). See e.g. Tong (1983) and Granger and Teräsvirta (1993) for a survey on threshold models.

The data, which cover the period 1960–1999, are from the EUROSTAT data bank. Unfortunately, the time series deviate considerably in terms of the time periods which they cover so that we have used two data samples in estimating the models. The first sample (covering the period 1972–1999) is used to estimate the

[5] In both equations we have an obvious simultaneity problem as fiscal policy will affect output growth and causality does not run from output growth to deficits only, although typically (for instance, in setting the restrictions in a VAR model) it is assumed that deficits (policy) react to contemporaneous output whereas the effect of fiscal policy shows up in output growth with a lag. In this panel data setting it is rather difficult to take this problem into account. However, we have also estimated the system using the Instrumental Variable estimator (see the last rows Table 1). The results turned out to be quite similar to the OLS estimates. In fact, the GDP growth rate coefficients increased somewhat when the IV estimator was used. Thus, the above-mentioned results (1) and (2) are not perhaps affected so much by the simultaneity bias.

model for the deficit (surplus) variable alone, while the second sample (covering the period 1961–1999) is used to estimate the model for different measures of deficits. The results are shown separately in Tables 1 and 2 below. Individual country estimates for the parameters b_{31} and b_{32} are given in Table 3 and Figure 1. A summary of the estimation results for output growth terms (reported in Table 2) is illustrated in Figure 2.

As we have so many countries we use mainly the pooled regression technique and restrict the coefficients to be equal across countries. More precisely, we use the fixed effects Seeming Unrelated Regression estimator as the basic alternative.

The main findings of the study are as follows:

(1) Fiscal policy seems to respond to business cycles quite considerably. Thus, the deficit elasticities with respect to output growth appear to be of the magnitude of 0.2–0.3 for the one year horizon (which is clearly more than obtained by e.g. Meliz (1997).

(2) There appears to be strong evidence of non-linear cyclical behaviour of government deficits. This can be seen very clearly from Table 1. The output effects on deficits seem to differ depending on the business cycle regime: they appear to be much strong in depressions (output falling) than in booms. Expressed technically, the hypothesis of equal coefficients for these regimes can be rejected quite clearly (see the last columns in Tables 1 and 2).[6]

(3) Nonlinearities mainly concern the structural deficit. Thus, the cyclical component of the government deficit seems to behave more or less symmetrically in terms of output fluctuations. This means that when output decreases structural deficits increase but when output increases structural deficits also tend to increase (surpluses decrease). Thus, in good times policy is perverse.[7]

(4) The different cyclical effects show up in both revenues and expenditures. Revenues seem to be more sensitive to output growth

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[6] In estimating equation (2) we used the threshold value of 0 as an obvious candidate for the optimal threshold value. The value does not have to be zero and so we computed the estimates with other threshold parameter values. In general, this did not change the results very much (i.e. the error variance reached its minimum with the parameter value 0 or with a value very close to zero. Therefore, we report here only the estimates with a threshold value of zero. Just to give an idea of the importance of this choice, we report one set of estimates for the case where the zero threshold is replaced by the sample average value of output growth (see the 8th row of Table 1).

[7] This assumes, of course, that the leaning against the wind policy rule is the right one. Obviously, fiscal policy is not that straightforward because we cannot be absolutely sure about even the most basic qualitative results as regards fiscal policy effects. See e.g. Sutherland (1997).

in depressions than in booms. Thus, when output grows, the revenue/trend output ratio remains more or less constant, while in depressions it decreases quite markedly. Expenditures seem to increase in depressions and decrease in booms. This probably reflects changes in government transfers (e.g. unemployment benefits).

(5) The direct effect of interest rates on deficits can be clearly discerned. The effect is particularly strong with net lending but it also shows in primary deficits. Thus, an increase in interest rates leads to some loosening of fiscal policies, and vice versa. The net lending effect obviously reflects the direct expenditure effect on interest expenses but the primary deficit effect is a bit hard to be interpreted. Following Melitz (1997) one might call a policy co-ordination effect but that is probably a too sophistical interpretation[8].

(6) More interestingly, the effect of government debt also turns out to be both significant and of "correct" sign and magnitude. Larger debt leads to some correction in the form of lower deficits.

These results seem to be reasonably robust in terms of estimation method (see rows 3, 6 and 7 in Table 1) and sample size. Moreover, as can be seen from Table 3 and the related Figure 1, the results seem to be quite similar for all countries in the case where individual country estimates for $\Delta y|\Delta y < 0$ and $\Delta y|\Delta y > 0$ are allowed to differ.[9] For individual country results we have the problem of small sample sizes. This applies, in particular, to the observations with $\Delta y < 0$, which represent just about 10 per cent of the total data. Thus, the individual country results should be viewed more as checks for robustness.

2.2 VAR-models

The single-equation models (2.1) and (2.2) are obviously based on several restrictive assumptions which may crucially affect the estimation results. Hence, one may ask whether a more general, say a VAR-model type specification, will produce similar results. To see that we carried out an analysis with the following unconstrained VAR model:

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[8] This result may only reflect the fact that high nominal interest rates and loose fiscal policies coincided in the 1970s and 1980s while in the 1990s the pattern was quite contrary. The coefficient estimates of real interest rates seem (see table 2) see to support this more modest interpretation.

[9] Only in the case of Ireland (of the sample countries in Table 1) are the estimates quantitatively quite different from the other countries. Thus, we also estimated the pooled data regression without Ireland (see row 3 in Table 1) but that did not change the results in any important way. Similarly, in the case of Portugal and the UK the results seem to deviate from the overall pattern, although the difference is not so striking as with Ireland.

The set of endogenous variables: Δy, rr, def/y* (where rr is the real long-term interest rate) The set of exogenous variables: Δy^{OECD} (which is growth rate of OECD GDP) The ordering of variables: Δy, rr, def/y The number of lags: 4 Impulse responses: Computed for 40 lags using the Cholesky decomposition. Standard deviations are computed by Monte Carlo simulation with 500 replications.

The analysis was carried out with individual country data so that the time series typically consist of 36 annual observations. For space reasons we here report on the impulse responses of def/y* to shocks in GDP growth rate Δy. The impulse responses (and the corresponding confidence intervals) are presented in Figure 3. For all countries, the size of the shock is set to one per cent. Figure 4 shows the (unweighted) average value of these impulse responses and, finally, Figure 5 represent a some sort of summary of these results. Thus, the impulse responses for the first three lags are reported together with an estimate of the long-run effect of (exogenous) world output growth on def/y*. A permanent one per cent increase is introduced into Δy^{OECD} (for the period 2000Q1–2004Q4) and the corresponding changes in def/y* are computed by means of dynamic simulation. Here, only the final year result is displayed. The figure illustrates what happens to European deficits if global economic growth accelerates by one per cent.

The results from these analyses can be quite easily summarised. First, the average values of impulse response function (IRF) go up to 0.4 for lag 3 to diminish to zero in ten years. The value of 0.4 is clearly consistent with the values obtained with equations (2.1) and (2.2) in the panel data analysis. The length of the lag is quite long which obviously has to do with sampling frequency of the data.

Although the average values of the IRF make sense, some individual country results are a bit obscure. In the case of UK, Ireland and the South-European countries, the impulse response are very small and no deviate from zero at any conventional significance levels. By contrast, in the case of Nordic countries, Netherlands, France and Austria (but not Germany), the results suggest that deficits are indeed quite sensitive to cyclical fluctuations and thus automatic stabilisers are importance. These countries have, of course, a large public sector (with a lot of transfers and a highly progressive income tax system) which well explains the finding.

The analysis which is reported in Figures 3 and 4 deals with individual country shocks in GDP growth rate and it is based on the assumption that the world growth rate is not affected by these shocks. Obviously, it is interesting to scrutinise what happens if the world growth rate is shocked instead. Here we consider the case of a permanent (acceleration) of growth (see Figure 5). Referring to this figure, we find that in all cases (except Italy) the growth effect has a non-trivial effect on the level of deficits. In fact, a permanent 1 per cent acceleration of economic growth (from, say, 2.5 per cent to 3.5 per cent) decreases deficits on an average by 1.5 per cent.[10] Although this means that growth is important from the point of deficits it also suggests that the current (structural?) deficits cannot be eliminated just by relying on (an acceleration of) economic growth.

2.3 NiGEM simulations

A final step in our analysis is the use of the multi-country NiGEM model to derive the estimates of the cyclical deficit effect (see NiGEM (1999)). Basically we intend to scrutinise how a one per cent increase in GDP affects the level of deficit/GDP ratio. Although the basic idea of the analysis is quite simple it is not so easy to carry through this kind of analysis just because there are numerous ways of creating the GDP growth effect.

Here we have done the analysis in different ways. First we introduced a permanent increase in GDP by increasing exports by one per cent for all EMU countries for the five – year period 2000Q1–2004Q4.[11] Then we computed the difference between the simulated and the base value of the deficit/GDP ratio. The size of the difference is then rescaled so that the initial GDP effect for 1999Q1 equals to one per cent. Thus, if the permanent export effect would create a permanent (and constant) GDP effect the dotted lines in Figure 6 would just stay at the level of one per cent.

Unfortunately, this is not what happens. The initial GDP effect usually starts to diminish quite quickly and goes even below zero (in the case of Belgium and Italy). With some other countries, most notably with Finland, the GDP effect first increases for a couple of years and first then starts to decrease.

Because the size of the GDP effects varies so much it comes as no surprise that the deficit effect also varies a lot (see the continuous line in the same figure). The first quarter deficit effect is about 0.2 but for longer time horizons, it is difficult to say what is the representative effect.

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[10] The instantaneous (first year) effects of world economic growth are, of course, much smaller (on an average 0.44 the median being 0.34) and quite similar for all countries as the following list shows: Austria 0.33, Belgium 0.30, Denmark 0.75, Finland 0.34, France, 0.31, Germany 0. 54, Greece 0. 34, Ireland 0.62, Italy 0.13, Netherlands 0.31, Portugal 0.94, Spain 0.19, Sweden 0.71, and UK 0.36.

[11] The model was solved imposing a insolvency condition for all counties for the simulation period (so that surpluses were allowed to increase freely). Moreover, forward-looking wage, exchange rate and long rate specifications were adopted.

Anyway, the surpluses tend to decrease slower than GDP which means that if the increase in GDP had stayed at the 1 per cent level surpluses would on an average have increased by 0.3 per cent in four quarters

Because of these difficulties in generating the GDP growth effect we ran another simulation in which we shocked the GDP directly by one per cent (this simulation was carried out on a country by country basis). The shock was allowed to affect the GDP for four quarters and the model was solved for 20 quarters in the same ways as above.

The resulting deficit effect is displayed in Figure 7 (dotted line) for both the EMU and non-EMU (EU) countries. The corresponding solid line indicates a rescaled value of the deficit effect which was obtained by dividing the difference between the simulated and base values by the corresponding GDP effect (so to constrain the GDP shock to be exactly one per cent for all four quarters).[12] The values of the deficit effect appear to be quite similar for all counties so that after four quarters the budget surpluses would have increased (or deficits decreased) by 0.36 per cent. The surplus/deficit effect is in fact larger than in the previous case of increased exports. The reason is related to the growth of consumption which clearly increases in the case of a GDP shock. This, in turn, generates more commodity tax revenues and that, in turn, a larger budget surplus.

All in all, we can conclude that the NiGEM model simulations produce results which are quite close to those that we obtained with the single equations model and with the VAR model. Thus, deficits are quite sensitive to cyclical movements of GDP so that the average EMU/EU elasticity for the time horizon of 1–2 years is about 0.3–0.4. The NiGEM simulations are particularly useful in the sense that they show that the elasticities are sensitive to the nature cyclical movements and especially to changes in the structure of aggregate demand.

However, the simulations also show that the results are quite sensitive to the basic properties of the model. There seems to be substantial differences between different countries. It is difficult to say how much they are related to the specification and how much to the data but it is obvious that both sources are important. This should be kept in mind when interpreting the results of this study.

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[12] In the NiGEM model, a one per cent shock in the GDP does not necessarily produce a one per cent increase of GDP but typically something less than that. With some countries the effect tends to diminish quite rapidly so that half of the shock may disappear in four quarters. By contrast, with some other countries, the GDP shock tends to reinforce itself which obviously generates a greater value of GDP and budget surplus (or a smaller value of deficit).

3. Discussion and conclusions

The fact that deficits in EU countries appear to be quite sensitive to cyclical fluctuations is good news in the sense that it may help to solve problems caused by country-specific output shocks. If the elasticity of surplus/output ratio to GDP growth is of the magnitude 0.2 to 0.3, the lack of a federal budget may not be such a serious problem as it would be otherwise.

Interestingly, the output growth effects on deficits seem to be more important in depressions than in "normal times". Basically, this seems to be due to the fact that policies appear to be quite different in these two regimes. Examination of the cyclically adjusted deficits reveals that policy seems to be counter-cyclical in bad times but that the opposite holds in good times. Thus, output growth leads to smaller surplus/GDP ratios. This could basically be explained by tax cuts or discretionary increases in expenditures in boom periods. Given the data, it is rather difficult to say which of these mechanisms dominates for EU countries.

Our results (see the last rows in Table 2) seem, however, to suggest that the explanation lies on revenue side in the sense that the cyclically adjusted revenues (in relation to trend GDP) seem to decrease when output increases. On the expenditure side, the coefficient of $\Delta y|\Delta y > 0$ points in the same direction (i.e. to a procyclical output growth effect).

In the case of depressions, we can see that cyclically adjusted expenditures seem to behave counter-cyclically, while the revenue side is quite passive. Thus it seems that in bad times fiscal policy operates mainly via increases in expenditure. And, as mentioned above, in good times discretionary action mainly affects taxes in the form of tax cuts.

From the viewpoint of counter-cyclical fiscal policy, the main problem appears to be behaviour in "good times". Although automatic stabilisers seem to operate in this case as well, discretionary action does not seem to help to smooth the output growth path. Expenditures are not cut but instead taxes are lowered rather than increased.

In many OECD countries it has been attempted to carry out structural reforms in the public sector (see e.g. Tanzi and Schuknecht (1997)). It may well be that the timing of these reforms has been ill suited as regards stabilisation policies. Of course, it is very difficult to say what is the right moment to implement structural reforms but at least major tax cuts should be postponed from periods of economic overheating.

Finally, a comment on interest rates and the debt effect may be in order. The relatively high (long-run) coefficients of the interest rate variables indicate that interest rate fluctuations may represent an important problem in terms of the deficit criterion. A one per cent age point increase in nominal interest rates may well increase the deficit/GDP ratio by 0.5–1.0 percentage points. This is clearly a nontrivial number and it also gives an idea of the importance of lower interest rates in the 1990s as a factor contributing to the success of various governments in reaching the deficit targets.

As for the debt effect, the estimates in this paper suggest that it is also far from nontrivial, though it is probably not (has not been) large enough to keep the debt level at a constant level. Although we cannot say much about this effect, it is certainly an interesting topic for future research on fiscal policy behaviour.

Table 1. Estimates of a threshold model for government deficits

estimator	def/y_{-1}	trend	r	Δy	Δy < 0	Δy > 0	R2/SEE	DW	F(1,n-1)	observations
SUR	.797	.014	-.111	.231			.878	1.740	-	336
	(28.44)	(.125)	(4.48)	(8.17)			1.566			
SUR(1)	.761	.025	-.152	.290			.882	1.511	-	240
	(20.50)	(2.39)	(3.55)	(8.11)			1.417			
SUR	.807	.007	-.128		.720	.137	.883	1.811	21.11	336
	(29.53)	(0.68)	(5.22)		(6.39)	(4.20)	1.537		(0.00)	
SUR(2)	.798	.008	-.111		.711	.163	.882	1.806	16.65	308
	(25.66)	(0.70)	(4.33)		(6.04)	(4.51)	1.509		(0.00)	
SUR(1)	.784	.026	-.134		1.318	.155	.900	1.691	52.06	240
	(23.71)	(2.67)	(3.42)		(8.90)	(4.25)	1.308		(0.00)	
OLS	.798	.016	-.117		.763	.168	.884	1.816	4.52	336
	(24.84)	(1.31)	(3.66)		(2.92)	(3.61)	1.533		(0.03)	
GLS	.804	.009	-.118		.963	.167	.883	1.858	9.01	336
	(31.61)	(0.94)	(4.82)		(3.84)	(4.74)	1.540		(0.00)	
SUR	.799	.007	-.121		.373	.220	.881	1.768	12.14	336
(H=3.0)	(29.27)	(0.63)	(4.76)		(7.48)	(7.76)	1.549		(0.00)	
OLS(3)	.897	.035	-.079	.190			.900	1.855	-	232
	(32.09)	(2.52)	(2.15)	(3.74)			1.512			
OLS(3)	.909	.031	-.080		.652	.110	.904	1.924	10.22	232
	(36.09)	(2.26)	(2.17)		(2.36)	(2.39)	1.482		(0.00)	
IV(3)	.912	.042	-.057	.308			.891	1.886	-	232
	(36.52)	(2.67)	(1.50)	(5.95)			1.518			
IV(3)	.924	.034	-.067		.876	.171	.897	2.005	2.87	232
	(36.41)	(2.23)	(1.83)		(2.53)	(1.92)	1.474		(0.09)	

t-values are inside parentheses. (1) The implicit interest rate for government debt is used instead of the long-term government bond yield. (2) Ireland is not included in the sample. F(1,n-k) is the F test for the parameter restriction b4 = b5. (3) The model is estimated by restricting the constant terms to be equal. All estimates are Seemingly Unrelated Regression estimates unless otherwise indicated (OLS denotes unweighted Least Squares estimates and GLS Generalized least Squares estimates weighted by cross-section heteroskedasticity weights; in the case of OLS, the t-values are heteroskedasticity consistent). In the case of the Instrumental Variable (IV) estimator, the set of instruments for △y, △y|△y < 0 and △y△y > 0 consists of the respective lagged values, the real interest rate and rates of change of real exports and real investment. Owing to the lagged dependent variable, the DW statistics is biased and should therefore be used with caution.

Table 2. Estimates of different deficit specifications

data	def/y_{-1}	Trend	r	Δy	Δy < 0	Δy > 0	$debt/y_{-1}$	R2/SEE	DW	F(1,n–1)	observations
def	.833	.009		.253				.875	1.675	–	473
	(33.76)	(1.24)		(10.29)				1.511			
def	.843	.008			.652	.195		.879	1.724	15.16	473
	(35.33)	(1.13)			(6.21)	(6.83)		1.492		(0.00)	
def	.785	–.000	–.143		.709	.143		.881	1.745	20.55	417
	(30.25)	(0.03)	(6.09)		(6.40)	(4.45)		1.416		(0.00)	
def, rr	.805	.020	–.104		.757	.201		.873	1.628	19.37	417
	(30.62)	(2.51)	(4.08)		(6.75)	(6.28)		1.467		(0.00)	
Δ(def)	.172		–.101		.475	.017		.109	1.984	16.06	417
	(3.42)		(1.91)		(4.78)	(0.55)		1.620		(0.00)	
def	.837	–.045	–.082		1.215	.139	.027	.891	1.727	41.28	239
	(24.06)	(2.28)	(2.95)		(8.20)	(3.22)	(4.25)	1.317		(0.00)	
def, rr	.830	–.019	–.144		1.195	.164	.034	.893	1.699	40.15	239
	(24.94)	(1.03)	(4.73)		(8.28)	(4.01)	(5.31)	1.304		(0.00)	
defp	.800	.031		.228				.804	1.654	–	467
	(31.10)	(5.33)		(10.06)				1.488			
defp	.804	.029			.650	.173		.812	1.711	17.65	467
	(32.00)	(5.01)			(6.37)	(6.60)		1.460		(0.00)	
Δ(defp)	.071				.296	.045		.086	1.874	23.96	453
	(1.51)				(6.44)	(1.80)		1.612		(0.00)	
defp	.781		–.067	.169				.804	1.587	–	411
	(25.78)		(2.77)	(6.19)				1.491			
defp	.776		–.070		.703	.096		.812	1.64	21.29	411
	(26.50)		(2.99)		(6.11)	(3.19)		1.461		(0.00)	
defp	.752		–.021		1.137	.148	.031	.880	1.625	22.64	236
	(23.26)		(0.96)		(8.04)	(3.75)	(8.48)	1.281		(0.00)	
defa	.876	–.013		–.112				.856	1.621	–	453
	(31.10)	(1.71)		(4.13)				1.571			

data	def/y_{-1}	Trend	r	Δy	Δy < 0	Δy > 0	debt/y_{-1}	R2/SEE	DW	F(1,n–1)	observations
defa	.882	–.015			.188	–.162		.858	1.635	7.40	467
	(32.02)	(1.93)			(1.63)	(5.11)		1.563		(0.01)	
Δ(defa)	.086				–.079	–.167		.040	1.921	2.82	453
	(1.87)				(1.67)	(6.55)		1.591		(0.09)	
defa	.828		–.167	–.171				.867	1.740		411
	(30.33)		(7.31)	(6.00)				1.434			
defa	.834		–.167		.220	–.238	.005	.870	1.746	13.08	411
	(31.68)		(7.39)		(1.96)	(7.20)	(1.22)	1.422		(0.00)	
defa	.777		–.113		.752	–.272		.887	1.758	39.62	238
	(19.41)		(3.85)		(5.21)	(6.29)		1.264		(0.00)	
defc	.938	.027		.371				.841	0.735	–	467
	(70.52)	(19.58)		(67.71)				0.495			
defc	.943	.029			.440	.370		.843	0.734	7.02	467
	(64.62)	(18.28)			(18.37)	(50.66)		0.492		(0.01)	
Δ(defc)	.964				.447	.442		.845	2.354	0.41	453
	(82.86)				(56.51)	(80.88)		0.396		(0.52)	
def,rr	.803		.017		.714	.116		.811	1.681	20.63	411
	(28.28)		(0.70)		(6.01)	(3.76)		1.467		(0.00)	
rev	.736	.114		.016				.902	2.414	–	467
	(22.74)	(6.74)		(0.64)				3.112			
rev	.732	.113			.311	–.030		.903	2.415	9.79	467
	(22.60)	(6.72)			(3.25)	(1.01)		3.110		(0.00)	
Δ(rev)	–.311				.062	.010		.158	2.211	0.99	453
	(6.45)				(1.40)	(0.40)		3.174		(0.32)	
reva	.921	.000			–.031	–.201		.986	1.864	3.95	467
	(55.85)	(0.02)			(0.42)	(9.30)		1.153		(0.05)	
exp	.837	.049		–.210				.905	2.426	–	467
	(33.55)	(2.87)		(6.52)				3.287			
exp	.840	.050			–.409	–.180		.905	2.433	2.67	467
	(33.55)	(2.87)			(3.26)	(4.84)		3.289		(0.10)	

data	def/y_{-1}	Trend	r	Δy	Δy < 0	Δy > 0	$debt/y_{-1}$	R2/SEE	DW	F(1,n–1)	observations
Δ(exp)	–.256				–.314	.037		.125	2.197	31.30	453
	(5.38)				(5.23)	(1.24)		3.364		(0.00)	
expa	.951	.001			–.286	.030		.980	1.556	9.71	467
	(59.47)	(0.09)			(3.05)	(1.46)		1.454		(0.00)	

def denotes net lending, defp net lending excluding interest expenses, defa the structural deficit, defc the cyclical component of net lending, rev total revenues and exp total expenditure. reva and expa denote corresponding cyclically adjusted variables. All of these are related to trend GDP. rr denotes the real interest rate (otherwise, r is the nominal long-term rate). All estimates are SUR estimates. The equations are estimated in level form unless the first difference operator Δ is shown in the left-hand side column (e.g. Δ(def)). Then all variables in (2.2) are differenced.

Table 3. *Selected country-specific estimates of equation (2)*

	$\Delta y < 0$	$\Delta y > 0$	$\Delta y < 0$	$\Delta y > 0$	$\Delta y < 0$	$\Delta y > 0$
Austria	2.115	.140	1.166	.279	.864	-.032
	(1.04)	(1.21)	(0.60)	(3.10)	(0.40)	(0.33)
Belgium	1.115	.212	.816	.090	-.238	-.105
	(2.34)	(1.78)	(1.79)	(0.98)	(0.47)	(1.01)
Denmark	2.084	.381	2.006	.494	1.726	-.229
	(2.01)	(2.51)	(1.78)	(2.92)	(1.79)	(1.56)
Finland	1.158	.168	.897	.177	.554	-.359
	(6.01)	(1.55)	(5.66)	(2.33)	(3.17)	(4.31)
France	1.092	.368	1.329	.246	.628	-.060
	(2.17)	(3.62)	(3.07)	(2.97)	(1.33)	(0.62)
Germany	-	-	1.344	.106	1.168	-.321
			(1.86)	(1.05)	(1.52)	(3.02)
Greece	.021	.306	.168	.145	-.338	.061
	(0.09)	(2.51)	(0.79)	(1.90)	(1.47)	(0.75)
Ireland	-8.362	.048	-7.130	.041	-7.086	-.155
	(1.44)	(0.54)	(1.26)	(0.49)	(0.96)	(1.33)
Italy	.718	.149	.861	-.051	.258	-.179
	(1.82)	(1.69)	(1.80)	(0.41)	(0.66)	(1.75)
Netherlan	.134	.241	.404	.187	-.293	-.301
ds	(0.15)	(1.54)	(0.48)	(1.38)	(0.32)	(2.05)
	.155	.298	.510	.210	-.143	.079
Portugal	(0.43)	(2.39)	(1.59)	(2.12)	(0.41)	(0.75)
	1.757	.182	1.217	.206	1.013	-.216
Spain	(2.67)	(2.67)	(1.94)	(3.12)	(1.45)	(2.88)
	3.112	.128	2.852	.059	2.314	-.634
Sweden	(5.36)	(0.49)	(4.74)	(0.22)	(3.84)	(2.29)
	-	-	-.424	.309	-.615	-.269
UK			(0.93)	(2.10)	(1.44)	(1.96)
data	def 1972-99	def 1972-99	defp 1961-99	Defp 1961-99	defa 1961-99	defa 1961-99

Figure 1. Effect of GDP growth on general government net lending

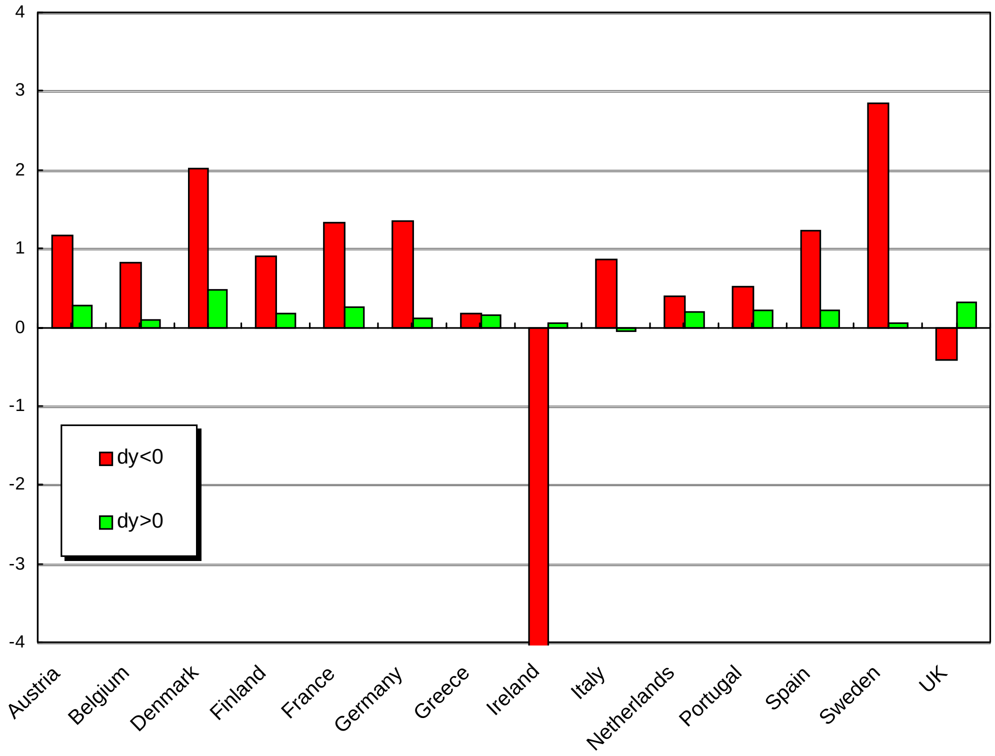


Figure 2. Summary of estimation results with pooled data

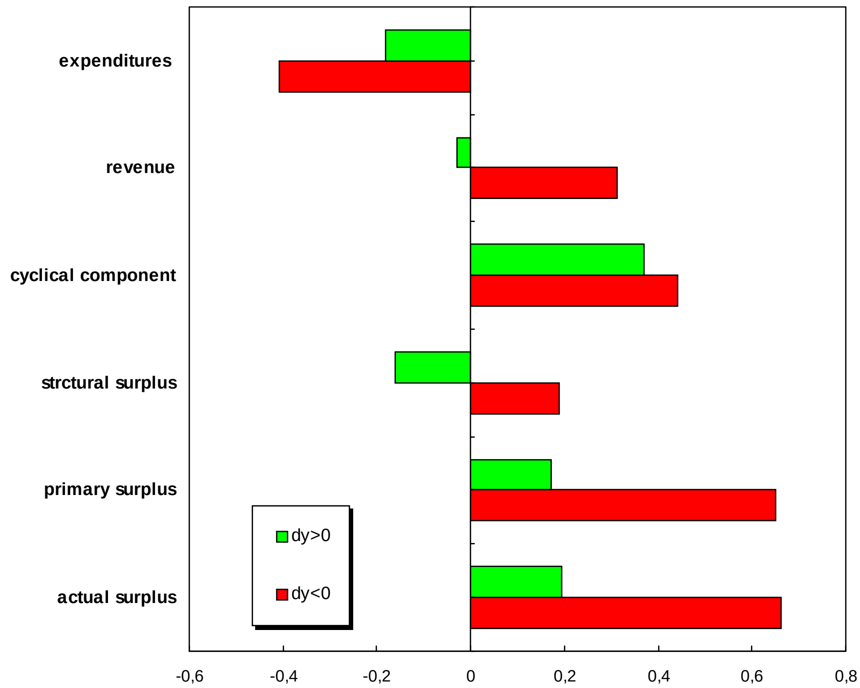
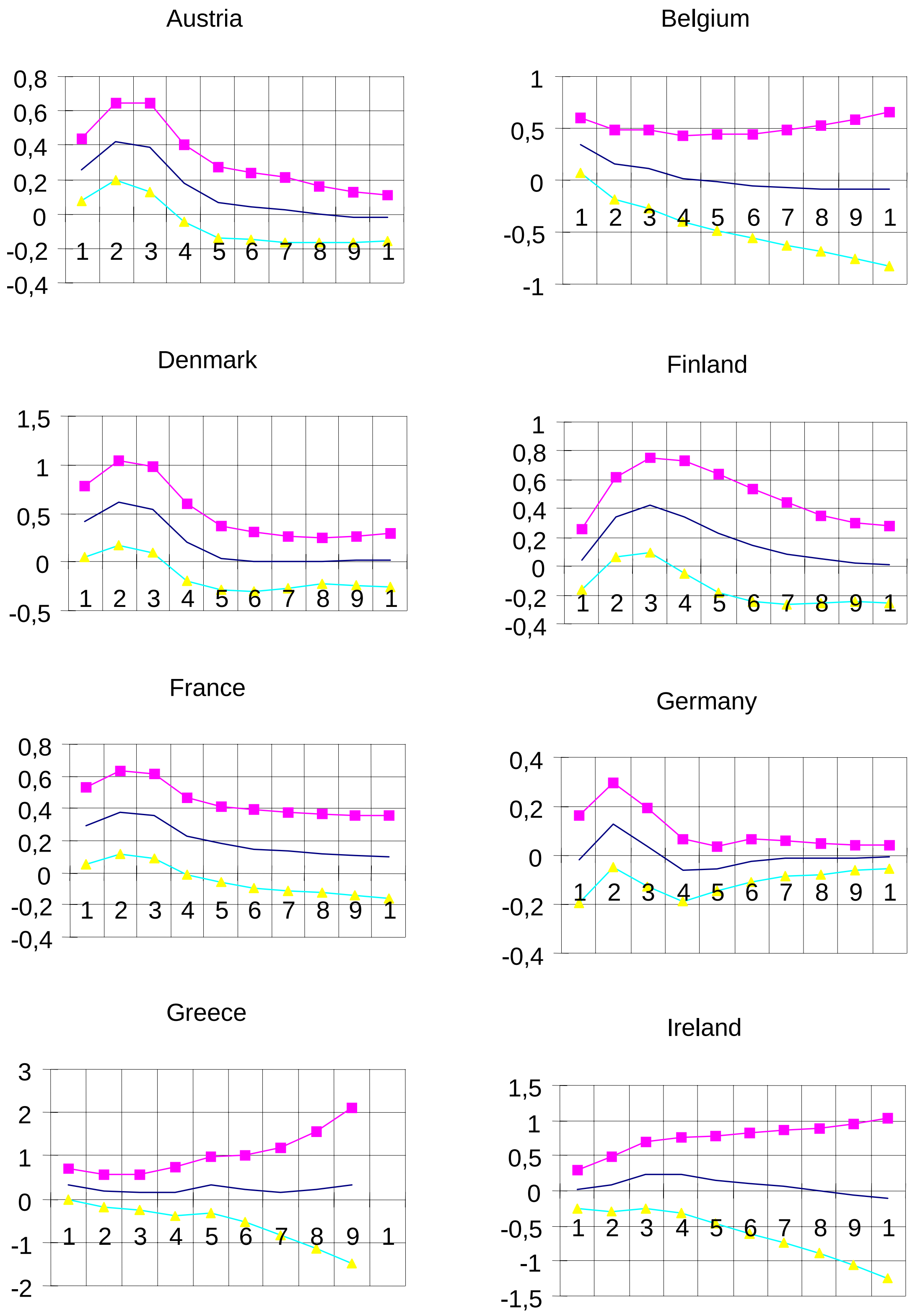
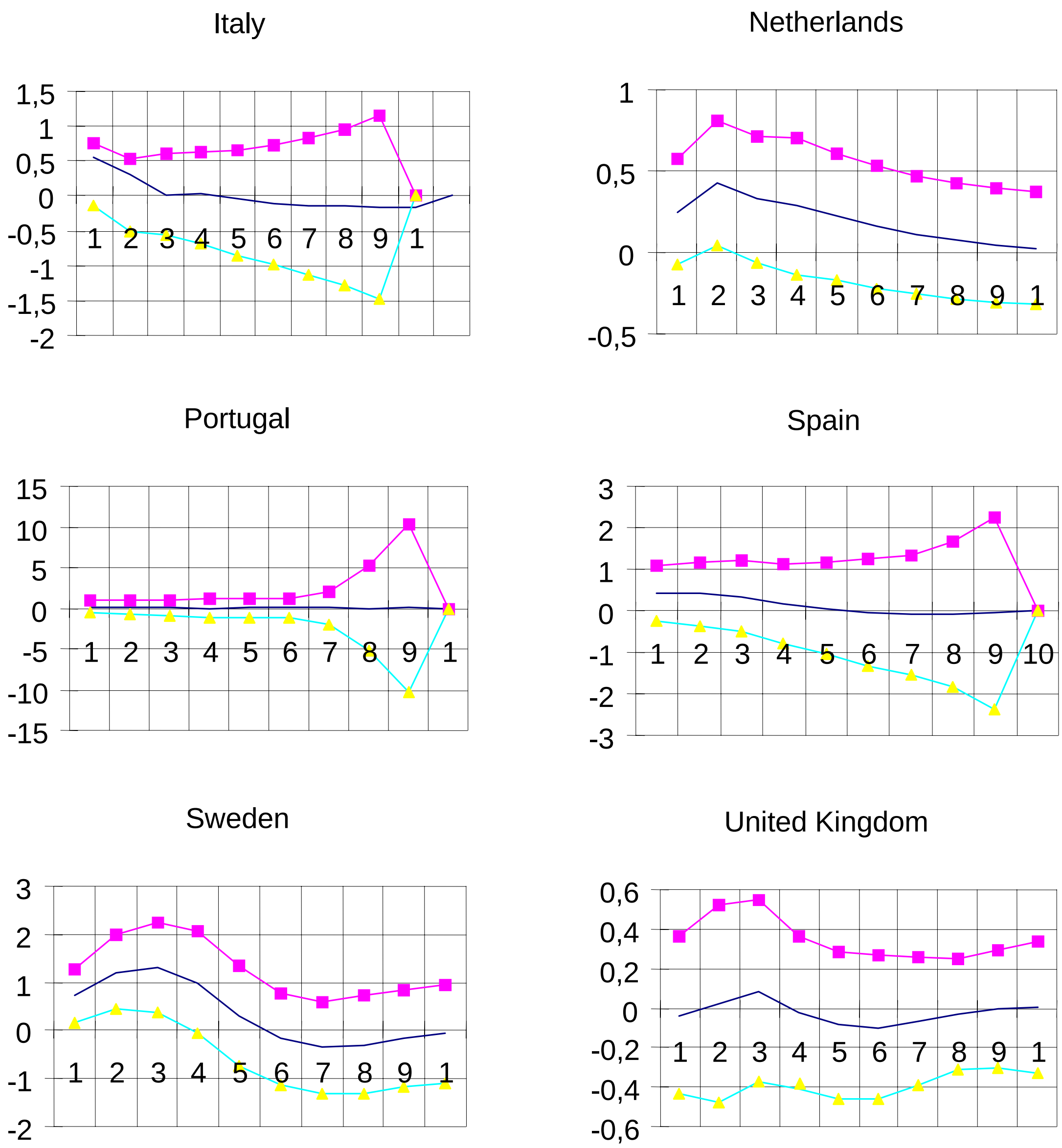


Figure 3. *Impulse responses of def/y* to GDP growth shocks in individual countries*





The size of the shock is 1 per cent. The confidence intervals represent the 5 per cent significance level.

Figure 4. An EU average of the impulse responses of def/y to growth shocks*

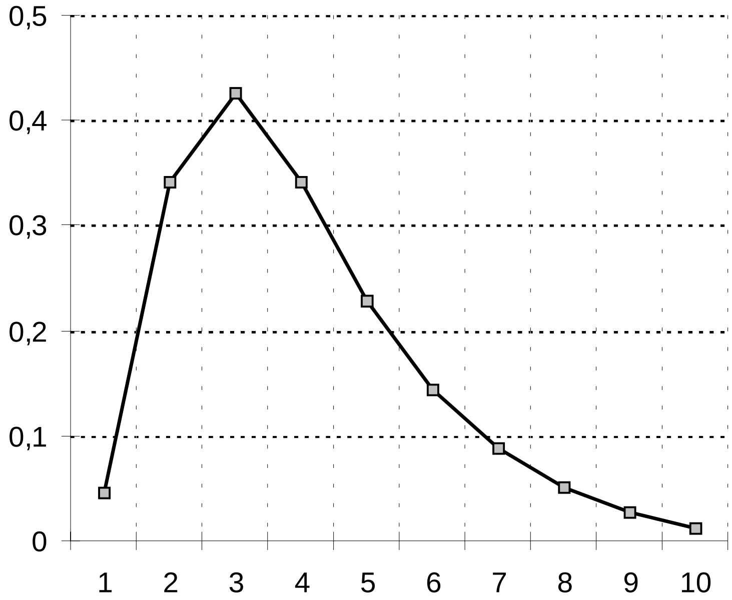


Figure 5. A cross-country comparison of growth effects

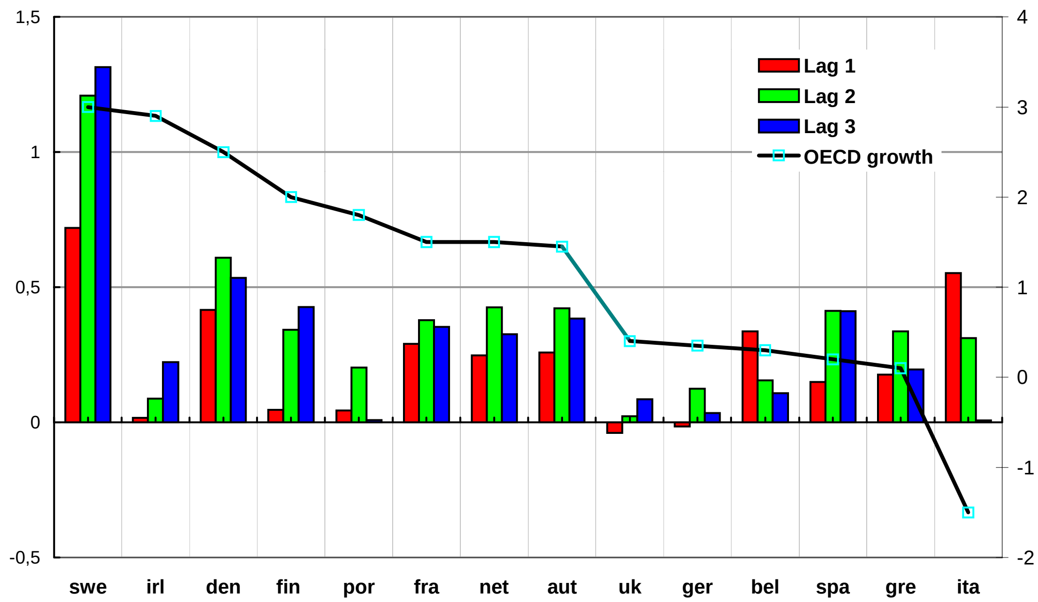
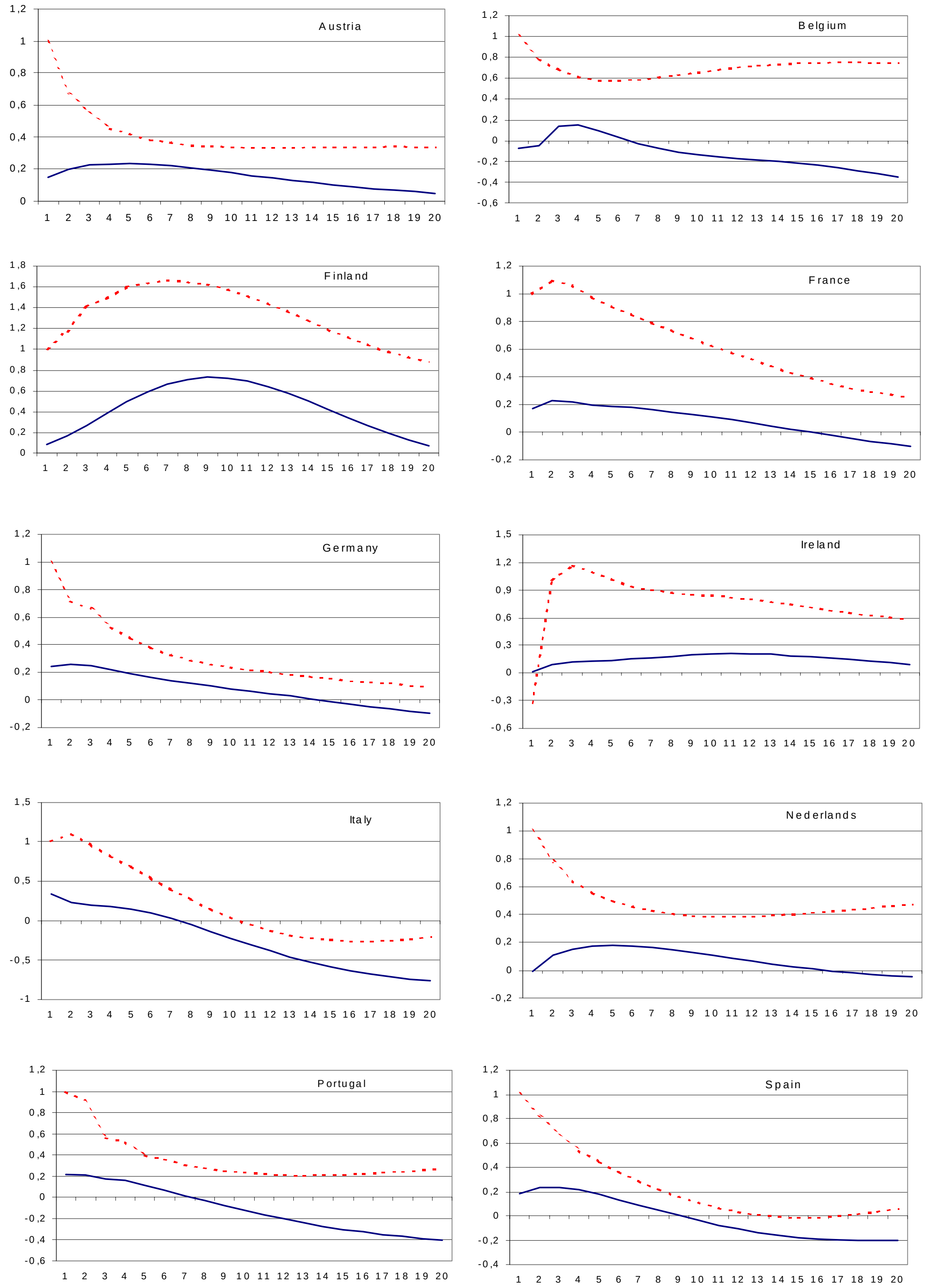
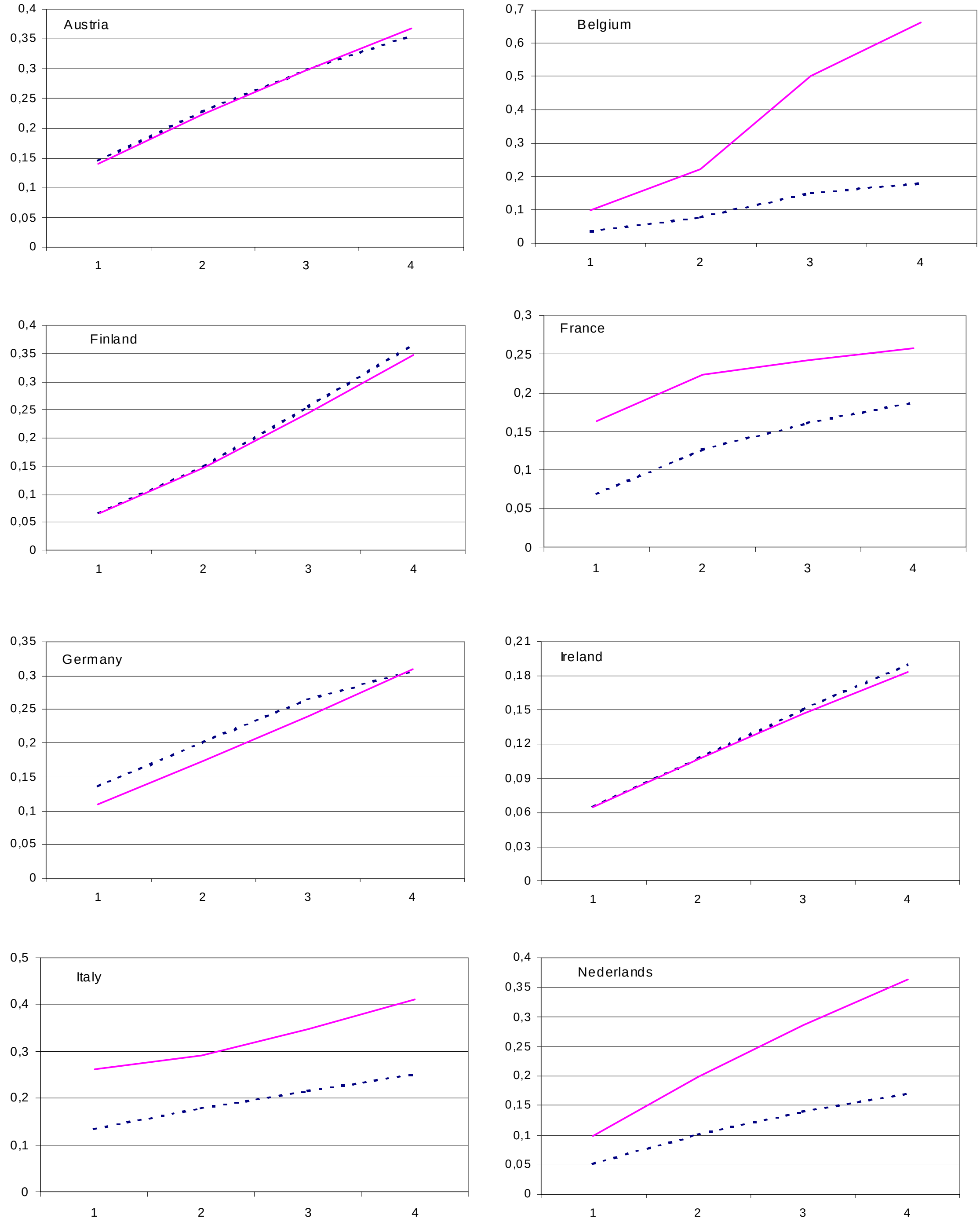


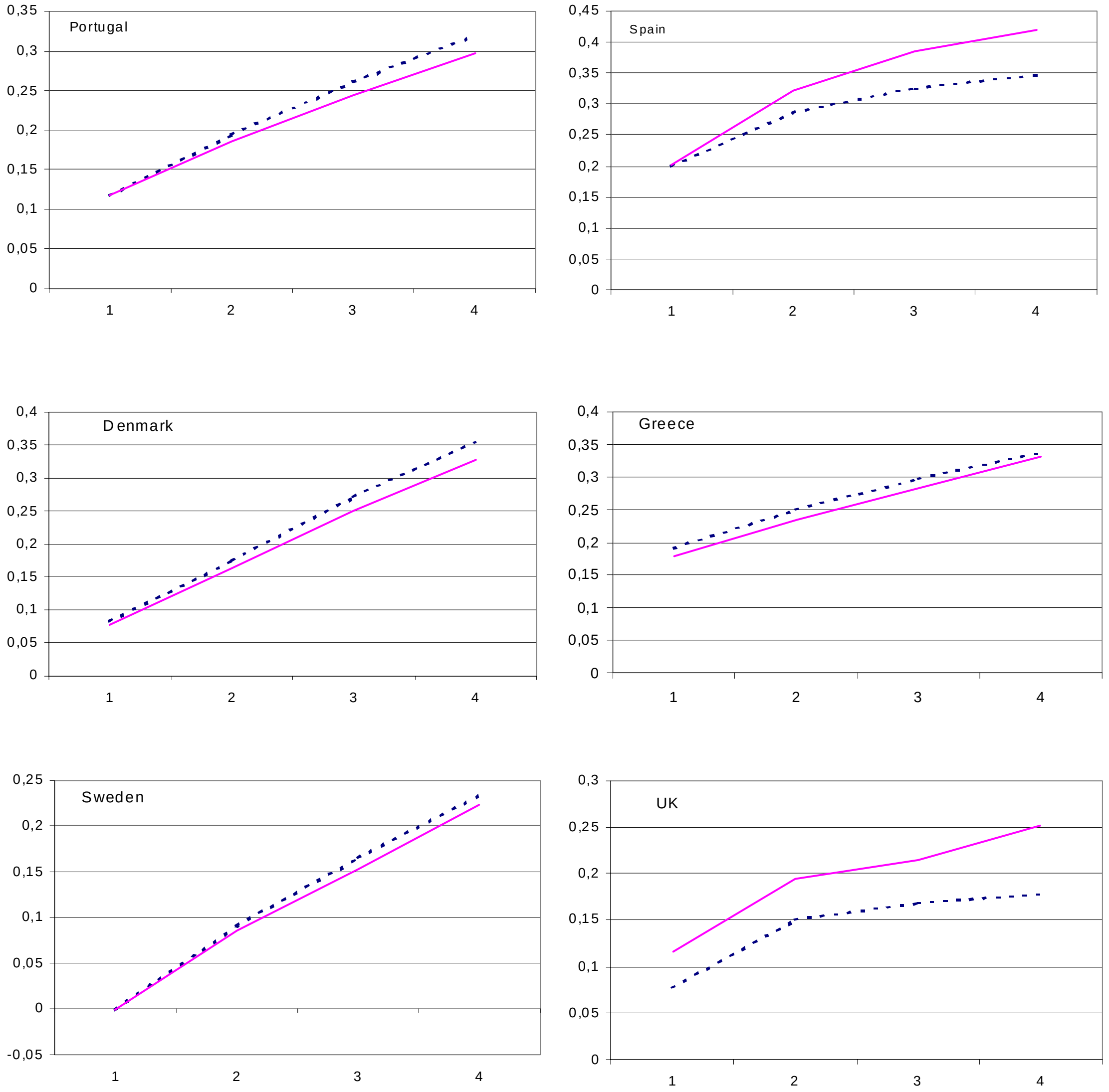
Figure 6. *Effect of increased exports on GDP and budget surplus*



The dotted line indicates the increase of GDP and the solid line the increase of budget surplus/GDP ratio.

Figure 7. *Effect of a GDP shock on budget surplus*





The dotted line indicates the difference between the simulated and base values while the solid line corresponds to a rescaled value of this difference for constrained one per cent GDP shock.

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