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Fiscal Policy, Growth and Convergence in Europe

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*Fiscal Policy, Growth and Convergence in Europe**

by

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Summary

Recent evidence on the impact of fiscal policy – taxes, public expenditures and budget deficits – on long-run growth in OECD countries has adopted the Barro (1990) framework to distinguish between ‘productive’ and ‘unproductive’ expenditures, and ‘distortionary’ and ‘non-distortionary’ taxes. Using estimated long-run growth effects from these fiscal variables, this paper simulates the effects on growth rates of observed fiscal policy changes in the EU. With two exceptions, the individual country growth effects of actual changes in taxes, expenditures and deficits appear plausible at around -0.2 to $+0.2$ of a percentage point per annum. Few common policy scenarios are apparent in the data however, with key sources of differences between countries being the extent to which *distortionary* taxes or deficits were used to fund public spending increases and whether additional spending was focussed on ‘productive’ activities. Our results confirm that the change in the *overall* share of taxes or spending in GDP, or the annual budget deficit, is not a good guide to whether the growth effects of fiscal policy are likely to be positive or negative. The paper also considers whether our growth regression model, which imposes parameter homogeneity across countries, is justified. The evidence suggests this is the case, with a high degree of uniformity across countries.

Finally the paper considers whether there is any evidence of ‘fiscal convergence’ across the EU. That is, are growth-affecting fiscal variables becoming more similar over time across the EU? Though data are limited, the answer to this question appears generally to be negative, with little evidence of unconditional convergence. Countries’ tax or expenditure/GDP ratios do, however, generally revert towards their steady-state paths.

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I. Introduction

How far are economic growth rates in the European Union (EU) affected by fiscal policy?¹ Recent empirical evidence suggests that changes in the level and mix of taxation, public expenditure, or fiscal deficits may have relatively long-run effects on growth rates in OECD countries. After a brief review of the relevant theory and empirical estimates in section II, this paper provides some simulations of possible fiscal-growth scenarios relevant to recent EU experience, in Section III. Important driving forces behind recent European integration have been the convergence criteria for budget deficits within the Euro zone, and a wider drive towards tax harmonisation. Together with some evidence for convergence in the growth rates in per capita income across European countries, this suggests that there may be forces within Europe encouraging both the convergence of key fiscal variables and their resulting growth impacts. Section IV explores some preliminary data on this issue.

II. Growth Effects of Taxes, Expenditures and Deficits

There are now numerous endogenous growth models incorporating fiscal variables and which are capable of yielding predictions of long-run or steady state growth effects arising from fiscal changes.² Most such models have focused on one side of the government budget or the other – usually the tax side.³ Barro (1990) and Cashin (1995) analyse both taxes and expenditures simultaneously, though both models preclude deficit finance. For present purposes, the Barro (1990) and Barro and Sala-i-Martin (1992) models provide a useful starting point. They adopt the standard Ramsey framework in which the consumption path of a representative consumer is obtained by maximising an inter-temporal utility function over an infinite horizon. There are n producers each producing output (y) according to the production function:

$$y = Ak^{1-a}g^a \tag{1}$$

¹ We define fiscal policy here as the level and structure of taxes and public expenditures, and the extent of budget deficits.

² See Kneller et al (1999) for a review, and the bibliography at the end of this paper.

³ Devarajan et al. (1996) is one of few studies to concentrate on the expenditure structure.

where k represents private capital and g is a publicly provided input (per capita). There are therefore constant returns to *total* (public plus private) ‘capital’ inputs, $k+g$.⁴ The government also produces consumption (‘unproductive’) goods, g_c , which enter consumers’ utility functions but have no effect on production. The government balances its budget in each period by raising a proportional tax on output at rate \mathbf{t} and lump-sum taxes of L , giving the constraint:

$$n(g + g_c) = n(l + \mathbf{t}y) \quad (2)$$

Of course, lump-sum (or non-distortionary) taxes do not affect the private sector’s incentive to invest in the input good, whereas the taxes on output do. Thus, with an isoelastic inter-temporal utility function, Barro and Sala-i-Martin (1992) show that the long-run growth rate in this model (\mathbf{g}) can be expressed as

$$\mathbf{g} = \mathbf{I}(1-\mathbf{t})(1-\mathbf{a})A^{1/(1-\mathbf{a})}(g/y)^{\mathbf{a}(1-\mathbf{a})} - \mathbf{m} \quad (3)$$

where \mathbf{I} and \mathbf{m} are constants that reflect parameters in the utility function. Alternatively, using (2), (3) can be re-written as:

$$\mathbf{g} = \mathbf{I}(1-\mathbf{t})(1-\mathbf{a})A^{1/(1-\mathbf{a})}(\mathbf{t} - \{ \frac{g_c - l}{y} \})^{\mathbf{a}(1-\mathbf{a})} - \mathbf{m} \quad (4)$$

Equations (3) and (4) show that the growth rate is decreasing in the rate of distortionary taxes (\mathbf{t}) and increasing in government productive expenditure (g), but is unaffected by non-distortionary taxes (L) or unproductive expenditure (C).⁵

The growth effects of the alternative combinations of taxes and expenditures in the Barro and Sala-i-Martin model are summarised in the four cells in the north-west corner of the matrix in Table A below. In addition, though Barro and Sala-i-Martin (1992) exclude the possibility of deficit finance, the framework is readily extended to include fiscal deficits, and their predicted effects on growth are also shown in Table A (and are discussed further below).

⁴ Notice however that public inputs are specified as a flow (investment) rather than a stock of capital, though this can readily be changed without altering the spirit of the model’s outcomes.

⁵ Thus, in (4) the growth effects of an increase in unproductive expenditures, g_c , financed by lump-sum taxes, L , cancel.

It is immediately obvious from the Table that the predicted effects of taxes or expenditures on growth rates depend on: (i) the *type* of tax or expenditure considered (and hence the tax/expenditure *mix*); (ii) the total level of expenditures; and (iii) how this is financed (compensating tax or expenditure change). This is reinforced when budget surpluses/deficits are included.

Table A Growth Effects of Taxes and Expenditures

<i>Financed by:</i>	<i>Public Spending:</i>		<i>Deficits:</i>
	<i>Productive</i>	<i>Unproductive</i>	
<i>Taxes: Distortionary</i>	positive/negative <i>(at low/high levels)</i>	negative	ambiguous
<i>Non-distort.</i>	positive	zero	negative
<i>Deficits:</i>	ambiguous	negative	-

As Table A shows, even where all government expenditure is productive, the use of distortionary taxes to finance this can, at sufficiently large tax/expenditure levels, generate negative growth effects.⁶

For this framework to be useful empirically, it is important to be able to distinguish productive from unproductive expenditures and distortionary from non-distortionary taxes within public budgets in practice. On spending, a typical ‘first approximation’ is to treat government consumption spending as ‘unproductive’ (i.e. it affects consumers’ welfare but not private production efficiency) and treat investment spending as ‘productive’. The latter usually includes (some or all?) education and health spending because of their effects on human capital accumulation. The growth effects of public expenditure on current transfers

⁶ As Bajo-Rubio (2000) shows, a similar ‘inverted-U’ relationship between the growth rate and government size is also consistent with an augmented Solow model (i.e. constant returns to total capital are not required). However, in the Solow case this only applies to out-of-steady state behaviour.

such as social security remains a debated issue. If these merely affect welfare they can be treated analogously to other ‘unproductive’ expenditures. However, transfers may affect savings rates, inequality, enforcement of property rights, etc. and could therefore be either growth enhancing or retarding depending on the empirical relevance of these potential growth mechanisms.

On taxation, in the Barro (1990) model ‘distortionary’ taxes are those distorting the decision to invest – essentially capital and labour income taxes. With no labour-leisure-education choices, consumption taxes are non-distorting. However, as Mendoza et al. (1997) show, human capital investment can be affected by consumption taxes when labour supply is endogenous. Clearly, in practice, almost all taxes are distortionary to some degree and the key issue in searching for long-run effects of various taxes is whether these distortions can be expected to be substantial or minor with respect to the main determinants of long-run growth, such as investment or technical progress.

In extensions to the Barro-type model allowing budget deficits, whether these affect growth depends on whether Ricardian Equivalence (RE) is assumed to hold – that is, whether the private sector anticipates future taxes and adjusts its savings to compensate fully for changes in public sector savings. Where RE does not hold, budget deficits are generally expected to be growth-retarding. This can arise because total savings are reduced (if the private sector does not fully adjust its savings or government borrowing finances consumption goods provision), hence reducing factor accumulation. Alternatively, as Tanzi and Zee (1997) argue, if deficits are perceived as unsustainable, then changes in tax/expenditure policy and/or monetary policy will be anticipated. Either is likely to retard growth via effects on investment from increases in expected inflation or uncertainties associated with possible fiscal policy changes. Even if monetary policy is designed to ‘neutralise’ the inflationary effects of a budget deficit, growth is still likely to be retarded by the associated increases in interest rates.

III. Estimating Fiscal Policy Impacts on Growth in Europe

Using the framework discussed in section II, Kneller et al (1999) and Bleaney et al. (BGK, 2001) estimated the growth impacts of fiscal variables on long-run growth in OECD countries. In this Section we apply the BGK (2001) results to EU-specific data. Firstly, we consider the effect on average growth rates of the changes made to the fiscal budget in various European countries over the 1990s.⁷

The estimates made here rely on correctly identifying structural from cyclical changes to policy. To try to compare similar points in the business cycle we use data from the end of the 1980's and the latter part of the 1990s and average across 3-year periods to minimise any remaining business cycle effects. To maintain consistency with BGK the work here is based on IMF data at the consolidated central government level. Data limitations reduce the sample to 11 European countries. To these we add the US - the small size of its public sector compared to European countries makes it a useful comparison. The eleven European countries comprise nine members of the European Union (of which six are Euro-members), plus Norway and Switzerland. The BGK (2001) estimates are based on a sample of 17 OECD countries over 1970-94, using a dynamic fixed effects panel with annual data. A long lag structure (8 years) was included to separate the short-run and long-run effects of policy. The fiscal data were pre-classified to match the types of fiscal variable in Table A. These are given in Table B.

As noted above, growth theory predicts that unproductive expenditure and non-distortionary taxes have no effect on growth and can therefore be removed from the regression equation. Empirical testing contained in BGK (2001) supports this claim. The estimated parameters of the remaining five fiscal variables (along with their standard errors) are listed in Table 1 below. These results suggest that increasing tax revenues from distortionary taxes by 1 per cent of GDP reduces the average growth of the economy by

0.411 percentage points, whereas increasing productive expenditures by the same amount increases growth by 0.387 percentage points.⁸

Table B Classifying Taxes and Expenditures

Productive Expenditure	Unproductive Expenditure	Other Expenditure
<i>Education</i>	<i>Social security & welfare</i>	<i>Other expenditures</i>
<i>Health</i>	<i>Recreation</i>	
<i>Law & order</i>	<i>Economic services</i>	
<i>General public services</i>		
<i>Housing</i>		
<i>Transport & communication</i>		
Distortionary Taxation	Non-distortionary Taxation	Other Revenues
<i>Income & profit taxes</i>	<i>Domestic goods & services taxes</i>	<i>International trade taxes</i>
<i>Social security taxes</i>		<i>Other tax revenues</i>
<i>Payroll & manpower taxes</i>		<i>Non-tax revenues</i>

Note: The budget surplus/deficit is calculated as total revenues less total expenditures.

Table 1: Parameter Estimates from Bleaney et al. (2001)

<i>Fiscal variable</i>	<i>Parameter estimate (standard error)</i>
Budget surplus (<i>surp/def</i>)	0.105 (0.06)
Distortionary taxation (<i>rdis</i>)	-0.411 (0.05)
Productive expenditure (<i>eprd</i>)	0.387 (0.07)
Other expenditures (<i>eothe</i>)	0.040 (0.07)

⁷ To simulate tax, expenditure and deficit changes simultaneously and at a reasonable level of detail from the available literature we are limited to using the results in Kneller, et al. (1999) and BGK (2000). We consider the latter to be more reliable.

⁸ Note that the estimated effect of the budget surplus on long-run growth is somewhat smaller (at 0.105) and, by assumption this figure applies regardless of the method of financing budget deficits (e.g. money creation, bond sales). It might be expected that money-financed deficits would have especially harmful effects on growth (though not necessarily over the long-run). However, macroeconomic policy in OECD countries in the 1990s has generally avoided significant money-financing of budget deficits. Note also that omitting ‘neutral’ categories (non-distortionary taxes, unproductive expenditures) from Table 1 implies that these do not affect long-run growth but they may still affect the long-run *level* of GDP per capita.

Other revenues (<i>roth</i>)	0.040 (0.07)
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EU Fiscal Policy in the 1990s

Table 2 provides some evidence on taxes and expenditures across the sample countries. During the period 1995-97 the government that appropriated on average the greatest proportion of GDP was the Netherlands, although several of the other European countries were not far behind. According to Table 2 the public sector, measured by central government total expenditure, was greater than 40% of GDP on average during the period 1995-97 in Austria, Denmark, France, Norway, Netherlands, Sweden and the UK. Perhaps unsurprisingly the US has the smallest government sector of the countries considered here.

The greater portion of tax revenues in the sample are collected from distortionary taxes: an average of 20.7% of GDP against an average for non-distortionary taxes of 9.4%. This varies between over 30% of GDP in the Netherlands to 13% in Finland. Norway collects the greatest proportion of its GDP from non-distortionary taxes (15.4%), and the US the least (0.7%). The figure for the US is low relative to the other countries in the sample partly because most indirect taxes are issued at the local rather than the national level.

Unlike the revenue side of the budget, expenditures are more evenly split between productive and unproductive forms. The average for all 12 countries is 13.2% for productive expenditure and 18% for unproductive expenditure. The most generous welfare systems are in the Scandinavian and Western European democracies such as Sweden and France. The least generous are in Spain and the US, again in line with expectations. The greatest provision of productive expenditure is made in the Netherlands while the lowest is again in Spain.

According to Table 2 all of the countries in the sample, except Norway, had on average a budget deficit during the mid-to-late 1990s. Given the timing of the data used to calculate

Table 2 it is perhaps unsurprising that the annual deficit in the EU countries is around the EMU-convergence limit of 3% of GDP.

In order to estimate how changes made to fiscal policy over the 1990's affected the average growth rate of the European economies we must separate structural from cyclical changes to fiscal policy. Table 3 does this for each of the fiscal categories by subtracting the average for 1987-89 from the 1995-97 average. The period 1987-89 was chosen as it represents a broadly similar point in the business cycle and the data were also averaged across 3-year periods to minimise any remaining business cycle influences.⁹

Table 2: Government Budget Data (% GDP), average for 1995-97

	<i>rdis</i>	<i>rndis</i>	<i>eprd</i>	<u> </u>	<u> </u>	<i>enprd</i>	<i>surp/</i> <i>def</i>	<i>texp</i>	<i>trev</i>
				(of <i>educ</i>)	(which <i>ehlth</i>)				
Austria	24.2	8.9	17.9	3.8	5.5	19.2	-3.9	41.0	37.1
Denmark	18.0	15.5	12.0	4.0	0.4	20.7	-2.1	42.3	40.4
Finland	13.7	13.7	12.4	3.9	1.2	21.2	-6.1	38.4	33.2
France	25.9	10.8	17.9	3.1	7.9	21.1	-3.6	44.4	40.7
Germany	19.9	7.1	10.3	0.2	6.2	18.1	-1.7	33.7	32.1
Netherlands	30.2	10.1	20.4	4.9	6.8	18.8	-2.8	46.9	43.9
Norway	17.4	15.4	11.6	2.6	1.6	17.3	1.0	37.1	42.2
Spain	21.0	7.2	7.9	1.5	2.1	15.7	-6.2	36.7	30.5
Sweden	22.3	11.8	11.7	2.3	0.1	25.7	-5.3	44.8	40.2
Switzerland	16.2	5.5	10.7	0.7	5.4	15.0	-1.1	27.4	26.5
UK	21.7	11.5	14.2	1.6	5.7	16.3	-3.7	40.0	35.9
US	18.2	0.7	11.7	0.4	4.4	7.1	-1.3	22.1	20.8
average	20.7	9.8	13.2	2.4	3.9	18.0	-3.1	37.9	35.3
<i>s.d.</i>	4.6	4.3	3.7	1.6	2.7	4.5	2.2	7.3	6.9

Note: All figures are expressed as ratios of GDP. The 'other revenues' and 'other expenditure' categories are omitted from the Table to conserve space.

rdis = distortionary tax revenues; *rndis* = non-distortionary tax revenues; *eprd* = productive expenditure; *enprd* = unproductive expenditure; *educ* = education expenditure; *ehlth* = health expenditure; *surp/def* budget surplus/deficit; *texp* = total expenditure; *trev* = total revenues.

⁹ These calculated changes to policy are amended slightly to ensure adding-up across the budget constraint. An identical data span was not available for all countries and so we compare the periods 1989-91 and 1993-95 for Denmark, and the latest suitable data for France, Germany and Switzerland is 1991-93. The estimated changes to fiscal policy in these countries are therefore more likely to contain information about cyclical adjustments.

Table 2 also makes clear that the mix of fiscal revenues and expenditures differs markedly between countries, while Table 3 shows that no single factor dominated changes in the fiscal budget over the 1990's. Of the few likely common influences the political pressure to meet the convergence criteria for EMU entry is an obvious one. This shows up only weakly in the data however. The annual deficit fell as a percentage of GDP in Germany, Austria and the Netherlands, while it rose in France, Finland and Spain. In these latter countries the deficit was lower in 1997 than in 1995 suggesting that the process of restructuring was not complete in the data available here. Of the three EU countries in the sample that chose not to join EMU, the UK, Sweden and Denmark, all saw a rise in the annual deficit as a percentage of GDP compared to the late 1980's. It would seem that any political pressure was less of a binding constraint in these countries.

Table 3: Changes to the Government Budget
(% GDP; 1987-9 to 1995-7)

	<i>rdis</i>	<i>rndis</i>	<i>eprd</i>	<i>enprd</i>	<i>surp/def</i>
Austria	2.6	-0.2	2.0	-0.8	0.8
Denmark	0.3	-0.6	0.9	3.1	-3.0
Finland	0.6	-0.2	-1.7	6.9	-6.6
France	0.4	-1.0	1.4	0.0	-1.8
Germany	0.7	-0.4	-0.4	1.5	0.5
Netherlands	-3.0	-0.6	-3.0	-4.0	1.8
Norway	0.0	-0.5	0.0	-1.3	2.0
Spain	0.1	0.5	-4.1	1.0	-2.9
Sweden	-2.5	0.0	-0.3	3.0	-6.3
Switzerland	1.2	0.8	0.0	2.2	0.6
UK	0.3	1.1	0.6	2.0	-4.0
US	1.0	0.1	-0.1	-0.5	1.6

rdis = distortionary tax revenues; *rndis* = non-distortionary tax revenues; *eprd* = productive expenditure; *enprd* = unproductive expenditure; *educ* = education expenditure; *ehlth* = health expenditure; *surp/def* budget surplus/deficit.

Despite the rather complex set of changes to the fiscal budget described in Table 3 the public sector (measured by total expenditure) increased by more than 1 percentage point of GDP in only four of the twelve countries: Sweden (1.9), the UK (2), Finland (3.4) and Spain (6.2). It fell in Denmark (-0.7), Norway (-0.9) and the US (-0.2), although none by more than 1 per cent of GDP. Given the decline in the deficit noted above it would appear

from this that most European countries chose to reduce the deficit by increasing revenues rather than decreasing expenditures.

In some cases expenditures on productive or unproductive goods and services were increased, perhaps to offset any negative political consequences of raising taxes. In Germany tax revenues were increased along with unproductive expenditures, while in Austria it was productive expenditures which were raised. The Netherlands is something of an exception: expenditures and distortionary tax revenues both fell (though again this may reflect a tendency to use some policy changes to offset the negative political consequences of others). The net effect of these changes was to increase the size of the public sector by 0.4 percentage points in Austria, 0.7 percentage points in Germany and 0.1 percentage points in the Netherlands. A similar lack of consistency in terms of policy rules appears to have occurred in the EMU-member countries in which the deficit rose.¹⁰

Fiscal-Growth Estimates for the 1990s.

Table 4 demonstrates that the net effect on growth of the changes to the fiscal budget in EMU countries is generally quite small. The exceptions to this are Spain and Finland, where the long-run growth rate of the economy decreased by over one percentage point per annum. As long-run effects, these figures are probably too large to be credible and serve to highlight several limitations in an application such as this using currently available empirical estimates and fiscal data which, for those countries, may not completely eliminate cyclical effects. Perhaps the most important limitation in this regard is the possibility of heterogeneity in the effect of fiscal policy changes across countries because of differences in institutional characteristics, as noted in Section III. Caution over the size of these estimated effects leads us to remove these countries from the sample from this point onwards.¹¹

¹⁰ In France the increase in the deficit was matched by a decrease in revenues from non-distortionary taxation but expenditure on productive goods and services were increased. In Finland the increased deficit appears to have largely been used to fund increases in unproductive expenditure, while in Spain there was a large increase in other expenditure and some decrease in productive expenditures.

¹¹ The results in Table 4 are robust to the use of alternative parameter estimates taken from BGK (2001) which take account of possible endogeneity bias.

Among the EMU countries, the average growth rate is expected to have increased due to fiscal policy in France and the Netherlands, and decreased in Austria and Germany. It is clear from Table 4 that whether fiscal effects on average growth rates are positive or negative depends both on whether fiscal deficits increase or decrease and on the mix of taxes and expenditure.

Table 4: Estimated Growth Effects

	<i>rdis</i>	<i>eprd</i>	<i>surp/def</i>	Growth Effect <i>(confidence interval)</i>	Growth Effect: <i>disagg. expenditures</i>
Austria	-1.06	0.77	0.09	-0.18 <i>(-0.3 -0.1)</i>	-0.31 <i>(-0.5 -0.1)</i>
Denmark	-0.14	0.35	-0.31	-0.11 <i>(-0.2 0.0)</i>	-0.18 <i>(-0.4 0.0)</i>
Finland	-0.25	-0.67	-0.69	-1.41 <i>(-1.3 -1.5)</i>	-
France	-0.18	0.55	-0.18	0.19 <i>(0.1 0.3)</i>	0.10 <i>(-0.1 0.3)</i>
Germany	-0.31	-0.17	0.05	-0.36 <i>(-0.5 -0.3)</i>	-0.31 <i>(-0.5 -0.1)</i>
Netherlands	1.23	-1.16	0.19	0.23 <i>(0.1 0.3)</i>	0.38 <i>(0.2 0.6)</i>
Norway	0.00	0.00	0.21	0.22 <i>(0.1 0.3)</i>	0.39 <i>(0.2 0.6)</i>
Spain	-0.04	-1.58	-0.31	-1.69 <i>(-1.8 -1.6)</i>	-
Sweden	1.04	-0.13	-0.66	0.20 <i>(0.1 0.3)</i>	-0.11 <i>(-0.3 0.1)</i>
Switzerland	-0.49	0.01	0.06	-0.38 <i>(-0.5 -0.3)</i>	-0.37 <i>(-0.6 -0.1)</i>
UK	-0.14	0.24	-0.42	-0.29 <i>(-0.4 -0.2)</i>	-0.33 <i>(-0.6 -0.1)</i>
US	-0.40	-0.05	0.17	-0.30 <i>(-0.4 -0.2)</i>	-0.28 <i>(-0.5 -0.1)</i>

Note: Overall growth effects include effects from other revenues and expenditures.
rdis = distortionary tax revenues; *eprd* = productive expenditure; *surp/def* budget surplus/deficit.

Using the variance-covariance matrix to create confidence intervals around these estimates suggests that there is a 95% probability that the net effect of the changes made to fiscal

policy in the 1990s is positive in France and the Netherlands and negative in Germany and Austria. These growth effects are reasonably precisely estimated and, though rather modest, are composed of much larger effects from individual changes to policy (see Table 4). For example, the dominant factor explaining the 0.2 percentage point per annum net increase in average growth in France is the increase in productive forms of expenditure (*row 4, column 2*). By itself this added over half a percentage point to the long-term growth rate. In the Netherlands the net positive effect appears to arise almost entirely because of a reduction in the deficit, given that the large positive growth effect from decreasing distortionary taxes (1.2 percentage points) was completely offset by the decrease in productive expenditures.

The predicted decline in average growth rates in Germany in the table is a consequence of increased revenues from distortionary taxation (0.3 percentage points) and decreased expenditure on productive goods and services (0.2 percentage points). Proposed EMU membership and the re-unification probably explain much of this combination of policy changes in Germany. Finally, in Austria an increase in revenues from distortionary taxation again appear to offer much of the explanation for the net decline in growth (1.1 percentage points), although this effect was to some degree offset by the effect of increasing productive expenditure (0.8 percentage points).

The remaining EU countries used their increased deficit to fund increased productive or unproductive expenditures, with some compensating or additional movement in tax revenues. In Denmark, Sweden and the UK, unproductive expenditures rose 1% of GDP, but whereas no substantive changes were made in the remainder of the budget in Denmark, Sweden experienced declines in distortionary taxation and the UK saw increases in non-distortionary tax revenues. As already noted above, the use of deficit financing meant that public spending in the UK and Sweden grew by around 2 percentage points of GDP from the late 1980s, whereas in Denmark the public sector actually decreased. The reduction in revenues from distortionary taxation is the principal explanation of the long-run growth increase in Sweden compared to Denmark and the UK. This change alone added 1 percentage point per annum to growth. Again the confidence interval placed round these estimates suggest a 95 per cent chance that the net effect of the changes made to fiscal

policy in the UK and Denmark had a negative effect on growth and a positive effect in Sweden.

Disaggregated Expenditures

By disaggregating expenditure categories, greater detail can be added to the government budget and to estimated fiscal-growth effects. The final column of Table 4 reports growth effects using regressions that disaggregate productive expenditures into education, health and ‘other productive’. The alternative parameter estimates have some impact on the estimated growth effects. Perhaps the most obvious change is that for Sweden where the net effect alters from +0.20 to –0.11 percentage points per annum. The principal explanation for this switch in sign is the negative growth effect from reducing expenditures on education over the 1990s that was not fully captured using the aggregated data. Unlike the forecasts for the other countries this new forecast is outside the 95 per cent confidence interval made using results from aggregated data.

The confidence intervals using disaggregated expenditure data are larger, suggesting some cost to using this greater level of detail in the data. Nevertheless, in only two of the ten forecasts does the confidence interval cross zero (Sweden, France), indicating that while we must be cautious about the precise magnitude of net growth effects, we can remain reasonably confident regarding whether the net effect of fiscal policy was positive or negative.

Heterogeneous fiscal-growth effects

In estimating individual country fiscal-growth effects, we have assumed so far that the homogeneous parameters estimated over all countries applies to each. This sub-section addresses an alternative source of potential differences between countries: that these marginal effects differ across countries. That is, do regression parameters differ across the sample such that, *ceteris paribus*, some EU countries experience stronger fiscal effects on growth than others?

It is known that the results from a dynamic fixed effects (DFE) regression are likely to be biased if, as Pesaran and Smith (1995) suggest, the assumption of homogeneity of the short-run parameter estimates across countries cannot be accepted. They show that this may be a more serious problem than the bias generated by the inclusion of lagged dependent variables and can lead to inconsistent and misleading results even for large T and large N. To overcome this bias they suggest the use of either the pooled mean group (PMG) or mean group (MG) estimators (Pesaran, et al., 1999). A comparison of the results from these two has the additional advantage of allowing us to address formally the question of whether the long-run effect of fiscal policy on growth is identical across countries.¹² Acceptance of this restriction implies that the results from the PMG estimator are more efficient than those from the MG estimator (Pesaran, et al., 1999).

The estimated regression for the MG model is of the following ARDL form,

$$\Delta g_{it} = \mathbf{f}_i(g_{i,t-1} - \mathbf{b}_i F_{it-1}) + \sum_{j=1}^k \mathbf{g}_{0ij} \Delta g_{it-j} + \sum_{l=0}^m \mathbf{g}_{1il} \Delta F_{it-l} + \mathbf{e}_{it} \quad (5)$$

where i indicates the country, t is time, g is the rate of growth, F is a matrix of fiscal variables, \mathbf{f} , \mathbf{b} and γ are parameters to be estimated and \mathbf{e}_t a classical error term. The test for the long run effect of fiscal policy is made on the parameter \mathbf{b}_i (the long run fiscal policy parameter adjusted for lagged growth). Consistent with the general-to-specific approach, the lag structure of the regression is chosen on the basis of the Schwarz information criteria. The long run effect of fiscal policy across countries is taken as the (unweighted) average of the estimates from the N individual country regressions. The PMG model differs from these single country time series regressions by imposing homogeneity of the long-run parameters: \mathbf{f}_i and \mathbf{b}_i become \mathbf{f} and \mathbf{b} respectively. A Hausman test can be used to test the statistical plausibility of this restriction.¹³

¹² The PMG estimator has the additional advantage over the alternative mean-group (MG) estimator in that it performs well even when, as is the case here, N is small (Hsiao et al., 1997). The MG estimator tends to be thought of as providing better information about the short-run and error correction coefficients of the PMG model (Pesaran et al., 1998).

¹³ We are grateful to H. Pesaran for making available copies of the GAUSS programme which were used for the estimation of the PMG model.

The disadvantage of the MG and PMG estimators is of course that unless the available time series is very long a degrees of freedom problem is soon reached. For this reason we restrict the right-hand-side variables to include the investment rate and three fiscal variables: the surplus, distortionary taxation and productive expenditure. These are chosen in light of the results from BKG (2001) and it is worth remembering that the coefficients on these terms must be interpreted as conditional, on those excluded fiscal variables, some of which the results from BKG suggest may be significant. We are also forced to restrict the regression equation to include a maximum of two lags of the dependent variable.

We begin by estimating equation (5) for the 16 OECD countries and then for the 10 EU countries. As reported in Table 5, we provide the individual test statistics (p -values) from the Hausman test of homogeneity of the long-run parameters as well as the test statistic from a joint test. For the OECD16 we find we can accept homogeneity both collectively and individually, although for distortionary taxation (*rdis*) acceptance is at the 13 per cent. Similarly for the EU10 we can again accept the restriction that the long-run parameters are identical, although for productive expenditures (*eprd*) acceptance is at the 11 per cent level. Having accepted homogeneity of the long-run parameters we choose to report the results from the PMG estimator in the table. (We omit the short-run parameters to conserve space).

Concentrating on the fiscal parameters, consistent with the results from BKG (2001) the surplus/deficit and productive expenditures are found to affect the growth rate positively whereas distortionary taxation is found to lower growth. All of these long-run parameter estimates are significant at standard confidence levels. The parameter estimates are broadly in line with those from BKG, the effect of distortionary taxation and the surplus are very close to the estimates found in that paper whereas the effect of productive expenditure is slightly lower. In order to test whether this is because of the use of a different set of countries, a slightly longer time period and the removal of several variables from the right hand side of the regression we re-estimate the DFE model of BKG with these restrictions. Regression 3 (Table 5) imposes the same length of lag structure as BKG. The DFE regression with a long lag structure in fact produces similar results to the PMG regressions.

The coefficients are similar in value, although the standard errors are somewhat larger such that the coefficient on the budget surplus is no longer significant and that on productive expenditure is significant only at the 10 per cent level.

Bassanini & Scarpetta (2001) argue that in small country samples the estimated parameters may be sensitive to the inclusion or exclusion of any one country, even when the Hausman tests do not reject the assumption of homogeneity of the long-run parameters. Following their example, we re-estimate the PMG regression 1 excluding in turn one country from the sample. Figure 1 reports the coefficients for each of the fiscal variables when a single country is omitted. We also indicate the standard errors from the full sample results to provide 95% confidence intervals for the results. As can be seen the parameter estimates remain stable from such a test and never stray outside of the confidence bands. The parameter estimates from the EU10 sample in Table 5 also lie within these confidence bands.

Table 5 PMG Regression Results

<i>Method:</i>	<i>PMG</i>	<i>Hausman tests</i>	<i>PMG</i>	<i>Hausman tests</i>	<i>DFE (8-lags)</i>
<i>Sample:</i>	<i>OECD16</i>		<i>EU10</i>		<i>OECD16</i>
<i>Regression No.</i>	<i>1</i>		<i>2</i>		<i>3</i>
Budget surplus	0.100 (3.27)	1.07 (0.30)	0.121 (3.32)	0.02 (0.88)	0.068 (0.84)
Distortionary taxation	-0.337 (8.01)	2.32 (0.13)	-0.353 (7.27)	1.52 (0.22)	-0.395 (3.68)
Productive expenditure	0.163 (3.30)	0.96 (0.33)	0.145 (2.41)	2.60 (0.11)	0.287 (1.79)
Investment ratio	-0.042 (1.44)	0.001 (0.92)	-0.052 (1.39)	0.08 (0.78)	0.119 (1.41)
<i>Joint Hausman test</i>		2.94 (0.57)		5.39 (0.25)	

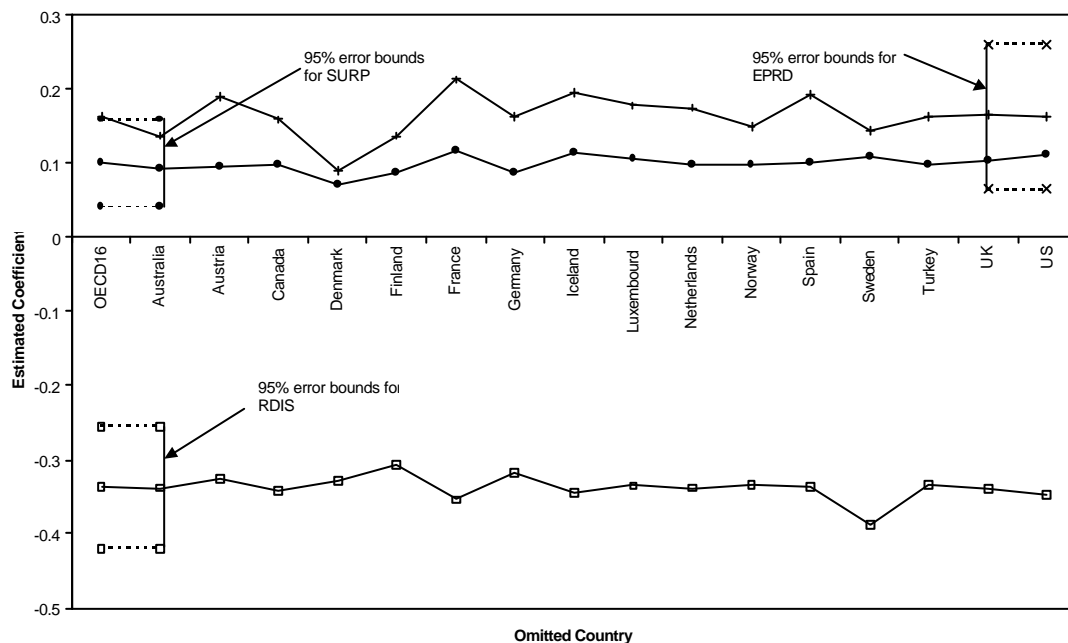
Note: t-statistics in regression parentheses; p-values for Hausman tests.

IV Convergence and Divergence in EU Fiscal Policy

The above results appear to suggest that fiscal policy has had a significant, and fairly robust, effect on long-run growth in European countries, and more widely in the OECD. Evidence

from, for example, Barro and Sala-i-Martin (1995) and de la Fuente (1998) also suggests a tendency towards per capita income convergence within and between European countries. This raises the obvious question: has fiscal policy contributed towards, or acted against, income convergence in Europe? There are, of course, several forces acting towards convergence of particular fiscal variables across the EU. For example, the ‘convergence criteria’ for monetary union include restrictions on budgetary deficits for participating countries, while tax harmonisation guidelines have operated more widely within the EU for some time, encouraging moves towards similar indirect tax rates in particular. Convergence of deficits and taxes would, of course, via the government budget constraint, imply some convergence of public expenditures. However, as we have seen, within tax and expenditure totals, EU countries continue to have considerable discretion over distortionary/non-distortionary and productive/unproductive components. Since it is these components which are important for growth, growth convergence need not necessarily be fostered by fiscal changes.

Figure 1 Parameter Heterogeneity



We begin by considering whether the five fiscal/GDP ratios (2 x tax; 2 x expenditure; budget surplus) are converging over time for a sample of EU countries. When examining income convergence, the usual measure adopted is σ -convergence – measuring changes in the

standard deviation of income levels. In our case however, since we wish to be able to compare *across fiscal categories* as well as over time, standard deviations are not very helpful due to the absence of any normalisation. An alternative, used by Sanz and Velazquez (2001), is to construct ‘similarity indices’ which measure the share of particular expenditure categories in total expenditure for country *i* relative to the average for all countries in the sample. A similar measure could be used for our GDP ratios. However, while this measure has a lower bound of zero (identical values across countries), it has no upper bound.

For present purposes, *Gini coefficients* provide a preferable alternative. Applied to the relevant fiscal category, these provide a measure of the degree of inequality (dissimilarity) in fiscal variables across countries. Since our public expenditure or tax/GDP ratios are simply expenditures (or tax revenues) measured in GDP units, we can consider the spatial distribution of expenditures (taxes) across EU countries analogously to the distribution of income across individuals.¹⁴ Thus a *Gini* = 0 implies complete equality (identical values across countries), and *Gini* = 1 implies complete inequality (i.e. one country spends the EU total, all others spend zero). Table 6 below shows *Gini* coefficients for total revenue and expenditure, while Figure 2 shows *Ginis* for the two expenditure (*eprd*, *enprd*) and tax (*rdis*, *rndis*) components. Since it is important that the sample is unchanged across periods, these are calculated for five 5-year periods from 1970-1995, for a sample of 10 EU countries for which comparable data are available.¹⁵ (Period averaging has been used to smooth short-term variations). Similar *Gini* coefficients for surplus/deficits are shown in Figure 3.¹⁶

¹⁴ Note that the tax/GDP ratios approximate effective average tax rates, such that harmonisation particularly of indirect tax rates in the EU might be expected to encourage convergence of *rndis*.

¹⁵ The countries are: Austria, Denmark, Finland, France Germany, Luxembourg, Netherlands, Spain, Sweden, UK. Data for France and the Netherlands are unavailable for some categories for 1970-4. Test in Table 7 therefore use 1975-80 as the initial period.

¹⁶ Constructing a *Gini* for deficits requires non-negative values. Those shown have therefore been constructed by adjusting all deficits upwards equally such that the smallest deficit (Finland in 1990-5) equals 1. *Ginis* are not invariant to this re-scaling so that while *Ginis* for *surp/def* can be compared across time, they cannot be compared with those for taxes/expenditures.

Table 6 suggests a considerable degree of similarity across EU countries, and both total tax and expenditure ratios have become more similar (equal) since the mid-1970s.¹⁷ It can be seen from Figure 2 that there is also some evidence of unconditional convergence (declining *Gini*) for the tax components and productive expenditures, but not for unproductive expenditures, where values are approximately constant throughout the period. Deficits, on the other hand (Figure 3), show clear *divergent* tendencies (increasing *Gini*).¹⁸

Table 6 Gini Coefficients for Total Tax Revenues and Expenditures

	<i>Total revenues</i>	<i>Total expenditures</i>
<i>1970-5</i>	0.105	0.109
<i>1975-80</i>	0.113	0.106
<i>1980-85</i>	0.114	0.107
<i>1985-90</i>	0.095	0.094
<i>1990-95</i>	0.084	0.070

To examine the strength of these effects we test for statistically significant changes in *Ginis*, and also use two tests for convergence based on changes in variances. These are the Variance Ratio (VR), and Likelihood Ratio (LR) tests proposed by Lichtenberg (1994) and Carree and Klomp (1995) respectively. The VR test is a simple ratio of initial and final variances while the LR test also uses the covariance. Table 7 presents the results of these tests, which indicate that for cases of potential convergence, the null hypothesis of no convergence cannot be rejected (with the possible exception of *rndis*). Note that the alternative hypothesis, H_1 , is of divergence for unproductive expenditure and surpluses, since for these cases, the final period variance (or *Gini*) exceeds initial period values. The *Ginis* suggest significant *divergence* for the budget surplus/deficit.

Though there is little statistical evidence of unconditional convergence across the EU sample as a whole, it may nevertheless be the case that (i) a subset of countries share a steady-

¹⁷ For the initial period calculations, limited data are available for France (1972-4) and the Netherlands (1973-4).

¹⁸ We have also calculated equivalent coefficients of variation which reveal broadly similar patterns to those in Figures 2 and 3.

state; and (ii) that countries converge (conditionally) to their own, or a shared, steady-state.

We can test for this using the fixed-effects regression:

$$\Delta \ln y_{it} = \mathbf{a}_{NT} + \mathbf{b} \ln y_{i,t-1} + \sum_{i=1}^{N-1} \mathbf{a}_i + \sum_{t=1}^{T-1} \mathbf{a}_t + \mathbf{e}_{it} \quad (6)$$

where y is the relevant fiscal variable, the \mathbf{a} and \mathbf{b} are parameters and \mathbf{e} is a classical error term. The parameter \mathbf{b} captures convergence ($\mathbf{b} < 0$) from short-run disequilibrium, towards the steady-state; \mathbf{a} captures common time-varying shocks, while \mathbf{a}_i captures country fixed effects, such that $\mathbf{a}_i \neq 0$ implies country i does not share a steady-state with country N – the ‘default’ country.

Results from this exercise are shown in Table 8. There is clear evidence of *within-country* \mathbf{b} -convergence with, perhaps unsurprisingly, especially strong equilibrating tendencies for the budget surplus/deficit.¹⁹ However, tests of the null that $\sum \mathbf{a}_i = 0$ generally reject the hypothesis, suggesting that the steady-state values for the various fiscal ratios differ across our OECD sample countries (though for *rndis*, H_0 is rejected only at the 10% level). Similar rejection is evident for the EU10 sample.

Table 7 Variance Ratio and Likelihood Ratio Tests for Fiscal Components: 1970/5 – 1990/5

Hypotheses:		Variance ratio	Likelihood	Gini change
$H_0 = \text{no converge./diverge.}$		$F\text{-test}$	ratio $\chi^2\text{-test}$	
$H_1: \text{Con} = \text{convergence}$		$F_{0.05} = 3.44$	$\chi^2_{0.05} = 3.84$	$t_{0.05} = 2.10$
$\text{Div} = \text{divergence}$			$\chi^2_{0.1} = 2.71$	$t_{0.1} = 1.73$
<i>eprd</i>	<i>Con</i>	1.12	0.05	-0.035 ($t = 1.43$)
<i>enprd</i>	<i>Div</i> (<i>Con</i> for Gini)	1.87	0.79	-0.007 ($t = 0.28$)
<i>rdis</i>	<i>Con</i>	1.16	0.10	-0.027 ($t = 0.97$)
<i>rndis</i>	<i>Con</i>	1.24	0.18	-0.043 ($t = 1.84$)*
<i>surp/def</i>	<i>Div</i>	2.39	1.44	0.139

¹⁹ Since the work of Arellano and Bond (1991), dynamic fixed-effects models are however known to generate biased and/or inefficient coefficient estimates arising from the presence of the lagged dependent variable. The magnitude of \mathbf{b} should therefore be interpreted with caution.

$$(t = 2.78)^{**}$$

Note: the null hypothesis is based on whether the ratio of final to initial variances (VR test) exceeds or falls short of unity (or the *Gini* falls or rises). *(**) = exceeds 10% (5%) critical value.

Table 8 Testing for Conditional Convergence

Technique:	2-way FE; 5-year averages					sample
Dep. Var:	<i>rdis</i>	<i>rndis</i>	<i>eprd</i>	<i>enprd</i>	<i>surp/def</i>	
b (<i>t</i> -ratios)	-0.046 (5.93)	-0.114 (4.75)	-0.083 (6.42)	-0.041 (3.83)	-1.067 (4.72)	EU10
b (<i>t</i> -ratios)	-0.056 (5.28)	-0.111 (5.19)	-0.070 (7.23)	-0.038 (3.53)	-1.093 (6.85)	OECD16
Test $\sum \mathbf{a}_i = 0$ (<i>p</i> -values)	2.06 (0.03)	1.62 (0.10)	3.67 (0.000)	3.19 (0.001)	2.09 (0.03)	OECD16

This raises the question of whether a European sub-sample shares common steady-state values? If, as is often suggested, EU countries share similar fiscal constraints and have been following harmonisation processes over this period, it might be expected that their long-run expenditures, taxes or surpluses (as shares of GDP) would be similar. On the other hand, different characteristics across EU countries (such as different population age structures, differing expenditure preferences) may perpetuate differing fiscal values in the long-run.

To examine this, we proceed as follows. First, using pair-wise comparisons, we consider all pairs of countries for which the hypothesis, $\mathbf{a}_k = \mathbf{a}_j$ ($k \neq j$) can be accepted. Following a similar procedure for groups of three, four etc countries sharing the same \mathbf{a} we identify the maximum number of countries belonging to such a group. For the three fiscal variables that appear in our growth regressions, this leads to the classification of countries given in Table 9 below. The *F*-statistics at the foot of each column test the hypothesis that countries belong to the groups to which they have been allocated.

Perhaps the most interesting case concerns the budget surplus, where 7 of the 10 EU countries appear to share the same steady-state values (fixed effects), with only Denmark, Germany and Luxembourg excluded (the first two of which share similar values). For *rdis*

and *eprd*, shared α s are less common with, at most, a group of 4 (*rdis*) or two groups of three (*eprd*) evident. For countries labelled “different α ”, we can accept the hypothesis that their estimated fixed effects are significantly different from all other EU10 countries. That is, each country is estimated to converge on its own steady-state value of *rdis*, *eprd* or *surp/def*.

Two points emerge from these results. Firstly, it is not surprising that some EU countries choose similar long-run ratios to GDP for their productive public expenditures or distortionary taxes, whilst some choose quite different values. Secondly, evidence of ***b***-convergence (but the general absence of ***s***-convergence) suggests that observed conditional convergence primarily reflects the tendency for countries to revert to their long-term trend, rather than any tendency for countries to approach a common steady-state over the period.

Since the data available here terminates in 1995, it may be that much of the pressure on EU governments towards similar tax/expenditure patterns post-dates the current evidence. Nevertheless, for the period we can study, the results in this section suggest three things. (1) There is very little evidence for ***s***-convergence - relevant fiscal variables are not, in general, becoming more similar across Europe. (2) There is only limited evidence of EU countries sharing the same steady state values of the three growth-affecting fiscal variables – *rdis*, *eprd*, and *surp/def*.²⁰ (3) Evidence of ***b***-convergence implies that country fiscal variables tend to revert toward their steady-state paths.

Table 9 EU Country Groupings

<i>rdis</i>	<i>eprd</i>		<i>surp/def</i>	
<i>Same α_i:</i>	<i>Same α_i:</i>		<i>Same α_i:</i>	
Group 1:	Group 1:	Group 2:	Group 1:	Group 2:
Austria	Austria	Denmark	Austria	Denmark
Germany	Luxembourg	Germany	Finland	Germany
Spain	UK	Spain	France	

²⁰ A similar picture emerges for the other two fiscal categories, *enprd* and *rdis*, with groups of at most three or four EU countries appearing to share common fixed effects.

Sweden		Netherlands
UK		Spain
		Sweden
		UK
<hr/>		
<i>Different α_i:</i>	<i>Different α_i:</i>	<i>Different α_i:</i>
Denmark	Finland	Luxembourg
Finland	France	
France	Netherlands	
Luxembourg	Sweden	
Netherlands		
<hr/>		
$F_{0.05}(15, 48) = 2.06$	$F_{0.05}(15, 48) = 3.67$	$F_{0.05}(15, 48) = 2.09$
$(p = 0.030)$	$(p = 0.0004)$	$(p = 0.027)$
<hr/>		

V. Conclusions

Recent evidence on the impact of fiscal policy on long-run growth in OECD countries has adopted the Barro (1990) framework to distinguish between ‘productive’ and ‘unproductive’ expenditures, and ‘distortionary’ and ‘non-distortionary’ taxes. Using estimated long-run growth effects from these fiscal variables from BGK (2001), this paper simulated the effects on growth rates of observed fiscal policy changes in the EU. With two exceptions (Finland and Spain - where long-run data appear unreliable) the individual country growth effects of actual changes in taxes, expenditures and deficits are plausible at around -0.2 to $+0.2$ of a percentage point per annum. Few common policy scenarios are apparent in the data however, with key sources of differences between countries being the extent to which *distortionary* taxes or deficits were used to fund public spending increases and whether additional spending was focussed on ‘productive’ activities. The paper also considers whether our growth regression model, which imposes parameter homogeneity across countries, is justified. The evidence suggests this is the case, with a high degree of uniformity across countries. One implication of these results is that changes in the *overall* share of taxes or spending in GDP or the annual budget surplus/deficit are not good guides to whether the growth effects of fiscal policy are likely to be positive or negative.

Finally the paper considered whether there is any evidence of ‘fiscal convergence’ across the EU. That is, are growth-affecting fiscal variables becoming more similar over time for

the EU? Though data are limited, the answer to this question generally appears to be negative, with little evidence of unconditional convergence but evidence of divergence for budget deficits. Countries do however revert to their own steady-state paths, but some EU countries appear to have chosen different long-run values for key growth-affecting fiscal/GDP ratios from their EU (or OECD) neighbours. However, as might be expected, budget deficits show a higher degree of long-run uniformity, with a few countries revealing strongly divergent behaviour (Denmark, Luxembourg).

Figure 2 EU Gini

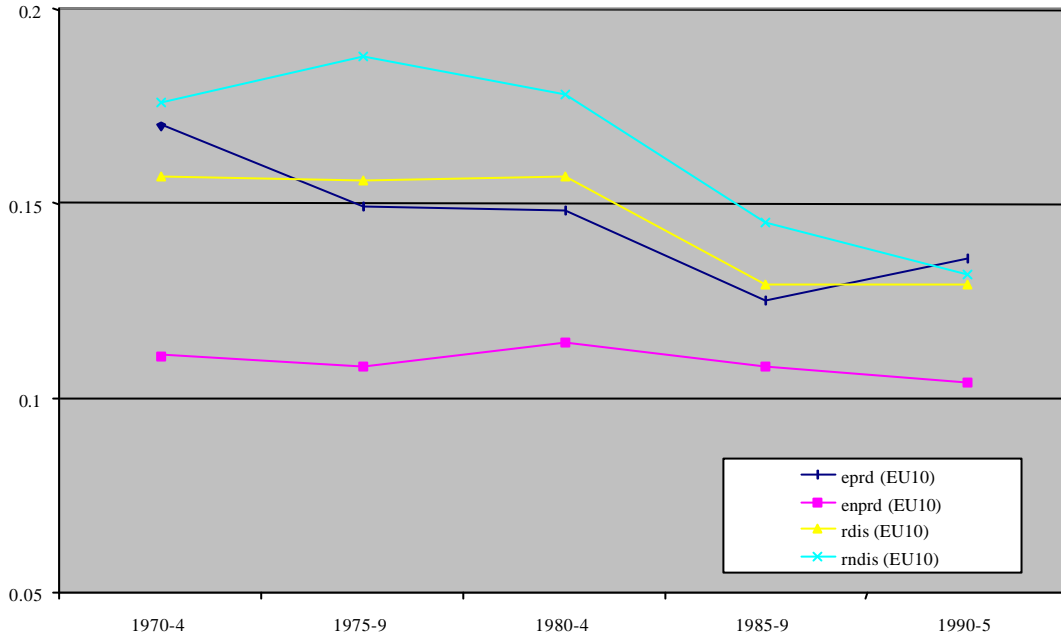
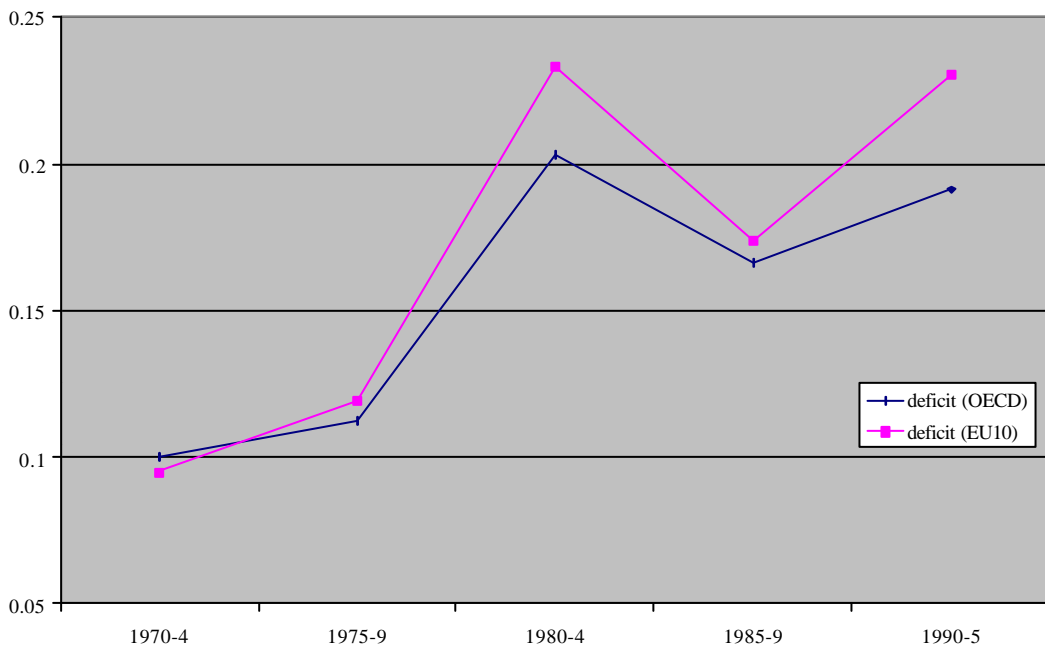


Figure 3 Gini Coefficients for Budget Deficits



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