

THE LONG-RUN DETERMINANTS OF GOVERNMENT RECEIPTS

Carlos Martinez-Mongay*

1 Introduction¹

This paper analyses the long-term determinants of government receipts. Unlike other contributions on the issue reviewed below, we claim here that the long-run evolution of tax revenues is ultimately dominated by their financing role, while government receipts depend much less on other functions of taxes, such as redistribution or regulation. This implies that the long-run determinants of tax revenues are broadly the same as those driving the long-run evolution of spending.

In the future, ageing of populations will be a major determinant of the evolution of spending and, thus, government receipts. The close-to-balance rule of the Stability and Growth Pact will reinforce the long-run links between receipts and expenditures. Compliance with the basic rule, including budgetary safety margins², will allow EU governments to reduce taxation in parallel with total spending. However, once the room for manoeuvre for spending restructuring is over, and unless welfare

* European Commission, DG ECFIN.

¹ Comments by A. Brunila, M. Buti, H. Carré, T. Fosdal, H. Huizinga, J. H. Schmidt, P. Weiss and participants to the Banca d'Italia workshop on fiscal sustainability are gratefully acknowledged. The opinions in this paper reflect those of its author and should not be attributed to the European Commission.

² See European Commission (2000).

systems are adequately modernised, spending items driven by long-run, structural factors, such as ageing, will set a positive path in total spending. Within the EMU framework, long-run trends in government revenues will, therefore, be dominated by such structural factors. This paper explores past evidence supporting the view that tax systems have been continuously adapted in order to cope with financing needs of governments, particularly in the field of social protection³.

Although with more ambiguous and, likely, lower impacts, tax revenues are also determined by a number of additional long-run, structural factors. Tax systems have to cope with the consequences of social, international and technological changes. Given a level of government receipts, such factors shape tax structures and determine the tax burdens borne by labour, capital and consumption. Analogously, for given tax codes, those factors determine the level of tax revenues. However, we present preliminary evidence that, albeit non-negligible, the effects of technological change and economic integration, are dwarfed when compared with those driving social transfers, namely demographic dependency.

Within such a background, the paper is organised as follows. Section 2 presents and discusses a number of stylised facts about the evolution of government receipts and tax structures over the last three decades. Section 3 discusses a number of previous empirical and theoretical contributions in the light of rather simple analytical tools. Section 4 presents a first range of econometric models of the long-run determinants of tax receipts on the basis of panel data. In order to analyse the robustness of the conclusions, section 5 provides evidence based on time series analyses at country level. Section 6 summarises the conclusions.

³ Indeed, this is a long-run, incomplete process, so that it has not avoided the emergence of budget deficits.

2 Government receipts in the long run. Some stylised facts

2.1 *The evolution of revenues and expenditures*

The tax burden – total tax receipts expressed as percentage of GDP- grew by almost 11 percentage points of GDP in the euro area between 1970 and 1998 (Table 1). The figures for the EU as whole, the US and Japan are, respectively, 9, 2 and 9. Only in Ireland, the Netherlands and the UK did tax burdens record changes lower than 6% of GDP. In the latter country, the weight of tax revenues in GDP remained fairly stable between 1970 and 1998.

The financing role of taxes is clearly seen when comparing tables 1 and 2. The latter shows the changes in three spending-to-GDP ratios between 1970 and 1998 (total, current and transfers spending). In the euro area, nominal total spending grew by 13 percentage points. The figure is somewhat lower in the EU (11%), and it strikingly compares with just 1 point increase in the US and a similar fall in Japan.

Interestingly, current expenditures grew more than total spending in all countries. Even in the two countries (Ireland and the UK) where total spending fell, current expenditures exhibited an increasing path. The comparison of the changes in expenditures and government receipts gives much support to the financing role of taxes. Correlation coefficients between the changes in tax burdens (first column of table 1) and the changes in spending (first and second columns of table 2) are higher than 0.8⁴.

The third column of table 2 suggests that, as a general rule, social transfers⁵ account for half or more the change in current spending.

⁴ The similarities between correlation coefficients for current and total spending indicates that, despite the mentioned differences, where their cross-country long-run changes are concerned, both variables are basically the same.

⁵ According to ESA95 definitions, by transfers we mean social transfers other than in kind, while social transfers in kind are part of current expenditures and include public health care and education, as well as other minor social expenditures. In most countries, the bulk of social transfers other than in kind is made up of pensions and unemployment benefits.

Table 1. Long-run changes in tax revenues, 1970-1998
(% of GDP)

Country	Total	Labour	Capital	Consump.
Belgium	11.2	10.6	1.8	-1.2
Denmark	8.0	4.4	3.2	0.4
Germany	7.0	7.4	0.1	-0.5
Greece	14.6	8.1	3.6	2.9
Spain	17.2	9.7	4.0	3.5
France	11.4	7.6	2.4	1.4
Ireland	4.7	4.1	3.2	-2.6
Italy	16.0	6.4	4.3	5.3
Luxembourg	17.8	5.6	4.2	8.0
Netherlands	6.0	1.3	2.6	2.1
Austria	9.7	9.6	0.7	-0.6
Portugal	15.7	8.4	3.4	3.9
Finland	14.7	9.6	3.9	1.2
Sweden	13.2	7.0	2.8	3.4
United Kingdom	0.0	0.6	0.3	-0.9
US	2.2	3.7	0.1	-1.6
Japan	9.1	7.2	0.2	1.7
EU-11	10.6	7.1	2.1	1.4
EU-15	8.8	5.8	1.9	1.1

Source: AMECO (European Commission, DG ECFIN), and own calculations.

**Table 2. Changes in expenditure, 1970-1998 (% of GDP),
and GDP per capita in 1970**

Country	Total spending	Current spending	Social transfers	GDP per capita 1970
Belgium	8.2	11.2	4.2	101.6
Denmark	14.6	18.1	7.4	115.3
Germany	10.5	12.8	6.7	115.1
Greece	21.4	21.1	7.4	62.9
Spain	20.8	21.0	7.8	72.9
France	15.6	17.2	8.6	110.7
Ireland	-3.1	0.6	4.6	61.2
Italy	16.6	17.4	7.9	95.7
Luxembourg	15.4	13.6	2.6	158.4
Netherlands	5.8	8.6	6.7	112.6
Austria	11.4	13.4	5.3	96.6
Portugal	22.6	21.0	13.1	50.4
Finland	20.8	21.9	12.4	91.4
Sweden	17.0	21.9	9.7	124.3
United Kingdom	-0.9	4.3	4.9	102.8
US	0.9	1.4	4.0	145.6
Japan	17.3	16.0	10.6	90.4
EU-11	13.2	14.8	7.4	99.6
EU-15	11.0	13.4	7.0	100.0

Source: AMECO (European Commission, DG ECFIN), and own calculations.

While total or current spending fell or recorded small changes in a few countries (Ireland, UK, US), in all of them, transfers followed positive paths. Although more complete and rigorous analyses of the determinants of social transfers are reserved for other sections, there is a significant, negative relationship between changes in transfers and the level of income at the beginning of the period (see 4th column of table 2)⁶. The correlation coefficient is close to -0.5 . Low-income countries in the seventies have increased social protection by more than high-income countries⁷. In addition, the correlation between changes in transfers and changes in tax revenues is positive and significant (0.4).

The consideration of absolute changes between 1970 and 1998 actually conceals some interesting additional facts. First, while over the whole period 1970-1998, social transfers accounted for around 50% of the changes in spending, such an apparent long-run relationship does not seem to hold in the nineties. During the last decade, transfers grew more than other spending items. While total spending fell and current expenditures increased by less than 1% of GDP in the euro area, social transfers followed a positive long-run path in most countries. Second, in order to reduce deficits, most EU countries implemented a strategy consisting of reducing total spending and increasing taxes⁸. As a result, for the first time in three decades, tax receipts increased more than total spending. *Finally*, changes in tax revenues in the nineties are more correlated with changes in transfers than with other broader measures of spending. This is particularly true for the sample including only the EU Member States.

⁶ Represented here by the per capita GDP in PPPs. Figures in table 2 are calculated as ratios of the per capita GDP of EU-15.

⁷ On the relationships between GDP per capita and expenditures and receipts, see also European Commission (2000).

⁸ Figures here refer to actually observed changes, while cyclically-adjusted expenditures and revenues give a more accurate view of the fiscal policy stance. For a more detailed analysis of fiscal-consolidation strategies, see European Commission (2000).

Table 3. Changes in expenditures and revenues in the nineties
(% of GDP)

Country	Total spending	Current spending	Social transfers	Government receipts
Belgium	-3.1	-3.6	-0.3	3.3
Denmark	-1.5	-1.8	0.3	3.9
Germany	3.8	3.3	4.0	3.8
Greece	-2.8	-0.6	1.1	7.0
Spain	-1.6	0.4	0.0	1.8
France	2.6	4.0	1.9	3.1
Ireland	-5.9	-9.1	-1.2	-0.8
Italy	-5.2	-3.0	1.5	3.1
Luxembourg	-0.6	-0.6	0.4	0.1
Netherlands	-7.0	-6.2	-3.6	1.3
Austria	0.3	1.4	0.6	3.1
Portugal	6.0	4.6	5.3	7.7
Finland	3.0	4.3	3.1	0.4
Sweden	0.0	0.1	0.8	-0.6
United Kingdom	-2.9	-0.2	1.6	1.2
US	-3.4	-3.3	0.8	2.1
Japan	7.4	6.8	5.6	-3.8
EU-11	-0.1	0.8	1.8	3.0
EU-15	-0.8	0.3	1.6	2.4

Source: AMECO (European Commission, DG ECFIN), and own calculations.

2.2 *Changes in the composition of tax revenues*

The last three decades have witnessed substantial changes in the structure of tax revenues. Table 1 shows the splitting of the changes in total tax burdens into tax revenues from labour, capital and consumption expressed in percentage of the GDP. Such figures have been calculated by using the so-called “effective taxation” methods⁹. There seem to be two main features marking the evolution of tax systems in industrial countries. The bulk of the additional tax revenues was obtained through direct taxes on labour, namely social security contributions and personal income taxes on wage income. In the EU, tax revenues from labour account for 2/3 of the total increase in tax revenues. The figure is 80% for Japan, while, in the US, the revenues from labour income grew more than total receipts. This is also the case of Germany and the UK. The second feature of the long-run evolution of tax systems, is that the relative importance of indirect taxes steadily decreased over time. For instance, in the EU the share of indirect taxes in total tax receipts fell by 6 percentage points, and, in a number of Member States, the fall is higher than 10 points.

In a first approximation, two main factors seem to explain such changes in the structure of tax revenues. *First*, economic integration and international liberalisation reduced to relatively negligible amounts revenues from tariffs and other customs duties, which lowered the relative importance of indirect taxes. *Second*, the rise in tax revenues from labour is strongly associated to the rise in spending and, most particularly, to the rise in social transfers. The importance of the “insurance” role played by some taxes, such as social security contributions, is highlighted by the correlation coefficients between the last three columns of table 1 and the first three of table 2. The correlation coefficient between labour tax revenues and transfers (0.4) is much higher than that for consumption (0.25) or capital (0.25).

⁹ See Mendoza et al (1994), European Commission (1999), (2000), Carey and Tchingilurian (2000) and Martinez-Mongay (1999).

2.3 Changes in tax burdens on production factors

In the framework of this paper, an interesting question concerns the way such increases in tax revenues were achieved. *Were the increases led by discretionary policy reforms aiming at increasing tax rates, or did they result from endogenous long-run trends in the tax bases?* To answer this question, we look at the so-called effective tax rates and tax bases¹⁰, the changes of which are presented in table 4. Although aggregate figures conceal large differences across countries, as a general rule, a sharp rise in the effective tax rate of labour is the most distinguishing feature of the 1970-1998 period. The tax rate of labour increased in the euro area by 14 percentage points, while the tax rates for capital and consumption went up by just 5 and 1 points, respectively. In parallel, the tax base of labour (gross wages) recorded a steady decline, which mirrored an equivalent increase of the capital tax base¹¹.

The idea that discretionary changes in tax rates have been the major source of increasing tax revenues is corroborated by the correlations between tax revenues from labour, capital and consumption and their respective tax rates and bases. The long-run changes in tax revenues for each tax category are much more correlated with the changes in the corresponding tax rates than with the changes in the tax bases. For instance, in the case of labour, while the correlation coefficient between the changes in tax revenues and changes bases is 0.2, that between the changes in tax revenues and changes in tax rates is 0.9.

In addition, such changes in the tax rates are closely associated to changes in spending. The correlation between changes in social transfers and changes in capital and consumption tax rates are low and non-significant. However, the coefficient between the changes in the effective tax rate of labour and those of transfers is close to 0.5.

¹⁰ Ideally, one should look at the evolution of statutory tax rates and bases. Unfortunately, such an ideal solution is not available due to the complexity of tax codes.

¹¹ Note that tax bases are expressed in percentage of GDP at market prices.

Table 4. Changes in effective tax rates and bases, 1970-1998
(percentage points)

Country	Tax rates			Tax bases		
	Labour	Capital	Cons.	Labour	Capital	Cons.
Belgium	16.6	7.6	-2.6	0.8	-1.0	1.8
Denmark	12.2	5.0	1.8	-8.7	8.0	-2.2
Germany	14.4	-2.9	-2.3	-4.2	5.5	5.4
Greece	15.4	10.7	2.3	-8.5	7.0	6.9
Spain	17.9	11.4	5.3	-10.2	8.8	0.3
France	15.0	6.1	1.4	-3.9	4.5	2.1
Ireland	11.7	-6.6	3.2	-17.0	21.1	-21.1
Italy	14.7	13.3	6.9	-8.6	2.9	4.4
Luxembourg	9.2	20.6	15.5	2.8	-19.8	-2.2
Netherlands	6.3	4.8	3.0	-8.3	5.9	1.4
Austria	14.3	4.1	-3.0	1.1	-1.2	5.0
Portugal	14.8	12.8	6.2	-6.5	1.9	-1.9
Finland	20.4	9.7	2.2	-6.8	4.8	-0.4
Sweden	14.3	8.3	5.1	-4.0	2.6	1.5
United Kingdom	1.7	-0.2	-3.5	-1.9	0.9	8.0
US	6.9	-4.0	-2.5	-3.6	5.2	1.8
Japan	10.2	4.6	0.6	2.6	-4.8	10.2
EU-11	14.2	4.8	1.2	-5.3	4.6	3.2
EU-15	11.9	4.2	0.6	-4.9	4.1	4.0

Source: AMECO (European Commission, DG ECFIN), and own calculations.

2.4 *Summing up*

- Tax systems have been adapted during the period 1970-1999 in order to cope with the financing needs generated by an ever-increasing provision of public goods and services. During the last three decades, tax receipts grew faster in countries where total and current expenditures recorded larger increases.
- The bulk of the additional tax receipts collected since the seventies came from labour taxes -social security contributions and direct taxes on labour income-, while the relative importance of indirect taxes decreased in most countries.
- Such additional labour tax revenues did not come from a broadening of the corresponding tax base, but from an increasing tax burden on gross wages. Interestingly, the observed changes in the tax rate on labour are closely associated to the changes in social transfers.
- Finally, the evolution of social transfers in the nineties suggests that welfare spending will be the major determinant of future trends in total spending. This seems to imply that the reduction of the tax burden may not be sustainable in the long run unless current welfare spending trends are curved.

3 **On the long-run determinants of tax revenues**

Recently, Cambridge Econometrics (1997) carried out an extensive review of the most relevant work done on the structural determinants of tax revenues, particularly those related with ageing. The study reviewed theoretical and empirical literature on (i) the effects of ageing on tax revenues, (ii) those of enhanced economic integration, and (iii) those of foreseeable changes in work organisation and employment structure driven by current trends in technology.

3.1 *Ageing populations and government receipts*

The future pressure of ageing populations and other structural factors on public finances is a matter of great concern among analysts and policy-makers. Evidence of such concerns is the growing theoretical and empirical literature on the economic impact of ageing populations, and,

especially, on the impact on sustainability of public finances¹². Most of such studies deal with the impact on public spending and, most particularly, with the effects of ageing on pensions and health expenditures. However, analyses of the consequences of ageing for public revenues are relatively scarce.

Goudswaard and Ven de Kar (1994) suggest that in the case of the Netherlands, which is representative of demographic trends in the OECD as a whole, tax revenues by 2050 might be 37% higher than they were in 1987. Such result takes account of a number of facts on demography, average-tax payments and labour-force participation. The authors argue that, *ceteris paribus*, the potential negative impact of a rising share of older people on tax revenues would be offset by a shift towards higher ages within the working-age group. It is argued that average-tax payments will increase by 20%. In addition participation would be boosted, since lower shares of young people in total population will stimulate female participation rates, and the official retirement age could be increased.

A key question in the simulations of the effects of ageing is its impact on productivity and, thus, on income. The evidence is rather ambiguous. Although MacGregor (1988) suggests that shifts within the working-age group would increase productivity, Hegemann and Nicoletti (1989) argued that, in a dynamic sense, ageing could have a negative impact on productivity growth. The reason would be that new technologies could render some of the older workers' human capital obsolete. In addition, an older population could be functionally and geographically less mobile, which could hamper structural adjustment in the future fast-changing economic environment.

The latter authors also argue that ageing could change the level and structure of consumption. This is particularly relevant for EU countries, where 1/3 of total tax revenues comes from indirect taxes. This, in turn, could affect savings. The conclusion seems to be that consumption could increase and, so could tax revenues, while ageing is

¹² See, for instance, Franco and Munzi (1997) and McMorrow and Roeger (1999).

likely to affect private savings negatively¹³. However, the size of the effects remains uncertain. Cambridge Econometrics (1997) concludes that ageing-independent long-run growth may be far more important than the indirect effects of ageing on consumption and savings. Where the final impact of ageing on public revenues is concerned, the overall effect of ageing on government receipts depends on the extent to which a higher dependency ratio outweighs the positive effects of an older highly-paid workforce.

With a view to contributing to the debate, table 5 shows the long-run changes in demographic and economic dependency. The former is represented by three indicators. First, the youth dependency ratio (DEPY) defined as the ratio of the people aged 0-14 to the working age population (people 15-64 years old). Second, the elderly dependency ratio, i. e. the ratio of people over 64 to the working age population (DEPO). Third, the sum of both is the total demographic dependency ratio (DEPT). The table also includes the economic dependency ratio (DEPE), which is calculated as the ratio of the population under 14 or above 65 to the occupied population, or equivalently the ratio of DEPT to the employment rate¹⁴. As mentioned by McMorro and Roeger (1999), economic dependency ratios reflect the economic burden of the demographic structure on those actually in employment.

The fall in the youth dependency ratio has been the most outstanding feature of demographic trends in industrial countries during the last three decades. Moreover, the changes recorded in the euro zone, the EU, the US and Japan are rather similar, and, leaving aside Japan, dwarf the increases recorded by the elderly dependency rates. Although these have been also relatively important in Greece, Spain, Italy and Finland, for the sample as a whole, the accession of the baby-boomers in the working age population has dominated the evolution of total

¹³ For a detailed analysis of the effects of ageing on savings see Rosevaere et al (1996).

¹⁴ The so-called potential economic dependency –the ratio of the population under 14 or above 65 to the total labour force- has also been used in the literature on ageing. I prefer DEPE to the potential economic dependency because, on the one hand, it actually reflects the demographic burden borne by the average worker, while, where long-run projections are concerned, it is easier and much more appealing to create scenarios on the basis of the employment rate rather than on the basis of the participation rate.

Table 5. Long-run changes in demographic and economic dependency, 1970-1998 (percentage points)

Country	Youth depend.	Elderly depend.	Total depend.	Economic depend.	GDP pc 98/70	Employ. rate	Unempl. rate
Belgium	-10.5	3.9	-6.6	-5.8	112.3	-3.4	7.7
Denmark	-9.1	3.2	-5.9	-10.4	119.4	2.6	4.5
Germany	-13.0	2.6	-10.4	-10.4	106.7	-4.4	8.9
Greece	-15.3	7.5	-7.8	-13.7	66.1	-0.3	6.5
Spain	-21.9	9.0	-12.9	-6.9	81.4	-9.9	16.1
France	-10.8	3.4	-7.4	-2.5	99.9	-6.5	9.3
Ireland	-20.1	-2.2	-22.3	-30.4	112.8	-3.4	1.4
Italy	-16.6	8.9	-7.7	-16.8	101.5	1.9	6.8
Luxembourg	-5.8	2.2	-3.7	-24.1	178.6	19.6	2.8
Netherlands	-16.6	3.5	-13.2	-19.7	112.3	2.4	3.0
Austria	-14.3	0.0	-14.2	-14.7	112.5	-4.4	3.3
Portugal	-18.4	7.5	-10.9	-10.5	77.9	-14.7	2.5
Finland	-9.0	8.0	-1.0	12.3	102.3	-11.7	9.1
Sweden	-2.7	6.3	3.7	7.4	98.5	-2.4	6.8
United Kingdom	-8.7	3.4	-5.2	-6.5	101.1	-0.5	4.1
US	-11.7	2.3	-9.3	-25.1	151.6	12.9	-0.4
Japan	-13.1	13.3	0.2	-1.1	115.9	1.9	3.0
EU-11	-13.4	4.5	-8.9	-8.5	100.7	-3.8	8.4
EU-15	-12.2	4.4	-7.8	-7.5	100.0	-3.2	7.6

Source: AMECO (European Commission, DG ECFIN), and own calculations.

demographic dependency. Nevertheless, demographic projections point to a relatively small fall of youth dependency, which will tend to stabilise. According to such projections, the major feature of demography will be a steady rising of the elderly dependency rate (McMorrow and Roeger, 1999).

Such a dominant role of youth dependency in explaining past demographic trends is supported by a very high correlation between the changes in youth dependency and those in total demographic dependency (0.8), which compares with less than 0.6 for changes in elderly dependency. However, when it comes to explain the evolution of the effective economic dependency, correlation coefficients suggest that employment performance has played an equally important role as demography.

The information in tables 1, 2 and 5 sheds some preliminary light on the relationships between dependency and tax revenues:

- Changes in tax receipts and those elderly dependency exhibit a correlation coefficient of 0.5. Rising elderly dependency has been inducing positive changes in spending and, as a consequence, tax revenues have risen.
- The correlation between the changes in elderly dependency, on the one hand, and the changes of three indicators of spending in table 2 is close to 0.7.
- Where the relationship between dependency and income per capita is concerned, it seems that the potential beneficial effects of an older population on income are not clear-cut. As a matter of fact, the correlation between the changes in income per capita and those in elderly dependency is negative.
- However, the correlation between employment performance and income growth is positive and strong (0.8). All in all, per capita income seems to depend much more on labour market outcomes than on demographic structures.
- Finally, the apparent positive effects of ageing populations on consumption could find some support on a significant correlation coefficient of 0.45 between long-run changes in elderly

dependency ratios (2nd column of table 5) and long-run changes in consumption tax bases (6th column of table 4).

3.2 *The effects of economic integration*

The four freedoms of the Single Market Programme, coupled with the single currency, are expected to increase factor mobility in a situation where taxation systems are still highly divergent within the EU. Such EU-specific economic integration comes hand in hand with more global processes, which affect most particularly capital and consumption.

The functioning of a fully integrated capital market may be distorted by capital chasing the lightest possible taxation regimes instead of the most efficient users. Where capital mobility is concerned, as discussed in Buti and Martinez-Mongay (2000), it could hamper the ability of governments to levy capital taxes. The most mobile tax bases might be eroded due to high taxes, increased opportunities for tax avoidance and evasion, and the migration of taxable income to low-tax jurisdictions, which may cause tax degradation. Harmful tax competition might lead to very low or even zero tax rates on mobile factors. As a consequence, fiscal revenues could fall significantly, which would lead to sub-optimal provision of public goods. Alternatively, it could jeopardise fiscal discipline unless the tax burden is shifted to less mobile bases like labour.

The effects of capital tax competition have been analysed recently in European Commission (2000). It is concluded that increased international tax competition may have contributed to the structural change in the tax systems and the growing gap between the tax burdens on labour and capital. However there is no evidence that tax competition has reduced the tax burden on capital, which has remained broadly stable over the past decades¹⁵. Neither is there evidence that changes in labour tax rates keep pace with those of capital. The correlation coefficient between the changes in the effective tax rate of labour and those for capital (table 4) is very low (25%).

¹⁵ This concurs with OECD data (Carey and Tchilinguirian, 2000).

However, the possibility of intensified capital tax competition leading to a generalised lowering of capital tax rates in the future cannot be disregarded. With rising spending, this should lead to a shift of the tax burden away from capital to other factors with more inelastic supply. In this case, tax revenues could decrease in the long run (Buti and Martinez-Mongay, 2000), through the perverse effects of taxes on accumulation and, eventually, growth and job creation¹⁶.

It has also been argued that capital tax competition could affect the location decisions of multinational companies. However, as mentioned by Cambridge Econometrics (1997), empirical studies on the importance of taxation as a determinant of location decisions seem to suggest that factors other than taxes may be much more important determinants of foreign direct investment.

According to Cambridge Econometrics (1997), the effects of labour mobility are likely to be small, with only modest effects on government receipts, depending on the characteristics of migration flows. Inward migration of skilled workers should increase tax revenues in the recipient country, while it seems that the effect of inflows of unskilled workers is uncertain. In any case, the authors of the study highlight the fact that ageing populations may reduce intra-EU labour mobility. This could counter-balance migratory flows induced by higher economic integration and factor mobility in EMU. However, given the very low degree of labour mobility in Europe, one should expect almost negligible effects of migratory flows on government receipts.

3.3 *The effects of technical and organisational changes*

The referred study by Cambridge Econometrics also considers the potential effects of a number of other structural long-run factors such

¹⁶ See de la Fuente (1997), Mendoza et al (1997), Daveri and Tabellini (1997), Elmeskov *et al.* (1999) and Buti *et al.*, (1998). To the extent that the tax burden is not entirely carried by wage earners, a rise in labour taxes may be detrimental to employment by contributing to capital-labour substitution. Consequently, tax shifts away from capital to labour could reduce income through lower employment rates and higher unemployment. *Ceteris paribus*, this would enhance the potential negative effects of higher elderly dependency on tax revenues from personal income..

as deindustrialisation, growing income inequality, increased female participation and rising self-employment. However, the evidence is inconclusive. Changes in the productive structure should not have *per se* any significant impact on tax revenues, even though higher female participation could increase income inequality. On the other hand, the study argues that self-employment, unless it poses outstanding problems in tax enforcement, does not seem to have any significant impact on government receipts. Nevertheless, it should be borne in mind that the ratio of social security contributions paid by the self-employed to the average wage is lower than that of the employees. In other words, *ceteris paribus*, a larger proportion of the self-employed would lead to lower social security contributions per average wage¹⁷.

Overall, it seems that structural trends have an impact on tax revenues as long as they influence income distribution. Cambridge Econometrics argues that higher income inequality will increase tax revenues in progressive tax systems. However, such a positive effect is actually uncertain, since it depends on the way income distribution is affected and on the degree of progressivity.

4 Determining long-run trends in tax receipts. Panel data evidence

Cambridge Econometrics (1997) contributes to the analysis of the long-run determinants of tax receipts by econometric modelling of tax revenues Belgium, Italy and the UK. Government receipts and their various components are expressed in percentages of GDP and represented by functions of official tax rates, tax bases and a battery of indicators representing demographic and other structural trends. The study concludes that tax policy –the changes in statutory tax rates and bases- is the major determinant of tax revenues in the long run, while the effects of demographic and other structural trends on tax bases are relatively small.

Such a conclusion is not surprising. In the end, tax revenues must depend on statutory rates and bases. Tax revenues are, by definition,

¹⁷ Some evidence on this is presented later in sections 4 and 5.

the effective tax rate times the corresponding tax base. Moreover, the effective tax rates are quite good proxies to the evolution –and sometimes to the levels– of the statutory rates. This is particularly true in the case of proportional taxes (viz. social security contributions, VAT, other indirect taxes, some capital taxes). In the case of more complex tax items, effective rates can be good proxies to average or representative rates. As a consequence, including in the regression for tax revenues “official” rates and tax bases, is equivalent to a linear approximation of the identity between tax revenues and the product of effective rates and bases. Once the latter are included in the models, any other variable should have an explicative power close to zero.

The close relationship between tax revenues, rates and bases is shown in table 6 for total, labour, capital and consumption tax revenues. The results have been obtained by means of a panel data made up by 17 countries (the 15 MS, plus US and Japan) over the period 1970-1998. In order to cancel cyclical effects out, the initial time span of 30 years has been reduced to six periods (1970-74, 75-79, 80-84, 85-89, 90-94, 95-98), and the variables have been recalculated as five-year averages (four-year averages in the last period). As expected, the joint explicative power of tax rates and bases is almost 1¹⁸.

Such panel results are coherent with simpler analyses in section 2. The marginal effects of tax rates are much larger than those of tax bases. Changes in tax burdens across countries and periods have been driven by rising tax rates of labour, capital and consumption, while the contribution of tax bases has been almost negligible. Interestingly, an increase of 1 percentage point of GDP in total tax receipts is associated in the past to increases of 0.65 and 0.53 percentage points in the tax rates of labour and consumption, respectively. This compares with only 0.15 for capital and highlights the relatively minor role played by this kind of taxes in providing funds to finance spending. Where tax revenues from the three categories of taxes are concerned, the conclusions are broadly similar. In comparing the four columns of table 6, one can conclude that, as a general rule, countries within and outside the EU have increased total tax receipts by raising the tax burdens on labour income and

¹⁸ Note that these are linear (non-logarithmic) transformations.

**Table 6. Regression between tax revenues
and tax rates and bases**

	Total .	Labour	Capital	Consump.
Intercept	-12.1 (-4.9)*	-17.3 (-11.4)*	-4.77 (-15.6)*	-11.6 (-21.4)*
Labour base	0.07 (2.92)*	0.26 (11.2)*		
Capital base			0.19 (15.3)*	
Consump. base	0.15 (9.46)*			0.18 (24.7)*
Labour rate	0.65 (92.2)*	0.65 (120)*		
Capital rate	0.23 (25.0)*		0.25 (38.7)*	
Consump. rate	0.53 (34.0)*			0.63 (83.7)*
Sample size	102	102	102	102
Adj. R ²	0.995	0.994	0.983	0.994
SBIC ⁽¹⁾	-0.98	-1.37	-2.72	-2.75
White ⁽²⁾	76.1 [0.00]	80.0 [0.00]	60.7 [0.00[61.7 [0.00]

t-statistics between “()”. Heteroskedastic-consistent standard errors.

“*” significant at 1%.

p-values between “[]”.

(1) Schwarz -Bayes Information Criterion.

(2) White-heteroskedasticity test.

consumption. Therefore, the inclusion of tax policy indicators in models for tax revenues will offset the effects of any other factor.

As shown in section 2, the correlation between revenues and expenditures is too strong and robust as to be neglected. If taxes follow expenditures, the determinants of the long-run evolution of government receipts must be much the same as those of expenditures. The analyst has to keep in mind such spending-determinants when interpreting the signs and significance of the factors driving revenues. This is particularly relevant when it comes to analysing the effects of ageing. Consequently, we follow here a model selection strategy starting by analysing the explicative power of demographic and other factors in the regressions for expenditures. In a second step, spending-determinants and, eventually, other factors will be used to analyse long-run trends in government receipts. In that way, it might be possible to disentangle induced effects on tax revenues, actually explained by the financing role of taxes, from direct effects caused by structural factors unrelated with spending.

Lack of data prevents us from carrying out a complete analysis of the effects of changes in the age, gender, skill and sectoral structure of employment. Neither is it possible to analyse the long-run effects of income distribution on tax revenues. Leaving aside the variables reported in tables 1 to 5, we have information on self-employment and on the evolution of the employment share of manufactures. Albeit clearly insufficient to carry out complete analyses, the information set used in this paper suffices to make its fundamental point, namely that it is spending, and especially welfare spending, the major force driving tax revenues in the long run, while other factors play a secondary role. We leave for future work more detailed analyses of the effects of employment and production structure on government receipts.

We put particular emphasis on the determinants of transfers. As shown in section 2, the link between transfers and government receipts is particularly important for the sustainability of public finances in EMU. Indeed, demographic dependency also determines other spending items,

such as education and health¹⁹. Consequently, we should find many similarities between models for transfers and models for spending.

Graphs 1 to 4 show the scattered diagrams for the simple linear relationships between the transfers-to-GDP ratio, on the one hand, and youth and elderly dependency, income per capita, and the unemployment rate, on the other hand. The following conclusions can be drawn:

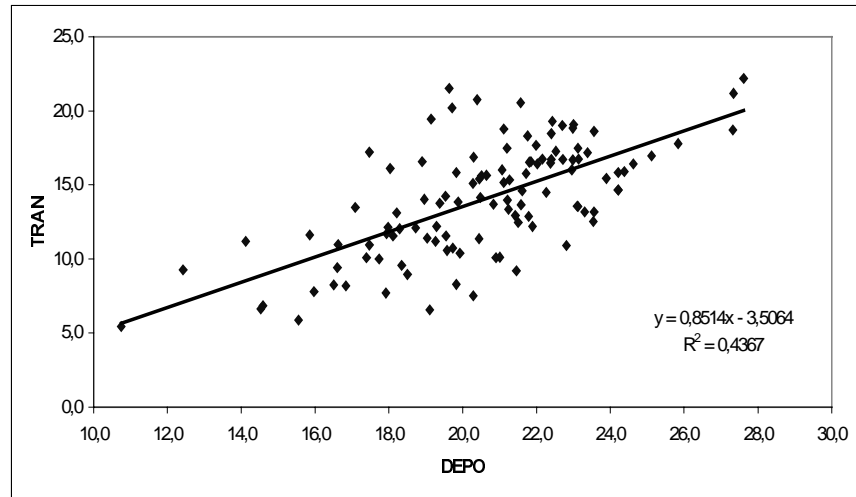
- *First*, as expected, the relationship between the share of the elderly in total population and social transfers is strong and positive. An older population increases the weight of pensions in GDP.
- *Second*, albeit weaker, and in accordance with section 2, a significant, positive relationship exists between income and transfers. High-income countries have higher levels of social protection, and, as long as countries become richer, their levels of social protection increase.
- *Third*, the relationship between transfers and youth dependency is significant and negative. The reason is that high youth dependency is associated to low levels of both elderly dependency and income per capita.
- *Finally*, there is no relationship between the transfers ratio and the unemployment rate. This likely reflects large disparities in social protection across countries and periods²⁰.

Multivariate results presented in table 7 are very much in accordance with simple correlations discussed above. The first four

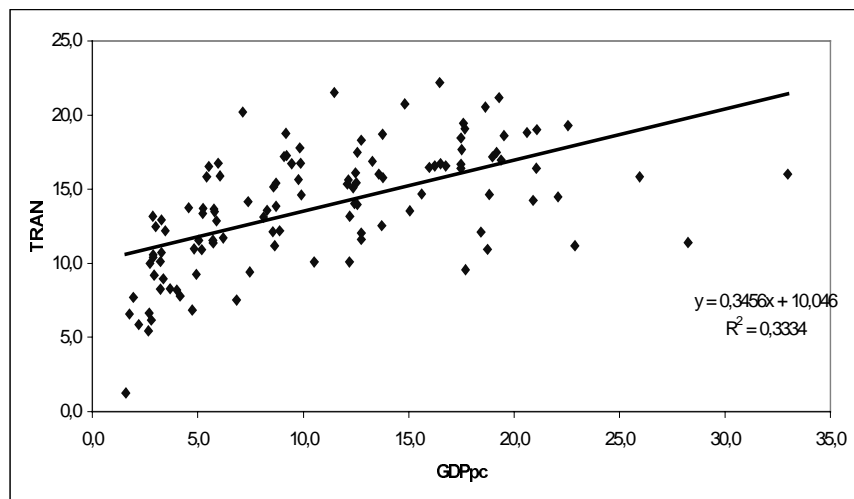
¹⁹ As a matter of fact, in the ESA95 National Accounting System, education and health care are considered as transfers in kind. In addition, the size of social programmes also determines the public sector wage bill, but, again, it is difficult to disentangle it from wages of public officials not involved in welfare programmes.

²⁰ However, it is worth pointing out that this does not preclude strong relationships between the two variables within countries over time. Next section will provide some empirical evidence on this.

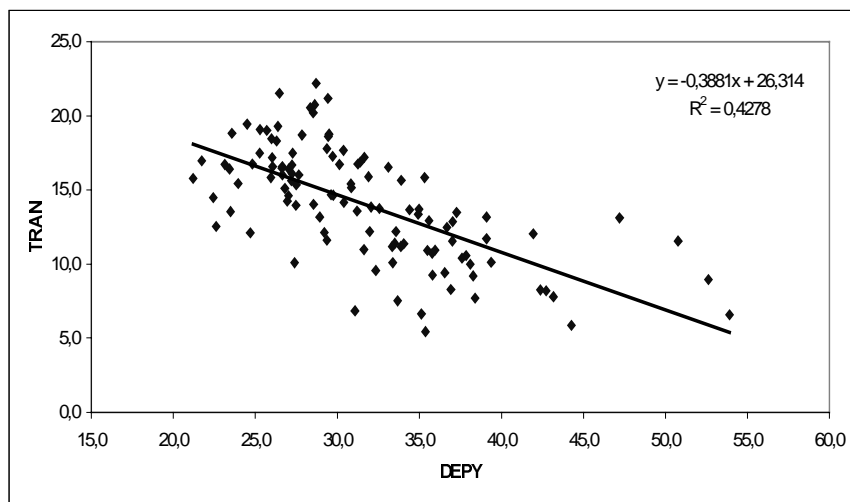
Graph 1. Simple correlation between transfers and elderly dependency



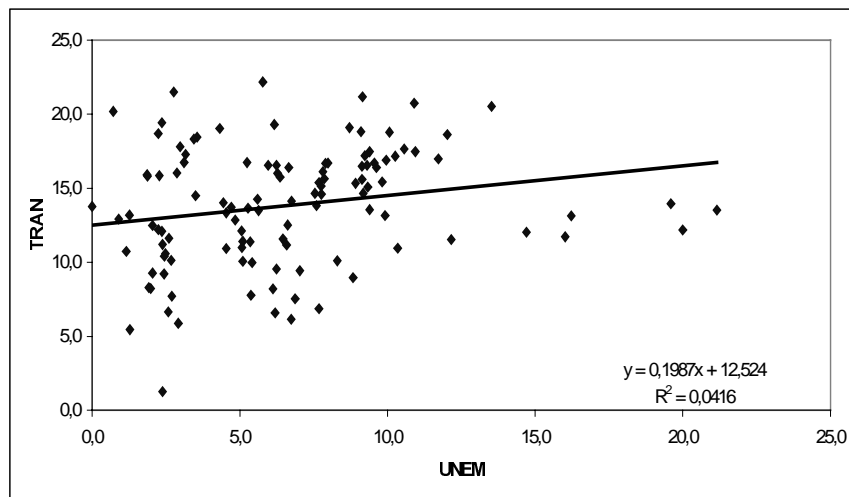
Graph 2. Simple correlation between transfers and income per capita



Graph 3. Simple correlation between transfers and youth dependency



Graph 4. Simple correlation between transfers and unemployment



columns of the table present the best four models for social transfers²¹. The last two columns of the table present regression results for total and current spending on the basis of the model in the second column of the table. Although such results are for the whole sample, they overall apply to the EU sub-sample.

Almost 60% of the variance of social transfers across countries and periods can be attributed to the variance of demographic dependency (youth and elderly) and income. The elderly dependency ratio pushes pensions up. An increase of 1 percentage point in this rate increases transfers by half a point of GDP. In addition, an increase of 1000 PPPs in the income per capita is associated to an increase of 0.1% of GDP on transfers. This is half the effect of a reduction of 1 percentage point in the youth dependency rate²². However, differences in the unemployment rate across countries and periods do not explain differences in the transfers ratio.

These results have important implications for the effects of ageing on expenditures and, in particular, on social spending. Future demographic trends are characterised by an ever-increasing elderly dependency rate, while the reduction in youth dependency slows down and tends to stabilise. This means that, in the coming years, *ceteris paribus*, there will not be compensatory changes in the youth dependence rate, while rising elderly rates will set constant pressure on pensions. Such positive trends could be accentuated by rising incomes, especially in low-income countries.

The importance of elderly dependency is also shown in the regressions for total and current expenditures, which only depend on the share of the people aged 65 or more in total population. Interestingly, the

²¹ Although we are more worried about robustness than about model selection, we applied a model selection procedure going from the general to the particular, looking for parsimonious regressions maximising adjustment, minimising SBIC and leading to heteroskedastic-free models.

²² Note, however, that coefficients of different variables are not comparable, since the indicators are expressed in (non-logarithmic) levels, so that the coefficients are not elasticities but are level-dependent. Future work, using a more complete data-set should take care of the analysis of the most appropriate functional form.

Table 7. The long-run determinants of spending

	Social Transfers	Social Transfers	Social Transfers	Social Transfers	Total Spending	Current Spending
Intercept	8.50 (2.67)*	8.32 (2.63)	10.9 (3.73)*	11.0 (3.77)*	7.01 (0.81)	0.27 (0.03)
Youth dependency	-0.21 (-3.94)*	-0.21 (-3.89)*	-0.27 (-6.03)*	-0.26 (-5.99)*	-0.08 (-0.52)	-0.07 (-0.48)
Elderly dependency	0.53 (5.57)*	0.54 (5.69)*	0.54 (5.61)*	0.56 (5.80)*	1.89 (7.29)*	1.93 (7.23)*
Income per capita	0.09 (1.74)***	0.10 (2.01)**			0.15 (1.12)	0.23 (1.68)
Unemploy- ment	0.05 (0.72)		0.07 (1.22)			
Sample size	99	99	99	9	99	99
Adj. R ²	0.58	0.58	0.57	0.56	0.46	0.47
SBIC ⁽¹⁾	2.03	1.99	2.02	1.99	4.0	4.06
White ⁽²⁾	16.2 [0.30]	11.21 [0.26]	11.16 [0.27]	3.75 [0.59]	6.78 [0.66]	6.12 [0.73]

t-statistics between “()”.

“*” significant at 1%; “**” significant at 5%; “***” significant at 10%, *p*-values between “[]”.

(1) Schwarz -Bayes Information Criterion.

(2) White-heteroskedasticity test.

coefficient of elderly dependency is similar for total and current spending. In addition, it is larger than for social transfers²³. Overall, almost half the variance of total and current spending across countries and periods is explained by differences in the elderly dependency rate. This suggests that, as indicated in sections 2 and 3, demography and,

²³ Note that expenditures are expressed as percentage of GDP.

therefore, welfare spending (pensions, health, benefits) have been major driving forces behind the trends in total spending in industrial countries.

On the basis of the model in the second column of table 7, the next step is to analyse the determinants of government receipts in the long run. To that end, we consider models including the same variables as those for spending plus the employment rate and two additional indicators of the structure of occupied population. The scattered diagrams and demographic dependency (youth and elderly), income and unemployment are almost indistinguishable from those for transfers in graphs 1 to 4. Consequently, the corresponding graphs are not shown here.

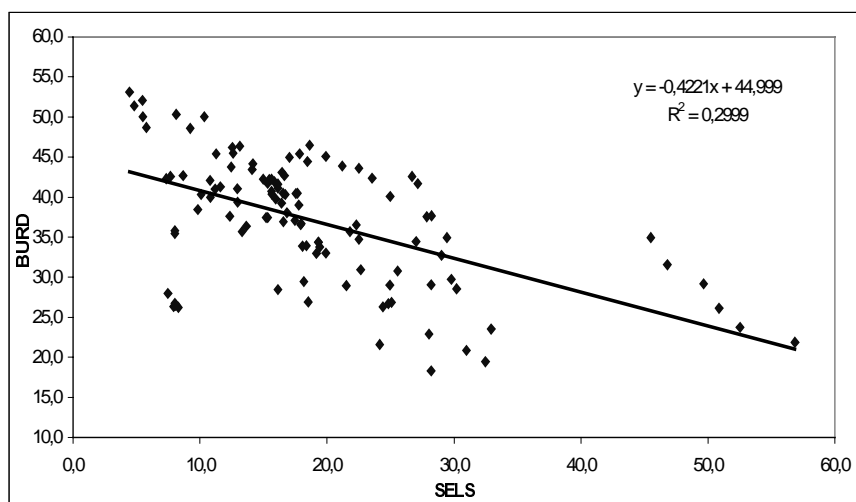
Such similarities simply highlight the fact that spending is a major determinant of transfers. In addition, the graph for the correlation between tax revenues and employment is not shown either since, as expected, there is no significant relationship between the two variables. Similar high-employment countries (such as the US in the most recent past and Nordic countries in the seventies and the eighties) raise very different amounts of taxes in terms of GDP, while the differences in tax burdens across low-employment countries can be very large²⁴.

Graphs 5 and 6 respectively show the scattered diagrams for the simple correlations between tax receipts and the self-employment and manufacturing employment shares in total employment. The negative relationship between the tax burden and self-employment is strong²⁵, while there is no relationship with the manufacturing-employment share.

²⁴ For instance, in the late nineties, Belgium, Greece, Spain and Italy, recorded employment rates (national accounts definition) below 60% (52-57%), while their respective tax burdens were 46.5, 35, 34 and 43 percentage points of GDP.

²⁵ Graph 5 reveals that Greece is a very especial case. Its high levels of self-employment are associated to the importance of the primary sector as well as of some tertiary sub-sectors related with tourist activities. Note that this country does not behave as a real outlier distorting the relationship between tax receipts and self-employment. As a matter of fact, it is easy to see that excluding Greece would reinforce the negative relationship between the two variables.

Graph 5. Simple correlation between tax receipts and self-employment



Graph 6. Simple correlation between tax receipts and manufacturing employment

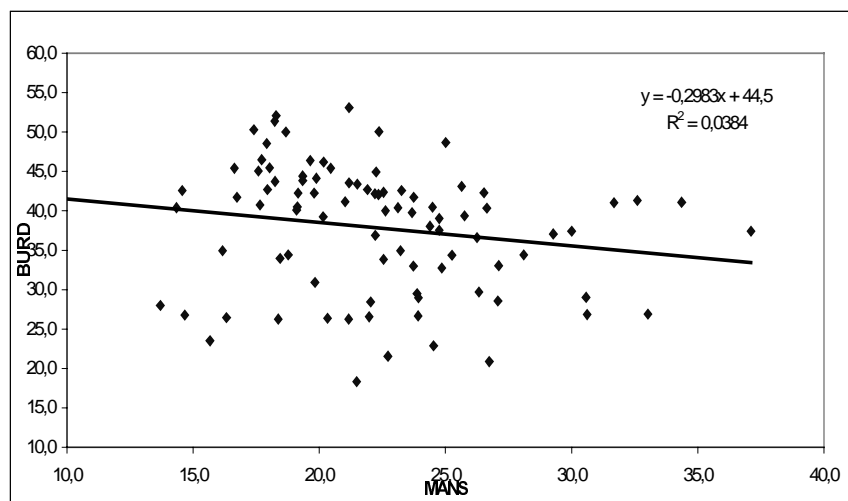


Table 8 presents multivariate regression results for total government receipts. Interestingly, unlike in the case of transfers, the differences between both samples are quite relevant for tax receipts. This may suggest that, overall, tax systems in the EU share distinguishing features, which are not found in other industrial countries (see European Commission, 2000). The first (whole sample) and third (EU sample) columns of table 8 show the regressions for government receipts including the variables selected for social transfers in table 7 (2nd column).

Three main findings are worth stressing.

- *First*, the explicative power of demography and income is lower in the regressions for tax revenues than in those for transfers. In addition, the coefficient for the youth dependency rate is non-significant.
- *Second*, the regression for the tax burden in the first column of table 8 very much resembles to those in the last two columns of table 7 for total and current spending. This seems to give additional support to the financing role of taxes.
- *Third*, while there is no relationship between tax receipts and income per capita for the whole sample, in the case of the EU sample (3rd column of table 8), a unitary increase of income across countries and over time leads to an increase of 0.33% of GDP in revenues. This is likely reflecting strong progressivity of tax systems in the EU, as well as the fact that lower-income Member States at the beginning of the period experienced strong increases in taxes, while shifting the tax burden from consumption to more income-related taxes.

As shown in table 8, the explicative power of the model is improved when including the three additional variables available in the data set (total employment, self-employment and manufacturing-employment rates). The adjusted R² increases, especially for the EU subsample. While total employment is positively correlated with tax revenues in the long run, higher shares of self and manufacturing employment in total employment are associated to lower revenues.

Table 8. The long-run determinants of tax receipts

	Whole sample	Whole sample	EU sample	EU sample	EU sample	EU sample
Intercept	12.0 (1.64)	21.9 (3.70)*	16.6 (2.05)**	24.1 (3.13)*	46.52 (4.12)*	41.91 (5.77)
Youth dependency	-0.19 (-1.60)	-0.20 (-2.33)**	-0.15 (-1.19)	-0.18 (-1.9)***	-0.52 (-3.7)*	-0.34 (-3.23)*
Elderly dependency	1.48 (6.77)*	1.31 (6.79)*	1.10 (4.26)*	0.73 (3.63)*	1.03 (4.95)*	1.05 (4.87)*
Income per capita	0.10 (0.85)		0.33 (2.72)*	0.18 (1.84)** *	-0.23 (-1.7)***	
Employment rate				0.13 (1.99)**	0.10 (1.53)	
Self-employment rate		-0.27 (-5.47)*		-0.30 (-5.81)*	-0.44 (-5.95)*	-0.46 (-7.30)*
Manufacturing rate					-0.40 (-3.22)*	-0.27 (-2.85)*
Sample size	99	99	87	87	63	63
Self-employment rate		-0.27 (-5.47)*		-0.30 (-5.81)*	-0.44 (-5.95)*	-0.46 (-7.30)*
Adj. R ²	0.47	0.59	0.44	0.68	0.77	0.76
SBIC ⁽¹⁾	3.65	3.39	3.54	3.05	2.83	2.80
LMHET ⁽²⁾	0.33 [0.57]	0.00 [0.99]	3.88 [0.05]	0.25 [0.62]	0.97 [0.33]	1.27 [0.26]
White ⁽³⁾	12.0 [0.21]	22.9 [0.01]	26.9 [0.00]	26.3 [0.08]	47.5 [0.00]	18.3 [0.19]

t-statistics between "()" .

"*" significant at 1%; "***" significant at 5%; "****" significant at 10%, *p*-values between "[]".

(1) Schwartz -Bayes Information Criterion.

(2) LM (Breusch-Pagan) heteroskedasticity test.

(3) White-heteroskedasticity test.

The last column of table 8 refers to the most parsimonious model for taxes, which maximises the adjusted R^2 and ensures white-noise disturbances. Where differences in tax receipts across Member States and periods are concerned, $\frac{3}{4}$ of them are explained by differences in demography and employment structure.

Overall, we can conclude that ageing populations are closely associated with higher tax revenues, but, as suggested by the last two columns of table 7, this is an induced effect driven by the financing role of taxes. Regarding employment structure, our results seem to suggest that self-employment and high economic weight of manufacturing seem to be associated to lower tax revenues.

At the current stage of this research, the latter conclusion should be treated with care. Indeed, these two variables are poor indicators of the overall employment structure. For instance, self-employment is high in countries where the primary sector is important, which, in turn, implies lower income and, then, lower social protection and taxes. However, the negative sign for self-employment could also be reflecting that social security contributions paid by the self-employed are lower than those paid by employed labour²⁶ for the same imputed average wage²⁷. In any case, although the variation range of self-employment is not large, the absolute value is unexpectedly large, thereby suggesting that this indicator may be encompassing the effects of other structural factors.

Where the manufacturing-employment share is concerned, its negative sign seems to indicate that a developing tertiary sector allows for increasing tax receipts. Again, the marginal effect seems too big, while multicollinearity with other variables should not be excluded. Deindustrialisation processes and, thus, lower manufacturing-employment shares are closely linked to higher income levels, which could be explaining their positive effect on tax revenues.

²⁶ These included SSC paid by the employers and those paid by the employees.

²⁷ A recent tax reform introduced by Portugal, a relatively low-tax, high-self-employment country, aiming at increasing tax revenues, envisages equalising SSC paid by the self-employed to those paid by employed labour (see European Commission, 2000).

5 Tax revenues in the long run. Time series evidence

Leaving aside the relatively strong and robust conclusion about the financing role of taxes, which ultimately links demography and tax receipts, the findings on other long-run determinants of revenues are rather ambiguous and, sometimes, do not have clear-cut explanations.

One major reason of such ambiguity is the lack of adequate indicators representing the structure of production and employment²⁸. Another possible explanation could be endogeneity bias. Taxes and expenditures affect economies in all their aspects in a more or less significant way, so that finding instruments allowing for circumventing endogeneity biases is not an easy task. This is particularly relevant in the case of income, the level of which is affected by efficiency effects of taxation²⁹. As mentioned in section 3, tax and social protection systems affect employment and employment structure. In longer periods of time, taxes and benefits may affect demography by changing work incentives and income, which, together with social and cultural factors, determine rates of birth.

All these problems seem to call, at least, for some additional robustness analyses. These are carried out here by discussing the existence of country-specific cointegrating relationships between government receipts and indicators of dependency and employment structure. Such long-run relationships are obtained by using an approach coherent with that of section 4. In particular, for each one of the 17 countries included in the sample, we first look for (linear) cointegrating relationships between the ratio of transfers to GDP, on the one hand, and a battery of indicators, which are basically coincidental with some of those used in tables 7 and 8, on the other hand. Once such cointegrating relationships are found for transfers, in a second step, the same relationships are used as starting-point models for tax receipts. As in

²⁸ In addition, the analysis has ignored some explanatory factors of the size of the government such as openness, or political organisation (viz. Rodrick, 1998).

²⁹ See, for instance, Harberger (1964) and Mendoza et al (1997). Although the effect of taxes on long-run growth debatable (Harberger's superneutrality conjecture), they affect the level of income, which is the indicator used here.

section 4, in a third step, these are supplemented with other indicators in order to find out the long-run determinants of government receipts.

Table 9 reports the results of cointegration analyses of the effects of demography, unemployment and income on social transfers (in % of GDP). In the basic model, demography is represented by the youth and the elderly dependency rates. One should expect that rising elderly dependency pushes transfers up by increasing pensions. The opposite should be found for the youth dependency rate. Where the unemployment rate is concerned, the relationship should be positive, reflecting increasing unemployment benefit spending. Moreover, such relationship could reflect permanent rather than cyclical effects of unemployment on transfers, since, especially in most EU countries, the structural component of unemployment is high. Finally, the expected sign of GDP per capita is more ambiguous. On the one hand, according to panel data evidence in section 4, the relationship could be positive, since social protection increases with real income, especially in poorer countries. However, on the other hand, leaving aside the effects of collinearity with other regressors within each country, a negative relationship might not be disregarded, since, over the cycle, the evolution of income and social transfers is negative (automatic stabilisation).

Main findings can be summarised as follows:

- Greece, the US and Japan are the only countries where no cointegrating regressions were found³⁰.
- Overall, the sign of the youth dependency rate is negative or non-significant. The only exceptions are Spain and the UK. In both cases, the basic relationship does not pass cointegration tests. In the alternative regressions, the rate is non-significant (Spain) or negative (UK).
- The sign of the elderly dependency rate is positive or non-significant in all the countries except Ireland³¹. No alternative

³⁰ Or when found, as is the case of Japan, they did not lead to meaningful relationships.

³¹ It was also negative in the basic, non-cointegrating regression for Spain.

Table 9. Selected cointegrating regressions for social transfers

Country	Youth Depend.	Elderly Depend.	Econom. Depend.	Unempl. Rate	Income Per cap.	Adj. R ² (SBIC)	Unit
Belgium	-0.67 (-4.5)*	0.74 (2.91)*		0.54 (6.97)*	-0.50 (-4.87)*	0.9278	-4.95 [0.00]
Denmark	0.09 (0.71)	-0.11 (-0.31)		0.62 (5.39)*	0.34 (6.02)*	0.936	-3.80 [0.02]
Germany	0.02 (0.59)	1.29 (11.7)*		0.82 (10.1)*	-0.16 (-4.33)*	0.942	-3.69 [0.02]
Spain	0.63 (4.10)*	-0.85 (-1.73)		0.31 (10.6)*	1.68 (4.12)*	0.958	-2.44 [0.36]
	0.16 (1.23)	0.74 (1.92)		0.31 (8.37)*		0.932	-4.16 [0.00]
France	-0.52 (-2.69)*	0.09 (0.75)		0.63 (5.57)*	-0.19 (-1.76)	0.981	-3.21 [0.08]
Ireland	0.15 (0.58)	-1.69 (-3.30)*		0.51 (13.9)*	0.13 (0.42)	0.933	-4.67 [0.00]
Italy	0.11 (0.32)	-0.51 (1.23)		0.13 (0.57)	0.70 (1.37)	0.934	-2.15 [0.52]
				1.13 (12.4)*		0.844	-3.20° [0.05]
Luxemb.	-1.20 (-7.88)*	3.31 (5.76)*		0.62 (1.9)***	-0.42 (-10.5)*	0.856	-5.14 [0.00]
Netherl.	-0.42 (-4.27)	3.86 (2.75)*		0.69 (6.30)*	-0.84 (-3.03)*	0.939	-3.64 [0.03]
Austria	-0.38 (-5.97)*	0.55 (3.03)*		0.74 (2.44)*	-0.08 (-1.56)	0.928	-4.43 [0.00]
Portugal	0.09 (0.99)	-0.25 (-1.12)		0.46 (3.45)*	1.04 (3.57)*	0.893	-3.73 [0.02]
Finland	-0.14 (-0.42)	0.73 (0.72)		0.61 (5.01)*	0.18 (0.65)	0.952	-2.95° [0.09]
Sweden	0.26 (1.17)	1.98 (8.49)*		0.54 (4.76)*	-0.26 (-2.16)*	0.947	-2.97° [0.09]
UK	0.58 (5.76)*	0.87 (3.69)*		0.76 (10.3)*	0.24 (5.20)*	0.953	-2.43 [0.36]
	-0.59 (-10.6)*	0.60 (2.79)*	0.58 (11.2)*		0.17 (4.10)*	0.959	-3.54° [0.02]

t-statistics between “()”; *p*-values between “[]”.

“*” significant at 1%; “**” significant at 5%; “***” significant at 10%.

“°” Weighted-Symmetric unit-root test; ADF otherwise.

cointegrating equation was found for this country showing the correct sign.

- In the case of unemployment, its relationship with transfers is, as expected, positive and strongly significant. The only exceptions are Luxembourg, where the p-value is comparatively high (between 5 and 10%), and the UK, where unemployment does not enter the selected cointegrating regression.
- Finally, results for real income depend on specifications and countries. Overall, the effect of real income on the transfers ratio is negative or non-significant. However, the sign of income is positive in Portugal, a low-income, low-protection country. Indeed, the positive sign found in Denmark and, to a lesser extent, in the UK cannot be interpreted in the same way, and seems to be in contradiction with the evidence provided by other countries, such as Belgium, Germany, France, Luxembourg, the Netherlands or Sweden. These are high-income, high-social protection countries, where regression results suggest that transfers increases less than real income.

When interpreting such quantitative effects at the margin the following should be borne in mind. *First*, although we are dealing with cointegrating regressions, residuals are far from behaving as white noises, so that the precision of the estimates can be low. *Second*, the relatively short span of the series (1970-1998) might not allow to disentangle long and short-run effects. As a consequence, cyclical swings play a role. *Finally*, precision of estimates could also be lower due to common trends between, for instance, elderly dependency and real income.

Leaving aside the sign of income, models in table 9 lead to similar conclusions as those presented in table 7. Elderly dependency coupled with labour market performance are the main factors determining the evolution of transfers in the long run. On the basis of these models, we identified cointegrating regressions for total government receipts (% of GDP) by considering two additional rates, namely self-employment, and manufacturing employment. We started by estimating models in table 9, but with the tax burden as dependent variable. The results are shown in table 10.

Table 10. The long-run determinants of government receipts

Country	Youth Depend.	Elderly Depend.	Econ. Dep.	Unempl. Rate	Income Per cap.	Self-empl.	Adj. R ²	Unit-root
Belgium	-0.76 (-3.21)*	1.32 (3.29)*		0.76 (6.25)*	-0.45 (-2.81)*		0.93	-4.15 [0.01]
Germany	-0.20 (-5.31)*	1.39 (10.8)*		0.56 (5.80)*	-0.25 (-5.78)*		0.907	-5.27 [0.00]
	-0.11 (-2.02)**	1.23 (8.64)*		0.60 (6.56)*	-0.29 (-6.57)*	-0.36 (-2.18)*	0.920	-5.03 [0.00]
Spain	-0.85 (-4.37)*	-2.39 (-3.31)*		0.38 (7.16)*		-0.98 (-4.76)*	0.969	-3.49 [0.04]
Ireland	0.19 (0.44)	-1.02 (-1.16)		0.66 (10.4)*	0.25 (0.47)		0.875	-3.86 [0.01]
Italy				2.64 (8.37)*			0.877	-3.32° [0.03]
Luxemb.	-1.74 (-6.86)*	3.61 (3.77)*		-0.10 (-0.20)	0.04 (0.55)		0.891	-3.28 [0.06]
Netherl.	5.69 (3.15)*	-0.34 (-2.63)*		0.59 (6.39)*	-1.28 (-3.41)*		0.769	-4.78 [0.00]
	1.61 (0.77)	-0.29 (-2.64)*		0.24 (1.67)	-0.88 (-2.51)**	-0.97 (-2.97)*	0.828	-4.93 [0.00]
Austria	0.64 (2.33)	-0.30 (-4.36)*		0.84 (1.87)* **	0.06 (0.91)		0.899	-3.26 [0.07]
Portugal	0.25 (3.17)*	-0.37 (-2.03)**		0.36 (3.36)*	1.42 (5.95)*		0.969	3.49 [0.04]
Finland	0.27 (0.50)	3.73 (2.25)**		-0.19 (-1.0)	-0.57 (-1.28)		0.840	-3.59° [0.02]
Sweden	0.59 (1.30)	1.50 (3.20)*		-0.71 (-3.1)*	0.43 (1.8)***		0.834	-3.13 [0.06]
UK	-0.70 (-4.54)*	-1.05 (-1.8)***	0.05 (0.39)		-0.21 (-1.90)**		0.431	-4.80 [0.00]

t-statistics between “()”; *p*-values between “[]”.

“*” significant at 1%; “**” significant at 5%; “***” significant at 10%.

“°” Weighted-Symmetric unit test; ADF otherwise.

In all the countries, except in Denmark and France, the same explanatory variables leading to cointegrating relationships for transfers, also ensure that residuals of the regressions for tax receipts are stationary, thereby signalling the existence of common trends between revenues and factors related with transfers in the long run, namely demography, unemployment and income. In addition, the sign of the coefficients remain broadly the same. This reinforces the message in the precedent sections that, in the end, the long-term trend of spending is the major determinant of taxes in the long run.

As a general rule, once such major determinants are included in the regression, any other factor seems to play a secondary role. Only in Germany, Spain and the Netherlands, does the inclusion of self-employment lead to cointegrating regressions with a significant coefficient. As in the pooled regressions of section 4, the sign is negative. Where the manufacturing-employment rate is concerned, its inclusion does not ensure stationary residuals and/or the coefficient is non-significant.

Indeed, such findings are rather indicative, as they are based on preliminary analyses. Less unambiguous conclusions would need detailed analyses at the country level, which are out of the scope of a short paper. Yet, even such preliminary analyses, which apply standard econometric techniques in a rather mechanic way, when compared with those presented in section 4, suggest that, if any, such more detailed and rigorous analyses would give stronger support to the conclusions presented here.

6 Conclusions

In the long term, the determinants of tax revenues are broadly the same as those determining the long-run evolution of spending, especially social expenditures. It has been shown that demographic dependency, labour market performance and income are the major factors behind the observed upward trends in social transfers and spending in industrial countries.

Similar factors are found when explaining across-country differences in tax burdens over the last thirty years. Higher government receipts are associated to higher elderly dependency and income. This

implies that ageing populations are equivalent to rising pension payments, while higher income levels across countries and over time correspond to more generous social protection systems. Therefore tax systems have been adapted in the past to cope with the financial needs of governments.

Once such determinants are included, any other structural factor plays a relatively secondary role in explaining the evolution of tax burdens in industrial countries. This particularly applies to the shares of self-employment and of manufacturing employment in total employment. Although both rates negatively affect tax receipts, their effects are relatively small.

These results have potentially important implications for economic policy in the EU. Most Member States are undertaking tax reforms lowering the current high tax burdens, especially on labour, as recommended in the Broad Economic Policy Guidelines and further stressed in the Special Lisbon European Council of March 2000. This paper shows that reductions of tax burdens may not be sustainable in the long run unless they are framed within comprehensive economic reforms including welfare systems.

REFERENCES

- Buti, M. and C. Martinez-Mongay (2000), "European Tax Policy after EMU. State of Play and Challenges" *Diritto e Economia*, forthcoming.
- Buti, M., L. Pench and P. Sestito (1998), *European Unemployment: Contending Theories and Institutional Complexities*. Economic and Financial Reports, Chief Economist's Department, No. 98/01, European Investment Bank.
- Cambridge Econometrics (1997), *Long-term Perspectives in Public Revenues*, Report submitted to the European Commission, DG ECFIN, mimeo.
- Carey, D. and H. Tchilinguirian (2000), *Average Effective Tax Rates on Capital, Labour and Consumption*. Mimeo, Paris, OECD.
- Daveri, F. and G. Tabellini (1997), "Unemployment, Growth, and Taxation in Industrial Countries", CEPR Discussion papers, No. 1681.
- De la Fuente, A. (1997), "Restructuring Government Expenditure", Report prepared for the European Commission, DG ECFIN., Mimeo.
- Elmeskov, J., J. P. Martin and S. Scarpetta (1998), "Key Lessons for Labour Market Reform: Evidence from OECD Countries' Experience", *Swedish Economic Policy Review*, No. 5, pp. 205-52.
- European Commission (1999), *Structures of the Taxation Systems in the European Union*, Luxembourg, EUROSTAT.
- European Commission (2000), "Public Finances in EMU –2000", Report of the Directorate General for Economic and Financial Affairs, forthcoming.
- Franco, D. and T. Munzi (1997), "Ageing and fiscal policies in the EU. In The Welfare State in Europe: Challenges and Reform". *European Economy Reports and Studies*, No. 4. DG ECFIN, European Commission, Luxembourg. Reprinted in M. Buti, D.

- Franco and L. R. Pench (eds.) (1999), *The Welfare States in Europe – Challenges and Reforms*, Edward Elgar.
- Goudswaard, K. and H. Van de Kar (1994), “The impact of demographic changes on public revenues”, *Atlantic Economic Journal*, No. 22, pp. 52-60.
- Hagemann, R. P. and G. Nicoletti (1989), “Economic effect and some policy implications for financing public pensions”, *Economic Studies*, Paris, OECD.
- Harberger, A. C. (1964), “The measurement of waste”, *American Economic Review*, No. 54, pp. 58-76.
- MacGregor, M. (1988), *Ageing and productivity*, Canadian Department of Finance.
- Martinez-Mongay, C. (1999), *Effective Tax Rates Based on AMECO Data. Updating o December 1999*, European Commission, DG ECFIN/508/99-EN.
- McMorrow, K. and W. Roeger (1999), “The economic consequences of ageing populations (A comparison of the EU, US and Japan)”, *Economic Papers*, No. 138, November. European Commission, DG ECFIN.
- Mendoza, E. G., A. Razin, and L. Tesar (1994), “Effective tax rates in macroeconomics. Cross-country estimates of tax rates on factor incomes and consumption”, *Journal of Monetary Economics*, No. 34, pp. 297-333.
- Mendoza, E. G., G. M. Milesi-Ferretti and P. Asea (1997), “On the effectiveness of tax policy in altering long-run growth: Harberger’s superneutrality conjecture”, *Journal of Public Economics*, No. 66, pp. 99-126.
- OECD (1997), *Revenue Statistics 1965-1996*, Paris, OECD.
- Rodrik, D. (1998), “Why do more open economies have bigger governments?”, *Journal of Political Economy*, No. 106, pp. 997-1032.

Rosevaere, D., W. Leibfritz, D. Fore and W. Eckhard (1996), "Ageing populations, pension systems and government budgets", OECD Working Papers, No. 168, Paris, OECD.

