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THE SOURCES OF IRISH GROWTH

Angel de la Fuente and Xavier Vives

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ABSTRACT

The Sources of Irish Growth*

This paper explores the sources of Ireland's relative growth performance. Using panel data for a sample of OECD countries, we estimate a convergence equation and use it to conduct a growth accounting exercise which provides quantitative estimates of the immediate sources of Ireland's growth differential *vis-à-vis* the OECD average and the other 'cohesion' countries of the EU. While we find that fiscal consolidation has contributed significantly to Ireland's improved performance, we are not able to fully account for the 'Irish miracle' in terms of the standard growth theory variables. This finding supports the extended view that some peculiar features of the Irish economy (such as its success in attracting high-quality foreign direct investment) have played a crucial role in recent years. We conclude with some reflections on the need for structural reforms as a way to ensure the sustainability of Ireland's rapid growth.

JEL Classification: E60, L40, O40, O52
Keywords: Ireland, growth, competition policy

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NON-TECHNICAL SUMMARY

Ireland's economic performance over the last few decades has been rather uneven. During the period 1960–85, Ireland's income per capita remained rather stable relative to the OECD average as the country was surpassed by Spain and Japan and lost considerable ground relative to Greece and Portugal. During the decade 1986–96, by contrast, Ireland exhibited the highest growth rate of the OECD, pulled away from the Mediterranean countries and significantly reduced the income differential with respect to the OECD average.

What factors can explain this dramatic reversal? This paper provides a tentative 'supply-side' answer to this question on the basis of an empirical analysis of the proximate determinants of growth in a sample of industrial economies. We estimate a simple empirical growth model which, building on the recent convergence literature, explicitly relates the evolution of income *per capita* to investment rates and other variables. This model is then used in a growth accounting exercise which provides quantitative estimates of the immediate sources of Ireland's growth differential *vis-à-vis* two natural references: the OECD average and two countries which start out from rather similar income levels, Spain and Portugal. In this manner, we can check how much of the 'Irish miracle' can be explained in terms of conventional variables, like investment in different types of capital or convergence effects. The residual of the exercise then gives us an indication of the extent to which we have to resort to 'special' explanations based on particular Irish features not captured in standard growth models.

The model we estimate seeks to 'explain' the growth pattern of a sample of industrial countries in terms of the behaviour of three sets of variables. First we focus on factor accumulation, as described by the rates of investment in physical, human and technological capital, and on the possible impact of two 'convergence mechanisms' identified by the growth literature (the operation of decreasing returns to scale and technological diffusion) which, other things equal, would tend to favour initially poorer economies. In addition to these 'growth theory' variables, the model incorporates two variables which summarize labour market performance (the unemployment and labour-force participation rates) and have a direct impact on income *per capita* for given levels of output per worker. Finally, we also include among our explanatory variables an indicator of the size of the government sector (total government expenditures as a percentage of GDP) which may serve as a proxy for the

effects of public sector activity on income levels, working through the efficiency of resource allocation and individual incentives for work and effort.

The estimated model and the underlying data are then used to quantify the contribution of the different variables of interest to Ireland's relative growth performance. If we focus on average growth over the entire sample period, the model accounts rather well for the Irish experience. Progress has been made relative to both the OECD average and the group of poorer EU economies, with the first growth differential reflecting mainly the usual convergence forces and the second reflecting Ireland's relatively high rates of factor accumulation and its greater degree of fiscal discipline. When we disaggregate the sample into subperiods, however, the story becomes rather less clear. While our results are consistent with the view that fiscal adjustment was directly responsible for a sizeable increase in the growth rate after the mid-1980s, the model leaves much of the improvement in Ireland's economic performance unexplained.

The large remaining residual in our analysis suggests that factors not considered by our model have played an important role and points us towards specifically Irish characteristics. As far as these go, the dominant view in the literature seems to be that rapid growth has been driven mostly by a very dynamic export sector dominated by multinational firms which have invested heavily in Ireland in recent years and served as a conduit for the adoption of advanced technologies. This boom in foreign direct investment would reflect Ireland's attractiveness as a natural base for exports to the European Union. This attractiveness would be due in part to the provision of generous tax incentives which may have served to compensate for other disadvantages such as high prices for business services and other inputs to manufacturing. Other important factors would be the availability of a highly skilled and English-speaking labour-force, relatively low labour costs (preserved in recent years by an incomes policy aimed at wage moderation), heavy investment in infrastructure and a pragmatic exchange rate policy. An additional consideration is the inflow of large subsidies from the European Union, which has helped to finance infrastructure and educational investment without undue budgetary strain.

This story has a ring of plausibility to it and indeed it is difficult to think of a convincing alternative explanation. It may be asked, however, why success came when it did. After all, many of the factors we have just cited have been in operation for quite a few years before the current growth spurt. We would venture the guess that the success in attracting foreign direct investment in recent years was triggered by two factors. The first is the renewed interest of

US and other multinational firms in gaining a foothold in Europe, which came with the stimulus to the EEC resulting from the accession of new members in 1986 and the formulation of clear plans for the completion of the Single Market in 1992. The second factor is Ireland's clear determination to ensure macroeconomic stability and its commitment to sustainable fiscal policy. In this sense, fiscal consolidation may have acted as a catalyst, helping to change foreign investors' perception of the country.

There seems to be some concern in Ireland about the sustainability of current growth rates and about the potential dangers of a growth strategy based on the attraction of foreign direct investment. Two of the main concerns are the probable loss of Ireland's status as an Objective 1 region as it approaches the European Union's average income per capita, and the prospect that existing tax benefits will be severely limited in the future. The loss of Structural Fund grants from the EU would represent a substantial loss of resources for public investment and training, and it is feared that the reduction of tax incentives may diminish the country's attractiveness for foreign firms.

Since the current regime of high subsidies to the manufacturing sector may in fact have rather perverse effects on the efficiency of resource allocation, the imposed reduction of existing aids may in fact turn out to be a blessing in disguise. In order to realize its potential, however, it will be necessary to implement policies designed to offset the negative impact of the loss of tax breaks through an improvement in other determinants of competitiveness. From this perspective, the real bottleneck may well be the lack of competition in the service sector. We argue that a greater degree of competition in the overall economy, and in the service sector in particular, would put Ireland on a sustainable growth track provided sound macroeconomic (fiscal and monetary) policies are pursued.

1.- Introduction

Ireland's economic performance over the last few decades has been rather uneven. During the period 1960-85, Ireland's income per capita remained rather stable relative to the OECD average as the country was surpassed by Japan and Spain and lost considerable ground relative to Greece and Portugal. During the decade 1986-96, by contrast, Ireland exhibited the highest growth rate of the OECD, pulled away from the Mediterranean countries and significantly reduced the income differential with respect to the OECD average. This extraordinary performance has earned Ireland the title of *Europe's tiger economy*.[1]

What factors can explain this dramatic reversal? This paper attempts to provide a tentative "supply- side" answer to this question on the basis of an empirical analysis of the proximate determinants of growth in a sample of industrial economies. We use a growth accounting approach and check how much of the "Irish miracle" can be explained in terms of conventional variables, like investment in different types of capital or *convergence* effects. The residual of the exercise then gives us an indication of the extent to which we have to resort to "special" explanations based on particular Irish features not captured in standard growth models.

The paper is organized as follows. To set the stage, Section 2 reviews the evolution of Ireland's relative income per capita during the last few decades and examines the comparative behaviour of the main immediate determinants of this variable. Next, we introduce and estimate a simple empirical growth model which, building on the recent convergence literature, explicitly relates the evolution of income per capita to investment rates and other variables. This model is then used in a growth accounting exercise which provides quantitative estimates of the immediate sources of Ireland's growth differential vis a vis two natural references: the OECD average and two countries which start out from rather similar income levels, Spain and Portugal. Section 3 presents the main results of the exercise, leaving the details of the model and the empirical results for the Appendix. Finally, Section 4 discusses the results, provides a tentative interpretation of the factors underlying Ireland's spectacular performance in recent years and concludes with some reflections on the types of policies which may be helpful in maintaining a rapid rate of economic growth.

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[1] *The Economist*, May 17th, 1997.

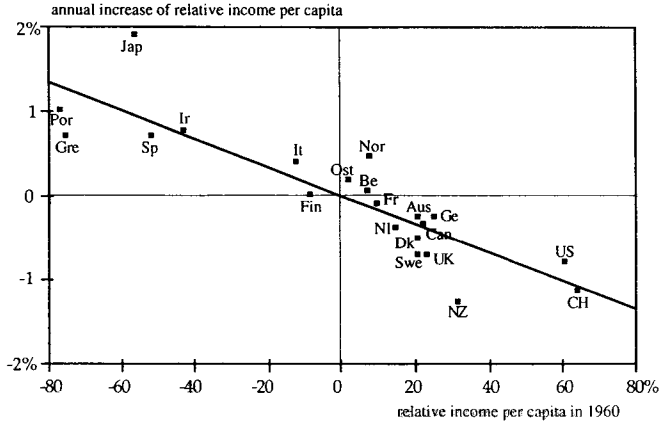
2.- Evolution of income per capita and other key variables

The convergence plot shown in Figure 1 provides a convenient point of departure for our analysis of Ireland's growth experience during the last decades. This plot summarizes the relationship between the initial position of each country in our sample of 21 industrial economies in terms of relative income per capita (i.e. log GDP per capita in deviations from the contemporaneous sample average of the same variable) and its differential growth rate during the period 1960-95.[2] As expected in this sample, the slope of the fitted regression line is negative, indicating that poorer countries have tended to grow faster than richer ones on average. The situation of each country in relation with the fitted regression line (which describes what may be considered the "typical" growth pattern in the sample) can be used as an indicator of a country's growth performance after eliminating a "convergence effect" which presumably reflects the relative advantages of initially backwards countries (such as a higher rate of return on investment if the technology exhibits decreasing returns to scale in reproducible factors, technological diffusion and the ability to shift a large fraction of the labour force out of agriculture and into more productive activities).

During the period 1960-95 Ireland has grown at an annual rate which exceeds the sample average by around 0.80%. Although this positive differential is quite significant in absolute terms, it represents only about average performance given the country's initial situation as the richest of the group of poor OECD economies. Controlling for the convergence effect, Ireland has done somewhat better than the Mediterranean countries in the sample (Portugal, Spain and Greece), but much worse than Japan.

[2] Ireland's GDP is significantly higher than its GNP because the first measure of national income includes the profits of multinational firms. Since these profits eventually revert to the companies' home countries, GNP is probably a better measure of welfare than GDP. In addition, measured GDP may tend to overstate Ireland's productivity because this indicator may be biased upward, particularly in recent years, by multinational accounting practices which can be expected to artificially shift profits into their Irish subsidiaries in order to benefit from low tax rates. Keating (1995, reported in Walsh, 1996), however, shows that adjusting GDP for this effect does not significantly reduce the growth rate of the Irish economy.

Figure 1: Convergence in income per capita in the OECD, 1960-95



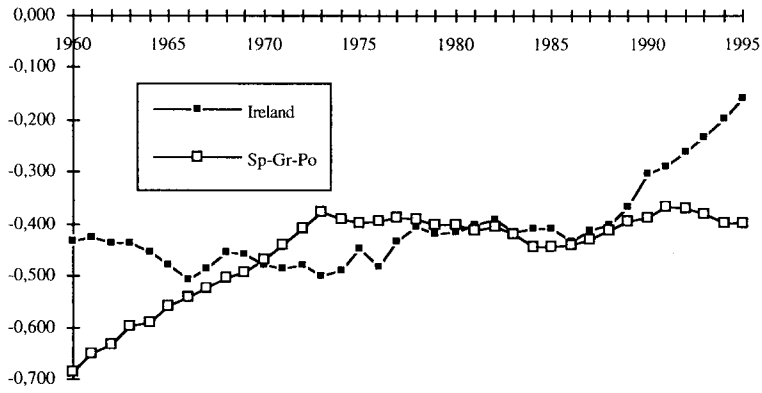
- *Note:* The fitted regression line is given by

$$gyrel.60\text{-}95 = 0.00 - 0.01698*lyrel60 \quad t = 7.91, \; R^2 = 0.7673$$

where gyrel is the average annual change in relative income and lyrel the initial value of relative income.

- Key: Por = Portugal, Gre = Greece, Jap = Japan, Sp = Spain, Ir = Ireland, It = Italy, Fin = Finland, Ost = Austria, Be = Belgium, Nor = Norway, Fr = France, Nl = Netherlands, Dk = Denmark, Swe = Sweden, Aus = Australia, Ge = West Germany, Can = Canada, UK = United Kingdom, NZ = New Zealand, US = United States, CH = Switzerland.

Figure 2: Evolution of relative income per capita



- *Note:* Ireland's reative income per capita is log GDP per capita in deviations from the contemporaneous average value of the same variable in the same sample of 21 OECD economies as in Figure 1. The figure also shows the unweighted average of the relative incomes of Spain, Greece and Portugal.

A positive growth differential has enabled Ireland to roughly preserve its initial advantage over the Mediterranean countries and to significantly reduce the income gap with respect to the OECD average. Figure 2, however, shows that progress on this front has been rather uneven. During the 1960s Ireland lost some ground relative to the OECD average and was surpassed by some of its closest "competitors" within the group of poorer economies. The period 1970-85 was a bit better, with Ireland gaining a few points relative to the sample average and overcoming the Mediterranean countries. Finally, the last decade in our sample was a period of extremely rapid growth in Ireland, which clearly pulls ahead of the pack of the poorer EU economies and approaches the OECD average.[3]

In this paper we will try to "explain" the growth pattern we have just highlighted in terms of the behaviour of three sets of variables. First of all we will focus on factor accumulation, as described by the rates of investment in physical, human and technological capital, and on the possible impact of two convergence mechanisms identified by the growth literature: the operation of decreasing returns to scale and technological diffusion.[4] In addition to these "growth theory" variables, we will examine the evolution of two variables which summarize labour market performance (the unemployment and labour force participation rates) and have a direct impact on income per capita for given levels of output per worker. Finally, we will also include among our explanatory variables an indicator of the size of the government sector (total government expenditures as a percentage of GDP) which may serve as a proxy for the effects of public sector activity on income levels, working through the efficiency of resource allocation and individual incentives for work and effort.

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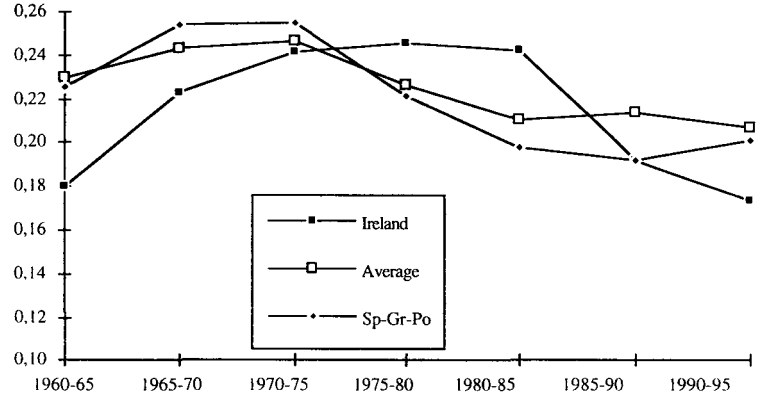
[3] Our GDP figures, as most of the data used in this paper, are taken from Doménech and Boscá (1996), who essentially replicate the Summers and Heston data base using a set of OECD-specific purchasing power parities and OECD National Accounts data. As various authors have noted, Ireland's growth profile may be somewhat sensitive to the data set used. O Gráda and O'Rourke (1994), for example, find significant differences between the series constructed by Maddison and by Summers & Heston during the period 1973-88. The first source, which seems to be based on OECD data (the authors do not provide many details), is rather more optimistic than the second one. Our data appears to be closer to Summers and Heston's, even though they are based on OECD data.

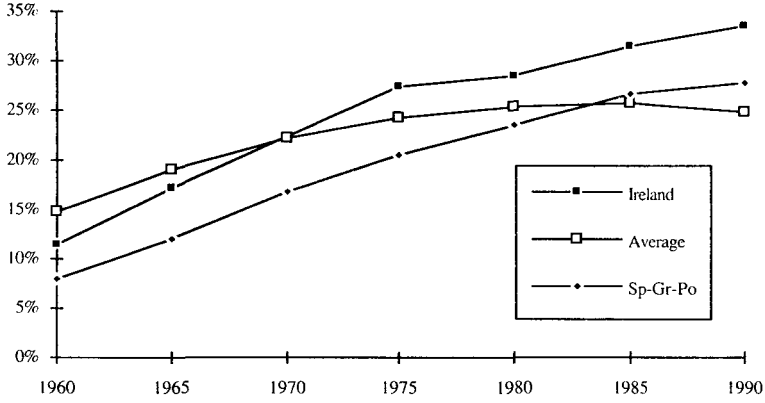
[4] Much of the recent empirical growth literature has focused on the convergence implications of decreasing returns to scale in reproducible factors (see for example Barro and Sala (1992) and Mankiw, Romer and Weil (1992)). Dowrick and Nguyen (1989) and de la Fuente (1995) examine the implicatons of cross-country technological diffusion.

Figure 3: Investment as a fraction of GDP



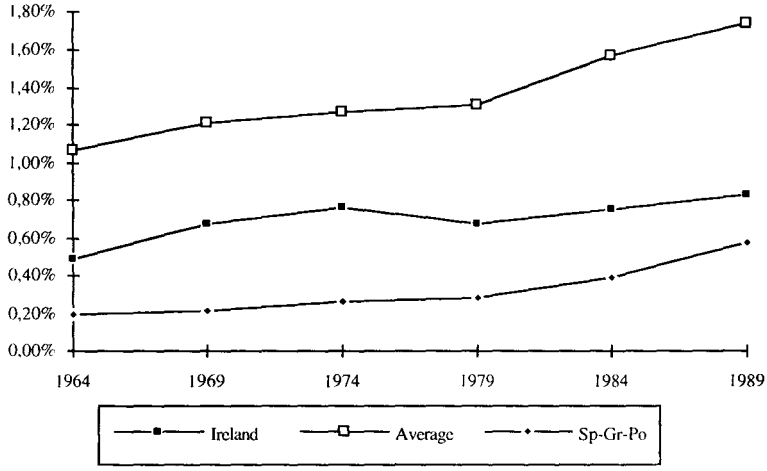
- *Note:* Average = unweighted average of the investment rates of the 21 OECD countries included in Figure 1. Sp-Gr-Po = unweighted average of the values for Spain, Greece and Portugal.

Figure 4: Secondary and university enrollment as a fraction of the labour force



- *Source:* UNESCO Yearbook.

Figure 5: R&D expenditures as a fraction of GDP



- *Source:* UNESCO *Yearbook* and *Basic Science and Technology Statistics*.

Figure 6: Labour force participation rate

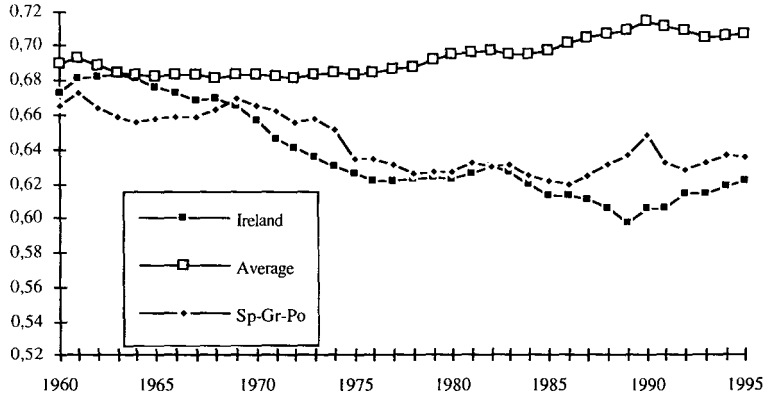


Figure 7: Unemployment rate

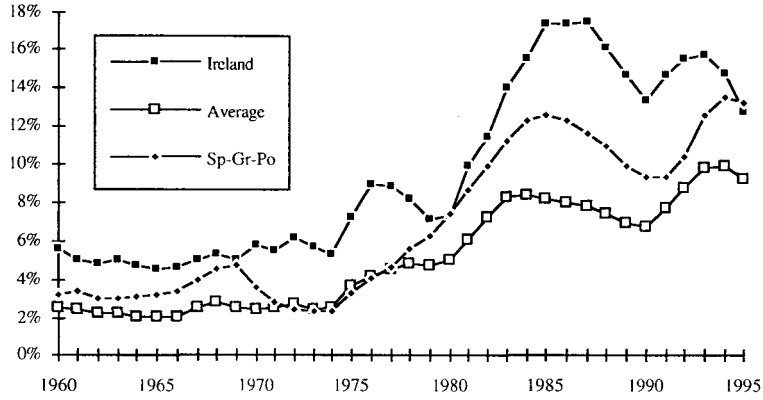
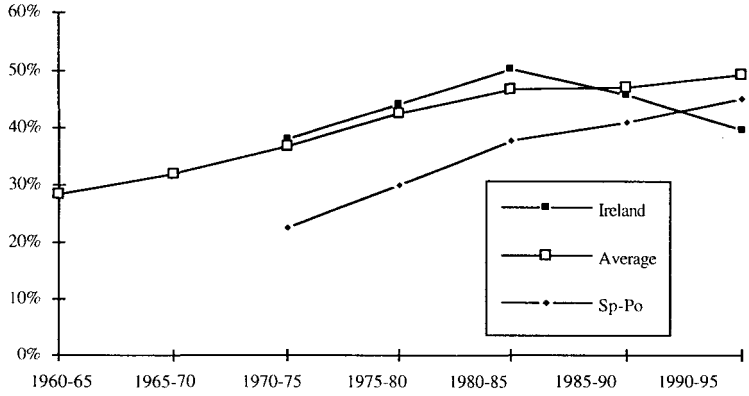


Figure 8: Government spending as a fraction of GDP



- *Note:* Average over each five-year period. The OECD average is taken over all countries for which data are available in each period. Switzerland and New Zealand are excluded for lack of data, and data for Greece start in 1980-5. Source: *OECD Statistical Compendium* and European Commission.

Figures 3-8 summarize the evolution of the relevant variables and allow a comparison of Ireland's performance with that of two natural reference samples: a sample of (up to) 21 OECD economies, and the group of low-income Mediterranean countries (Spain, Portugal and where possible Greece) which are Ireland's closest neighbours in terms of their position in the OECD income distribution. In terms of investment rates and labour market performance, Ireland's situation is fairly similar to that of the Mediterranean group. In both cases we find low and falling participation rates, high and rising unemployment, below-average R&D investment and sharply increasing rates of educational investment. Ireland, however, displays rates of investment in human and technological capital which are consistently above those observed in most other low-income contries, and a generally higher unemployment rate.

In terms of public finances, however, the pattern is very different. Ireland seems to have developed a fairly extensive welfare state earlier than either Spain or Portugal. As a result, the share of public expenditure in GDP was much higher in Ireland than in either of these other countries in 1970-75 (and even higher than the OECD average). In the second half of the eighties, however, a determined programme of fiscal consolidation reduced the share of public expenditure in Ireland by almost ten points, leaving it below Spanish or Portuguese levels.

3.- A growth accounting exercise

How well do the factors we have highlighted in the previous section explain Ireland's differential growth performance? This section will try to provide an answer to this question on the basis of a simple empirical growth equation based on the recent literature on growth and convergence. The model, which is described in the Appendix, explicitly relates the growth rate of income per capita in each country with its rates of accumulation of physical, human and technological capital, the share of government expenditures in GDP and the behaviour of the labour market, while allowing for some of the *convergence factors* which, other things equal, would tend to favour initially poorer economies. As discussed in the Appendix, the inclusion of a measure of government expenditures among the explanatory variables attempts to capture in a simple way the distortionary effects of various public activities. Since we control separately for factor accumulation, however, our measure of government's

contribution to growth will not include the direct positive impact of public investment on growth, or any adverse crowding out effects.

The model is estimated using panel data for a sample of 19 OECD countries covering the period 1965-95 at five-year intervals with the results summarized in Table A.1 of the Appendix. In this section we will use these results and the underlying data to quantify the contribution to growth of different variables of interest. In particular, we will decompose each country's growth rate differential with respect to the OECD average into seven factors which reflect, respectively:

i) a convergence effect (CONV) which results from the operation of decreasing returns to scale and technological diffusion and tends to favour initially backwards countries;

ii) the impact of labour market performance on income per capita (LAB, which summarizes the contributions to growth of income per capita of changes in the unemployment and labour force participation rates);

iii) - v) the contribution of factor accumulation (investment in physical (K), human (H) and technological (R&D) capital), normalized by population growth in the manner suggested by the model;

vi) the impact of government size (measured by the share of total expenditures in GDP) on productivity (GOV); and

vii) an error term which is the difference between the observed growth rate differential and the model's prediction for each country and period.

Table 1 summarizes the results of the exercise for the case of Ireland and for a fictional country constructed as an unweighted average of Spain and Portugal (Greece is excluded because full data for this country is only available after 1980). The first two columns of the table show the observed (OBS) growth rate in income per capita in differences with the contemporaneous sample average (excluding Greece), and the model's prediction for the same variable (PRED). The remaining columns report the seven components of the differential growth rate described above. The first group of rows displays averages for the period 1970-95. The second and third groups break down this period into the subperiods 1970-85 and 1985-95. In all three cases, the growth rates of Ireland and our fictional average Latin country are expressed in differences with the sample average, and the last row in each group

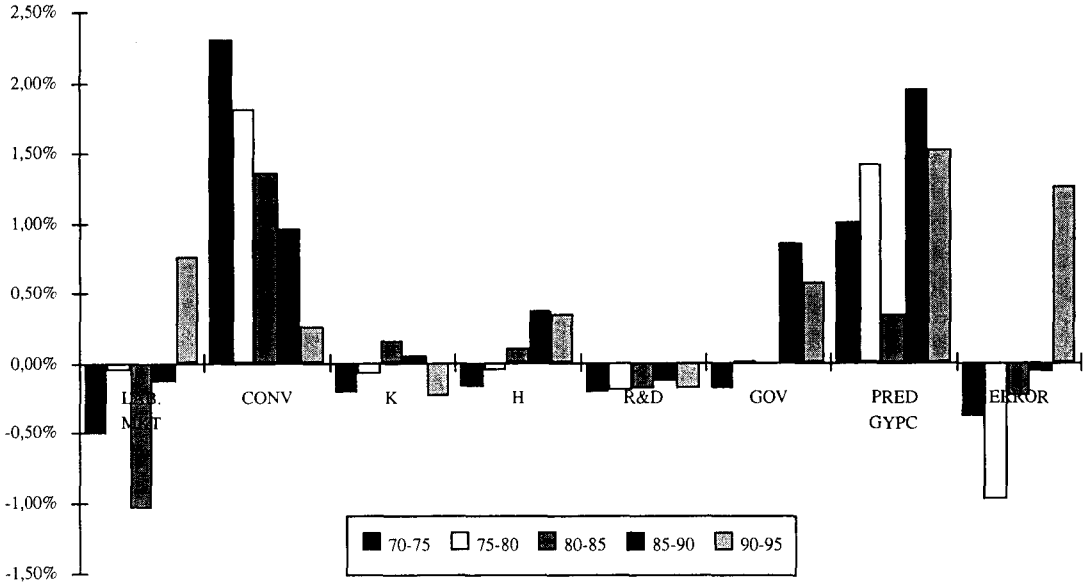
shows the difference between these two figures *(difference)*, which measures Ireland's performance relative to the average of Spain and Portugal. The last group of rows (Δ) displays the change in Ireland's performance relative to the OECD average *(Ireland)* and to the Latin countries *(difference)* between the first and second subperiods. Finally, Figure 9 shows a more detailed, period-by-period breakdown of the components of Ireland's growth differential with the OECD average. As can be seen in the graph, the convergence effect is initially positive and very large but declines rapidly throughout the period. This negative change is partially offset by the improved contribution of the government sector and the rise in human capital investment. These effects, however, are not sufficient to explain Ireland's extraordinary performance during the last part of the period, leaving us with a large positive residual for the subperiod 1990-95.

Table 1: Sources of differential growth, 1970-95

		OBS	*PRED*	*LAB*	*CONV*	*K*	*H*	*R&D*	*GOV*	*ERROR*
Ireland	*1970-95*	1.17%	1.25%	-0.20%	1.34%	-0.07%	0.12%	-0.18%	0.25%	-0.08%
Po&Sp	*1970-95*	0.33%	0.18%	-0.36%	1.35%	-0.06%	-0.27%	-0.47%	-0.03%	0.16%
difference	*1970-95*	0.84%	1.08%	0.16%	0.00%	-0.01%	0.39%	0.29%	0.28%	-0.24%
Ireland	*1970-85*	0.39%	0.93%	-0.54%	1.83%	-0.05%	-0.04%	-0.20%	-0.07%	-0.54%
Po&Sp	*1970-85*	-0.10%	-0.12%	-0.70%	1.74%	-0.18%	-0.48%	-0.51%	-0.01%	0.02%
difference	*1970-85*	0.49%	1.05%	0.16%	0.09%	0.13%	0.44%	0.31%	-0.06%	-0.56%
Ireland	*1985-95*	2.34%	1.74%	0.31%	0.61%	-0.10%	0.36%	-0.16%	0.72%	0.61%
Po&Sp	*1985-95*	0.98%	0.62%	0.16%	0.76%	0.12%	0.05%	-0.41%	-0.06%	0.35%
difference	*1985-95*	1.37%	1.12%	0.15%	-0.15%	-0.21%	0.31%	0.25%	0.78%	0.25%
Ireland	*Δ*	1.95%	0.81%	0.85%	-1.22%	-0.05%	0.40%	0.04%	0.78%	1.14%
difference	*Δ*	0.88%	0.07%	0.00%	-0.24%	-0.34%	-0.13%	-0.06%	0.84%	0.81%

Moving on to Table 1, the figures shown in the first group of rows refer to average performance over the entire period 1970-95. The small residual (-0.08%) shows that when we consider the sample period as a whole the model explains rather well Ireland's performance relative to the OECD average and the Latin countries. The positive growth differential with the OECD (1.17%) seems to be due mostly to the contribution of the convergence effects (1.34%). The factor accumulation components of the growth rate are negative (with the exception of human capital) and rather small, while labour market performance (-0.20%) and government's contribution (0.25%) roughly offset each other. The pattern is qualitatively similar in the case of Spain and Portugal, but with some differences which help account for the 0.84% positive differential in Ireland's favour. In particular, relatively high rates of

Figure 9: Sources of Ireland's differential growth rate



investment in education and R&D and a lower rate of growth in the share of government expenditures contributed around a third of a point each to this differential.

If we take the sample period as a whole, then, the sources of Ireland's relative growth performance seem fairly straightforward: convergence towards the OECD average was fueled mostly by the usual convergence effects, and the positive differential with respect to the Latin countries reflected mainly a higher rate of factor accumulation and a greater degree of fiscal discipline. When we disaggregate into subperiods, however, the story becomes rather less clear. As shown in the last two rows of the table, Ireland's growth differential with respect to the OECD average increases by 1.95% between the first and second subperiods. The model explains around half of this increase in terms of improved labour market performance (0.85%), a reduction in the convergence effect (-1.22%), increased investment in human capital (0.40%) and greater fiscal discipline (0.78%), but this still leaves us with a residual of over a percentage point per year. The problem is similar when we compare Ireland's growth to that of Spain and Portugal: the positive contribution of the government term (0.84%) just about offsets the negative contributions of the convergence effects (-0.24%) and factor accumulation (-0.43%), leaving us with an unexplained residual of 0.81% per year.

4. An interpretation and future perspectives

What conclusions can we draw from the exercise in the previous section? First, if we take 1970 as our starting point, Ireland's growth performance has been quite satisfactory. Progress has been made relative to both the OECD average and the group of poorer EU economies, with the first growth differential reflecting mainly the usual convergence forces and the second relatively high rates of factor accumulation and below-average growth of the government sector. Secondly, the sources of the "Irish miracle" of the last decade are not entirely clear. Fiscal discipline seems to have played an important role in it, but there are probably other factors at work which our aggregate model does not capture.

Our results about the positive impact of fiscal discipline on growth, while supportive of the widespread view that this factor has contributed significantly to the recent Irish success story, raise some difficult questions about the channels linking tight fiscal policies with economic growth. Tax and expenditure reductions can be expected to increase growth by reducing disincentives which tend to depress

investment and labour supply. King and Rebelo (1990) show that the impact on output of these effects can be quite important, especially in the case of a small open economy. Since we are controlling for both employment and factor accumulation, however, what our estimates are presumably picking up are not these effects, or the "crowding out" of private investment, but a negative externality effect of government size on the efficiency of resource allocation and on work effort. From this perspective, the estimated effects are surprisingly large, particularly when we consider that fiscal tightening in Ireland has not been accompanied by the comprehensive microeconomic reforms which may conceivably have triggered such large efficiency gains. On the other hand, there is some support in the literature for the view that taxation and other policies which distort resource allocation may have large adverse effects on productivity (see for example Jorgenson and Yun (1986)). Other models also suggest additional links between fiscal policy and growth which may help account for our results. Olson and other authors, for instance, have argued that large governments may be linked with slow growth through rent-seeking behaviour (see Benabou (1996)). In a different line, Bertola and Drazen (1993) have shown that fiscal contractions can have an expansionary effect, working through private consumption and possibly investment, if they trigger expectations of a permanent reduction in government expenditure and tax levels. Indeed, Bertola and Drazen (1993), as Giavazzi and Pagano (1990), focus on the Irish experience as a paradigmatic case of such an expansionary fiscal consolidation.

While our analysis does not allow us to identify the channels through which such a policy may affect growth, our results do suggest that the contractionary effects of a reduction in government expenditures predicted by standard Keynesian-type models seem to be outweighted on the average by forces working in the opposite direction. Further research is needed to clarify just what these forces are.

Coming back to the Irish case, our results are consistent with the view that fiscal adjustment was directly responsible for a sizable increase in the growth rate. But this still leaves much of the improvement in Ireland's economic performance unexplained. The large remaining residual in our analysis suggests that factors not considered by our model have played an important role and points us towards specifically Irish characteristics. As far as these go, the dominant view in the literature seems to be that rapid growth has been driven mostly by a very dynamic export sector dominated by multinational firms which have invested heavily in Ireland in recent years and served as a conduit for the adoption of advanced

technologies.[5] This boom in foreign direct investment would reflect Ireland's attractiveness as a natural base for exports to the European Union. This attractiveness would be due in part to the provision of generous tax incentives which may have served to compensate for other disadvantages such as high prices for business services and other inputs to manufacturing.[6] Other important factors would be the availability of a highly skilled and English-speaking labour force, relatively low labour costs (preserved in recent years by an incomes policy aimed at wage moderation), heavy investment in infrastructure and a pragmatic exchange rate policy. An additional consideration is the inflow of large subsidies from the European Union (peaking in 1979 at 6% of GDP and then gradually falling to slightly below 4%), which has helped to finance infrastructure and educational investment without undue budget strain.

This story has a ring of plausibility to it and indeed it is difficult to think of a convincing alternative explanation. It may be asked, however, why success came when it did. After all, many of the factors we have just cited have been in operation for quite a few years before the current growth spurt.[7] We would venture the guess that the success in attracting foreign direct investment in recent years was triggered by two factors. The first one is the renewed interest of American and other multinational firms in gaining a foothold in Europe which came with the impulse to the EEC represented by the accession of new members in 1986 and the formulation of clear plans for the completion of the Single Market in 1992. The second factor is Ireland's clear bet for macroeconomic stability and its commitment to a sustainable fiscal policy. In this sense, fiscal consolidation may have acted as a catalyst, helping to change foreign investors' perception of the country.

There seems to be some concern in Ireland about the sustainability of the current growth rates (in excess of 6%) and about the potential dangers of a growth strategy based on the attraction of foreign direct investment.[8] Two of the main concerns are

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[5] See, for example, O Grada and O'Rourke (1994), Walsh (1996), Leddin and Walsh (1997) and *The Economist*, May 17th, 1997.

[6] Subsidies to the manufacturing sector are quite important. For example, subsidies represented 6.4% of GDP in 1986-88 and 4.9% in 1988-90, while the EU average was 4% and 3.5 %, respectively. See OECD (1993).

[7] Ireland joined the EEC in 1973 and has always been a net recipient of aid from the Community. Irish industrial policy has followed since the sixties an aggresive policy of promoting foreign direct investment in export-oriented sectors. The relief to the exporting sector turned into a low corporate tax (10%) for the manufacturing sector in 1981, which was then extended to some traded financial services. Other tax relief measures included fixed asset grants and accelerated capital allowances. (See Ruane and Goerg (1997) for a discussion of Irish industrial policy).

[8] See, for example, Leddin and Walsh (1997).

the probable loss of Ireland's status as an Objective 1 region as it approaches the European Union's average income per capita, and the prospect that existing tax benefits will be severely limited in the future. The loss of Structural Fund grants from the EU would represent a substantial loss of resources for public investment and training, and it is feared that the loss of tax incentives may diminish the country's attractiveness for foreign firms.

Since the current regime of high subsidies to the manufacturing sector may in fact have rather perverse effects on the efficiency of resource allocation, the imposed reduction of existing aids may in fact turn out to be a blessing in disguise. In order to realize its potential, however, it will be necessary to implement policies designed to offset the negative impact of the loss of tax breaks through an improvement in other determinants of competitiveness. From this perspective, the real bottleneck may well be the lack of competition in the service sectors. Indeed, the fact that Ireland is a small open economy does not help to discipline non-tradables. Ireland has a manufacturing sector open to international competition but favoured with large state subsidies, a service (non-traded) sector with a low level of competition (and no corporate tax discount), and a heavily regulated public enterprise sector. There is evidence that the level of competition in the Irish economy is low. For example, the OECD's (1993) Economic Survey of Ireland provides evidence of high relative costs and prices in Ireland (with respect to other countries) in transportation, communication, food and health care, worries about vertical restraints in retailing and finds barriers to entry in a host of industries including telecomunications, energy, banking, insurance and financial services. The Survey also finds that public firms tend to be inefficient. There is consensus that until 1991, when the passage of the Competition Act adapted Irish legislation to the Treaty of Rome, competition policy was ineffective in Ireland. Since then some progress has been made, with a considerable strengthening of competition law through the 1996 Amendment, but there is still a long way to go in this area (see Fingleton (1996)).

All this means that there is no way around increasing competition in the service sectors if Ireland is to maintain a competititve edge. As usual, this is a painnful process. Not because consumers do not gain -- they are indeed the major beneficiaries of such a move-- but because of the vested interests which have consolidated privileged positions over the years, and consequently have the resources to try to keep those privileges. The objection that an active competition policy would decrease total employment is unfounded. On the contrary, it will tend

to increase it.[9] A larger degree of competition in the overall economy and, in particular, in the service sector, would put Ireland in a sustainanble growth track provided sound macroeconomic (fiscal and monetary) policies are pursued. This is why we think that the enforcement of competition policy is one of the major and most important challenges ahead for Ireland.

[9] See Barry and O'Toole (1997).

Appendix: An empirical growth model

This Appendix sketches the empirical model which underlies the growth accounting exercise reported in Section 3 of the text and summarizes the most important results of the estimation. For a full discussion, the interested reader is referred to de la Fuente (1997a).

Following the usual procedure in the recent empirical growth literature,[10] we derive an empirical convergence equation from a log-linear approximation to a simple growth model. We assume that the production side of the economy can be described by a reduced-form aggregate production function of the form

$$(1)\ Y_{it} = \Theta^{\gamma} K_{it}^{\alpha_k} H_{it}^{\alpha_h} R_{it}^{\alpha_r} (A_{it}L_{it})^{1-\alpha_k-\alpha_h-\alpha_r},$$

where Y_{it} is aggregate output in country i at time t, L the level of employment and A_{it} an indicator of the level of technical efficiency which grows at an exponential rate g. The variables K, H and R denote, respectively, the stocks of physical, human and technological capital, and Θ is an indicator of the relative weight of the government sector in the economy.

This formulation is completely standard except in that it allows national output to be a function of the relative size of government. The "government externality" term (Θ^{γ}) is meant to capture in the simplest possible way the fact that public activities may affect productivity in a variety of ways other than through infrastructure investment, which contributes directly to factor accumulation. Since some of the relevant effects are positive and others negative, the sign of the coefficient γ is unclear ex ante, and may conceivably change with the expenditure level.

Under the assumptions that the workforce is equal to population and the depreciation rate is constant and equal for all types of capital, it is easy to derive a *convergence equation* of the form:

$$(2)\ GYPC_{it} = g + \beta a_{it} - \beta^{*}LYPC_{it} + \gamma\left(\dot{\theta}_{it} + (\delta+g+n)\theta_{it}\right)$$

$$+\ (\delta+g+n)\left(\alpha_k \ln \frac{s_{kit}}{\delta+g+n_{it}} + \alpha_h \ln \frac{s_{hit}}{\delta+g+n_{it}} + \alpha_r \ln \frac{s_{rit}}{\delta+g+n_{it}}\right)$$

[10] See for example Barro and Sala (1992) and Mankiw, Romer and Weil (1992).

where $GYPC_{it}$ is the growth rate of income per capita in country i during the subperiod which starts at t, LYPC the log of income per capita at the beginning of the subperiod, s_{jit} the fraction of GDP invested in capital of type j (=k, h, r), n_{it} the rate of population growth, a_{it} the log of the indicator of technical efficiency (A_{it}), $\theta = \ln \Theta$ the log of government's share in GDP, and δ the rate of depreciation. The coefficient β measures the rate of convergence towards a pseudo-steady state which would be attained asymptotically if the rate of population growth, the share of government expenditures in GDP and the different investment rates remained constant over time. The value of the convergence coefficient will depend on the degree of returns to scale in the reproducible factors (i.e. in the different types of capital), with convergence being faster the faster diminishing returns set in.

Before proceeding to its estimation, we extend equation (2) so as to incorporate some important determinants of growth not considered by the theoretical model from which we start. Since we will work with data on income per capita rather than output per worker, we will include in the equation the increase in the unemployment and labour force participation rates, as changes in these variables would affect income per capita with a constant level of output per employed worker. Secondly, we will control in a simple way for a technological catch-up effect. As discussed in de la Fuente (1995), if technology diffuses across countries at a sufficiently rapid pace, those economies which are technically less advanced at the beginning of the period should grow faster than the rest. This effect, however, will gradually exhaust itself as each country approaches an equilibrium level of relative technical efficiency which is determined by its own R&D effort and the speed of diffusion. To try to capture this effect we include a dummy for initially backwards countries (Spain, Ireland, Greece, Portugal and Japan) and the product of this variable and a trend. We would expect the coefficient of the first variable to be positive, and that of the second to be negative.

With these changes, the equation to be estimated is of the form

$$(3)\ GYPC_{it} = \Gamma_o + \Gamma_1{*}t + \Gamma_2{*}t^2 + \Gamma_3{*}DLAG5 + \Gamma_4{*}\ DLAG5 * t + \Gamma_a{*}GTAC_{it} +$$

$$+ \Gamma_u{*}DU_{it} - \beta{*}LYPC_{it} + \gamma\ (GGOV_{it} + (\delta+g+n) \ln GOV_{it})$$

$$+ (\delta+g+n)\left(\alpha_k \ln \frac{s_{kit}}{\delta+g+n_{it}} + \alpha_h \ln \frac{s_{hit}}{\delta+g+n_{it}} + \alpha_r \ln \frac{s_{rit}}{\delta+g+n_{it}}\right)$$

where (Θ =) GOV is total government expenditure as a fraction of GDP, GGOV the growth rate of this variable, DU the average annual increase in the unemployment rate during the subperiod and GTAC the growth rate of the labour force participation rate (labour force over working-age population). The first terms of the equation (a constant, a trend and a trend squared and the terms which include the dummy DLAG5) try to approximate the term $g + \beta a_{it}$ which appears in equation (2) while allowing for some country heterogeneity.

Following the standard practice in the literature, we will impose a value of δ+g equal to 0.05. We will also assume that the convergence parameter β is constant over time and across countries (even though the theoretical model suggests that it may vary with the rate of population growth) and will therefore interpret the variable n which enters the term (δ+g+n) (= ($\beta/(1-\alpha_k-\alpha_h-\alpha_r)$)) that multiplies the logs of the investment rates as the average rate of population growth in the sample as a whole. These simplifying assumptions have the advantage that they make the coefficients which multiply initial income and the logs of the investment rates constant, a feature which facilitates the growth accounting exercise undertaken in the text.

Our data on real income per capita, employment, investment and population growth are taken from Doménech and Boscá (1996) who essentially replicate the Summers-Heston database for the OECD, using a set of OECD-specific PPPs. Our proxy for the level of investment in human capital (s_h) will be the total secondary and university enrollment as a fraction of the labour force (from the UNESCO Yearbook). The series on R&D expenditure are constructed combining information from the UNESCO Yearbooks and the OECD's *Basic Science and Technology Statistics* as discussed in de la Fuente (1997a). The last two variables are averaged over several subperiods because it is expected that investment in education and R&D will affect output only with relatively long lags. In the case of s_h we use the average value over the current five-year subperiod and the previous one, and for R&D (s_r) the cumulative average share of total R&D expenditure in GDP over the current and all preceding subperiods. Finally, our data on government expenditures are taken from the OECD's Statistical Compendium and from CEE (1996). Due to the lack of fiscal data, we have had to exclude Switzerland and New Zealand from the original sample. With this ommission, our sample covers 19 countries and ends in 1990-95. In most cases the first observation corresponds to the period 1965-70 or 1970-75. The exception is Greece, whose first observation corresponds to the subperiod 1980-85.

Table A.1 summarizes the results. Following de la Fuente (1997a,b), equation (3) is estimated jointly with an investment equation using a SUR procedure. Although we will not make much use of this second equation in this paper, this method allows us to increase the precision of the estimates by taking into account the correlation between the error terms of the two equations. The results, and in particular the coefficient of the public expenditure variable, are robust to the use of instrumental variables to correct for a potential endogeneity bias.

Table A.1: Empirical results

(dependent variable) =)	*parameter*	*GYPC*	*(t)*	s_k	*(t)*
constant	Γ_o	0.0835	(4.60)	0.0987	(1.61)
trend: t	Γ_1	-0.00104	(2.15)	0.0059	(5.10)
trend^2*:* t^2	Γ_2	$2.94*10^{-5}$	(2.41)	-0.00013	(4.85)
technology gap: DLAG5	Γ_3	0.0188	(3.72)		
tech. gap trend: DLAG5*t*	Γ_4	-0.00098	(4.71)		
growth of participation rate: GTAC	Γ_a	0.5267	(4.44)		
change in unemployment: DU	Γ_u	-0.6496	(4.54)		
log initial income per capita: LYPC	$-\beta$	-0.03394	(5.25)	-0.0413	(4.12)
invest. in physical cap.: ln $s_k/(\delta+g+n)$	α_k	0.3065	(5.07)		
invest. in human capital: ln $s_h/(\delta+g+n)$	α_h	0.2041	(3.74)		
R&D investment: ln $s_r/(\delta+g+n)$	α_r	0.0603	(2.22)		
gov't spend.: (GGOV+(δ+g+n) ln GOV)	γ	-0.1789	(4.51)	-0.3209	(8.41)
	R^2	0.7817		0.9420	(10.69)
	N	103		99	

- *Notes:*
- t statistics in parentheses next to each coefficient. N is the number of observations.
- The investment equation (with dependent variable s_k) includes as regressors, in addition to the variables shown in the table, the rate of population growth (+), the dependency ratio (total population/employment (-)), the fraction of the population aged 15 to 64 (+), and index of the relative price of capital goods, government transfers to households (+), current subsidies to enterprises (+) and the level of public investment (+), with the last three variables measured as shares of GDP. Country dummies for Ireland (-), Norway (+), US (-), UK (-), Austria (+) and Spain (-) are also included. The sign shown in parentheses next to each variable is that of its estimated coefficient.

The coefficients of the different regressors are significant, have the expected sign and present reasonable values. Thus, the coefficient of the stock of technological capital in the production function (0.0603) is similar to the one obtained by Lichtenberg (1992), and those of physical and human capital (0.306 and 0.204 respectively) and the convergence rate (0.034) are within the usual range in the literature. The coefficients of the terms which include the technological backwardness dummy are significant and have the expected sign. The values of these coefficients suggest that the contribution of technological diffusion to the growth of the poorer countries was

quite important at the beginning of the sample period (around 1.8% per year) but has declined rapidly with the passage of time.

As for the remaining regressors, the coefficients of the changes in the rates of unemployment and labour force participation have the expected sign but their size is smaller than expected. Since both coefficients should be close to one (in absolute value) if labour were a homogeneous factor, the estimated values of the parameters suggest that the "quality" of the marginal entrant into the labour force or the stock of employed workers is significantly lower than that of the average employed worker. Finally, the coefficient of the government size variable is negative, significant and quite large. While the sign of this coefficient is not surprising in view of the previous literature,[11] its size is considerably larger than we expected -- particularly because, since we are controlling for factor accumulation and the level of employment, the distortionary effects we are picking up exclude crowding out and adverse labour supply responses. One possibility we have considered is an endogeneity bias. De la Fuente (1997b), however, investigates this possibility with some care and concludes that the results do not seem to be driven by reverse causation. Hence, an increase in the size of the public sector seems to have a negative and quite sizable effect on the level of productivity, even after controlling for employment and factor stocks. The analysis, however, sheds no light on the mechanisms behind this effect.

[11] See for example Landau (1983, 1985 and 1986) and Barro (1991a,b)). Levine and Renelt (1992) and Andrés et al (1996), however, find that the partial correlation between growth and most fiscal indicators is not robust, in the sense that these variables often lose their significance when additional macroeconomic indicators are included in the growth equation.

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